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Information Deficiencies in Agricultural Policy Design, Implementation and Monitoring

David Blandford



TABLE OF CONTENTS

Executive summary....2

1. Introduction....6
2. The role of information in the policy process....8
3. The cost of information....12
4. Types and sources of information deficiencies....15
5. Traditional sources of information for agricultural policymakers....24
6. Some issues in obtaining and using policy-relevant information....26
7. Illustrations for three policy areas....29
8. New approaches to meeting information deficiencies....46
9. Political issues in addressing information deficiencies....50
10. Conclusions and recommendations....51

References....53

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INFORMATION DEFICIENCIES IN AGRICULTURAL POLICY DESIGN, IMPLEMENTATION AND MONITORING

EXECUTIVE SUMMARY

Accurate and complete information is needed to guide the formation, implementation, monitoring and assessment of agricultural policy. Obtaining both qualitative and quantitative information is vital for ensuring that policy measures are targeted, efficient and cost effective. Quantification of impact and benefit-cost analysis are only possible if information of sufficient quantity and quality is available. Meeting this requirement is increasingly challenging due to an expansion in the range and complexity of policy concerns associated with agriculture. Problems can be posed by a lack of knowledge about technical relationships that underlie key processes, by the inherent uncertainty of outcomes or difficulties in monitoring these, and by information asymmetry (*i.e.* situations in which the information necessary to inform policymaking exists but it is difficult or costly to obtain).

This study examines information needs to guide the formation, implementation, monitoring and assessment of policies for agriculture, outlines deficiencies, argues for selective improvements in data availability, quality and relevance in order to satisfy policy priorities, and suggests ways to achieve these. Methods for dealing with remaining deficiencies when designing and implementing policies are also outlined.

Agriculture has traditionally been a sector for which a large volume of data is collected in many OECD countries. Maximum utility must be extracted from existing sources. Where critical gaps are identified, efforts must be made to fill these at the lowest public and private cost. Efficiency requires an understanding of policy issues by data providers and an understanding by policymakers (or their advisors) of what providers are able to supply. Effective provision requires constant and close interaction between providers and users. Information, as distinct from data, involves a value-added process in which knowledge of underlying processes is employed to interpret and present data in a form that illuminates policy issues. The costs of supplying policy-relevant information can be controlled if there is a thorough understanding of the environment within which the information will be used; investment in the internal infrastructure of data resources, technological capability, human expertise and physical capital; willingness to access external data sources, including consulting services when these are less costly; and the design of processing systems to transform data into forms that maximize expected information gain. The use of a matrix approach in which data relating to multiple areas of policy interest are collected through existing mechanisms can help to reduce the costs of solving information deficiencies.

Much of the basic data needed to inform agricultural policy is furnished by farmers and landowners. They can incur financial costs in assembling, processing and delivering information to government agencies or opportunity costs through time spent on record keeping and reporting. There is a need for accountability when public funds are involved and it is reasonable to expect policy beneficiaries to provide sufficient information to permit the effectiveness of expenditures to be evaluated. However, there is also a need to control policy transactions costs. This helps to maintain support for policies among target groups and results in a higher benefit-cost ratio for society as a whole.

In some cases the information needed to inform policy is unavailable simply because it is impossible to obtain. In other cases missing information may be due to management issues or information asymmetry. Management issues can be associated with decentralization in the policy making process and in information provision or through imperfect communication between data providers and users. Challenges may be posed by the sheer volume of data needing to be processed, which may be only partially overcome

by advances in information technology. Finally, information on agriculture is important to a range of stakeholders and often has a significant public good dimension. As a result, the provision for information may not be driven solely by the policymaking process.

Information asymmetry is of growing importance in policy formation and evaluation in agriculture. As the focus of policy evolves, the information required for policy implementation becomes more complex and difficult to obtain. In the area of environmental policy, for example, farmers will usually be better informed about the opportunity costs of environmental measures than governments. They are in a highly favourable position when negotiating payments under environmental programmes and may be reluctant to provide information if they believe that future benefits from government programmes will be reduced or they will be subject to additional regulation. Agribusiness firms may be reluctant to disclose data that have private value. Missing markets may make it difficult to determine the value of certain agricultural outputs, such as environmental goods.

Three main sources of information deficiency are important for agricultural policy: instrument-related deficiencies involving uncertainty about farmers' reactions to policy measures; cost-related deficiencies involving budgetary, transactions, production and opportunity costs; and benefit-related deficiencies due to uncertainties about the chain of action and reaction in policy implementation. Uncertainty in policymaking can be reduced, particularly through research and the use of analytical models, and by exploiting available qualitative information, but it can never be completely eliminated.

Two important issues to be addressed in overcoming information deficiencies are confidentiality and information asymmetry. Legal restrictions can constrain the acquisition and use of personal information for policy purposes. Regardless of any legal requirements, the protection of confidentiality is a key requirement for safeguarding the supply of information. Information asymmetry can be addressed if the aims and objectives of the policymaker (the principal) can be aligned with those who are targeted by the policy (the agent). Incentives play a key role in overcoming the unwillingness of agents to disclose information.

Examples of how deficiencies can be overcome are drawn from three areas of policy concern: 1) the performance and competitiveness of the agricultural sector; 2) the economic well-being of farmers and farm households; and 3) positive and negative externalities and the provision of public goods by agriculture.

The economic performance of the agricultural sector has been a traditional concern of policymakers in OECD countries and remains important in an environment of policy reform. New performance criteria relating to product attributes are becoming increasingly prominent in many OECD countries. Information on performance can be generated through the use of both market and regulatory mechanisms. Structural change in the agricultural sectors of many OECD countries makes it more difficult to generate meaningful information on performance. The declining share of total value added at the farm level, the growing use of contracts as opposed to auction markets, and product differentiation make it challenging to obtain necessary information and increase the complexity of interpretation. Mandatory reporting may be the only realistic option for overcoming information deficiencies when the level of industrial concentration is high.

The economic contribution of the agricultural sector (measured by its share of national income of employment) has declined substantially in many OECD countries, but its contribution in some regions can be important. As a result, the information focus has tended to shift towards broader indicators of rural development. Considerable challenges are created by this change in terms of coverage, availability, methodology, and data acquisition and management. Some of these issues are being addressed in OECD countries as part of the monitoring and evaluation of rural development programmes. A major issue in identifying information priorities in the area of rural development is the lack of clarity and consensus in

policy focus. Efforts to clarify basic aims and the quantitative targets that can be used to monitor these would help to identify priorities for meeting information deficiencies.

The economic well-being of farmers and farm households is an important policy concern in many OECD countries. In many countries the primary focus is on measuring the income associated with farming, although that is just part, and in some cases a declining part of the total income of farm households. Well-being is not captured by measuring income, since wealth is an important consideration. The primary source of data on income and wealth is farm-level surveys. From the perspective of policy formation and evaluation it is particularly important that data are collected on non-farm activities and sources of income, as well as information on assets, and that coverage is representative of all farm types. In countries where the renting of land is important, data on both land owners and operators is needed to evaluate policy impact. A number of OECD countries have been taking steps to remedy information deficiencies relating to farm household well-being. Recent work by the Intersecretariat Working Group on Agricultural Statistics and Rural Indicators provides a foundation for further improvements in this area. The targeting of income support and other payments to farmers and landowners may require that the voluntary provision of information be supplemented by a requirement to provide certain types of information in order to be eligible for payments.

There is increasing recognition of the contributions (both positive and negative) that agriculture can make to society, beyond those reflected in crop and livestock products. Interest in the non-commodity outputs of agriculture has expanded and so has the need for information to inform policy decisions. Considerable progress has been achieved in the creation of agri-environmental indicators (AEIs) at the national and international levels. The focus is on policy relevance, analytical soundness, measurability, and ease of interpretation. The OECD Secretariat has identified a number of challenges in developing AEIs, of which two are particularly relevant to this paper. The first is that the scientific and analytical basis underlying some agri-environmental relationships needs to be developed further to derive useful indicators. The second is the lack of basic data relating to some indicators. A number of approaches can be taken to improving information on environmental issues at the farm level. An OECD expert meeting on farm management indicators and the environment provides examples of how value can be added to existing data. These include expansion of information collected through existing farm financial surveys, the use of special targeted surveys, and the use of data obtained through regulatory programmes.

Technological and methodological developments create new opportunities for reducing information deficiencies. One example is the ability to generate and analyse geo-referenced information through remote sensing in order to monitor changes in land use. Electronic data submission has the potential to reduce the response burden for primary data providers, increase efficiency in acquisition and processing, and improve timeliness. It also offers the potential of supplying useful data to individual providers, increasing their willingness to incur the costs of participating in surveys. Programme features through which farmers and others have a built-in incentive to provide the information required by policymakers can play a role in overcoming information deficiencies in policy formation and implementation in some areas, helping to reduce policy costs and increase effectiveness. New methodologies, such as those involved in indirect and direct approaches to valuation may be able to fill some information gaps relating to non-market goods in a cost-effective way.

In conclusion, an information-based approach is needed to guide policymaking in agriculture. High priority should be attached to obtaining information that will permit better policy targeting, the quantification of outcomes and, to the extent possible, formal benefit-cost assessment of policy measures. An information-based approach is essential for monitoring policy needs and effectiveness, as well as for identifying existing measures that are obsolete or inefficient in achieving their aims. Sunset clauses requiring the re-examination of the *raison d'être*, the efficiency and effectiveness of a measure are particularly important when it is known that the information basis on which the measure was based was incomplete.

Data collection through existing mechanisms (*e.g.* surveys) needs to be kept under constant review. Close interaction is required between and among data providers and users in order that the usefulness of existing sources can be evaluated, additional data needs can be communicated, and solutions can be found to filling key information gaps. Value-added modifications to existing data collection mechanisms need to be made where possible. Given the continued emphasis in some OECD countries on farm household income support and the growing emphasis on environmental issues in agriculture, the enhancement of farm-level data collection to provide greater information on all sources of income, wealth and the level of well-being, and the provision of information on farming practices with environmental implications should have a particularly high priority.

Policy design and implementation need to take into account the reduction of information asymmetries and situations in which required information does not currently exist. In many cases it is possible to make the provision of information part of the policy implementation process. It is not unreasonable to require those who benefit from public funds to provide the information necessary to ensure accountability, and to permit an evaluation of the effectiveness and efficiency of expenditures. In some cases, the method of policy implementation may help to reduce the potential costs of missing information and thereby increase effectiveness. In this context, the use of market-based approaches such as auctioning in the provision of environmental goods and services is an area that merits particularly close attention. In general, however, much remains to be done in order to be able to evaluate externalities associated with agriculture. It is particularly important that the confidentiality of data collected from individual farms and firms be protected in order to maintain confidence in the data gathering system that underpins an information-based policy approach.

Information is valuable, but its supply is not costless. Careful consideration needs to be given to controlling both the private and public costs of acquiring and processing data. New technologies, such as geographic information systems and electronic data collection, offer possibilities in this regard. In other cases the requirement is to design collection instruments in such a way that the costs imposed on the providers of data do not become excessively burdensome. The primary suppliers of data (*e.g.* farmers) are likely to be more amenable to absorbing the costs of provision if data processors can find ways to make the data useful and usable by those suppliers. Maximum use needs to be made of incentives to induce the provision of data by the beneficiaries of policy.

International collaboration among public agencies in the area of data collection and processing can play an important role in increasing the effectiveness with which existing data are used, as well as improving the policy relevance of information. Activities that involve the sharing of knowledge on concepts, data collection experiences, and processing techniques can play an important role. Two examples that show the relevance of this approach are activities undertaken on the measurement of farm household income by the IWG.AGRI group, and joint activities undertaken on environmental indicators by the OECD and other bodies.

Making changes that will improve the policy relevance of information for agriculture poses a challenge, particularly where current data collection mechanisms need to be modified. Stakeholders may view changes in data collection as a threat to their interests and may resist change. Data collection agencies that have become used to particular data collection mechanisms or to collecting certain types of data may also be resistant to change. The suppliers of primary data, particularly farmers, may be concerned that new requirements will increase the complexity and cost of providing data. There may be political risks from increased transparency in an information-driven approach to policy. Despite these challenges the reduction of information deficiencies is a key priority for achieving the aim of improving the effectiveness and efficiency of agricultural policy in OECD countries.

INFORMATION DEFICIENCIES IN AGRICULTURAL POLICY DESIGN, IMPLEMENTATION AND MONITORING

1. Introduction

The importance of information in the formation of agricultural policy in OECD countries is underscored by the increasingly stringent requirements that policy measures must satisfy.[1] At their 1998 meeting, OECD Ministers agreed that in order to meet their shared objectives, policy measures should be:

- "***Transparent*:** having easily identifiable policy objectives, costs, benefits and beneficiaries;
- ***Targeted:*** to specific outcomes and as far as possible decoupled;
- ***Tailored:*** providing transfers no greater than necessary to achieve clearly identified outcomes;
- ***Flexible:*** reflecting the diversity of agricultural situations, be able to respond to changing objectives and priorities and applicable to the time period needed for the specific outcome to be achieved;
- ***Equitable:*** taking into account the effects of the distribution of support between sectors, farmers and regions" (OECD, 1998a).

These requirements drive information needs. Accurate and complete information must be provided if policy measures are to be targeted, efficient and cost effective. This is increasingly challenging due to an expansion in the range and complexity of policy concerns associated with agriculture and the inherent difficulties in obtaining accurate information on some of these. Challenges are posed by a lack of knowledge about the technical relationships that underlie processes or the difficulty in monitoring outcomes (*e.g.* the environmental impact of agricultural practices). Other challenges are created by information asymmetry, *i.e.* the information necessary to inform policymaking exists but is difficult to obtain and may also be costly.

Agriculture has traditionally been a sector for which a large volume of data is collected in many OECD countries. Detailed data are often assembled on the use of inputs and composition of output and on farm structure through a periodic agricultural census or through farm surveys. The effort devoted to agriculture reflects the importance attached to the sector and its position as a focus for public policy. Even with a steady decline in its share of gross domestic product, the sector has retained an important policy status, not least because it is a major user of natural resources and the main occupier of land. Despite this, a major expansion in data gathering from agriculture is unlikely to be financially or politically feasible.

1. The term "agricultural policy" is used in a generic sense throughout this paper to include policies that have traditionally been considered agricultural (e.g. the provision of price and income support to farmers) as well as policies that involve agriculture but have a broader focus, such as the economic performance of the food and agricultural sector, and those related to environmental or rural development aims. Where greater specificity is required, labels such as agri-environmental or rural development are used.

Maximum utility must be extracted from existing sources. Where critical gaps are identified, efforts must be made to fill these at the lowest public and private cost.

This study examines information needs to guide the formation, implementation, monitoring and assessment of policies for agriculture, outlines deficiencies, argues for selective improvements in data availability, quality and relevance in order to satisfy policy priorities, and suggests ways to achieve these. Methods for dealing with remaining deficiencies when designing and implementing policies are also outlined. Some of the key questions relating to the provision of information for policy formation are:

What information is required to pursue particular policy objectives, for each of the steps from policy design to implementation, monitoring and evaluation?

What are the issues to be faced in obtaining and using such information (collection methods, technical feasibility and costs)?

What are the major sources and types of information deficiency?

What are the implications of the absence of complete information for the choice of policy instruments and for monitoring performance?

What approaches can be used to implement policies in the absence of perfect information?

In dealing with the challenges posed by information deficiencies, some key issues are:

- Is it possible to design and implement policies in such a way as to minimize the costs of obtaining the information needed to monitor impact and effectiveness?
- What should be the balance between the use of economic incentives and compulsion in eliciting required information?
- What role can be played by new technologies and methods of information gathering in meeting deficiencies?

In order to address these issues the paper first examines the role of information in the policy process and factors affecting acquisition costs. Major types of deficiencies and their implications for the implementation of agricultural policy are examined. A brief review is provided of principal data sources in OECD countries and issues involved in improving their policy relevance. The paper then focuses on three key areas of policy concern: 1) the performance and competitiveness of the agricultural sector; 2) the economic well-being of farmers and farm households; and 3) positive and negative externalities and the provision of public goods by agriculture. With respect to each of these, an assessment is provided of the major types of information currently available in OECD countries; how these relate to policy needs; issues involved in trying to fill critical gaps; and realistic options for improving the situation. Attention is then directed to the potential role of recent technological and methodological developments and some political issues. Finally, principal conclusions and recommendations are summarized.

2. The role of information in the policy process

The availability of accurate and sufficiently complete information is a fundamental requirement for guiding the formation, implementation, monitoring and evaluation of agricultural policies. It is needed to:

1. Identify baseline conditions for an issue of concern to determine whether policy intervention is necessary;
2. Define clear objectives and targets to guide the use of chosen policy instruments (*e.g.* identify the target population, target variables and point of intervention);
3. Determine instrument settings (*e.g.* the rate of support or taxation to be used or the structure of regulatory measures);
4. Monitor and control implementation; and
5. Evaluate the impact of policy measures on targeted variables and the target population.

The types of information needed for each of these stages may differ. While relatively aggregate information may be sufficient for identifying issues and evaluating overall results, disaggregated information is usually required for implementation (*e.g.* in delivering most types of payments) and for monitoring compliance. The more targeted and tailored a policy measure, the greater the disaggregation needed to set targets and instrument levels. The policy implementation process often generates administrative data, but impact assessment requires information suitable for establishing cause and effect linkages. Policy evaluation, particularly the determination of benefits and costs, requires data suitable for economic analysis. It is important to understand these different needs in order to identify the source of information deficiencies.

The OECD's work on policy design indicates the need for well defined objectives and explicit targets to guide the selection of policy instruments, to monitor their impact, and to evaluate outcomes (OECD, 2006a). General objectives, such as "providing adequate food supplies", "stabilizing farm income," "improving the environmental performance of agriculture" or "improving rural viability" need to be translated into more precise operational objectives, such as domestic self-sufficiency ratios for staple foods, a minimum income level for farmers or farm households, increased area of restored wetlands, or the preservation of farm employment in a region at a given level. Ideally, policy instruments should target desired outcomes directly (*e.g.* a reduction in the nitrogen content of water). But since this may be difficult to achieve, targets can be established for process variables (*e.g.* rates of application of nitrogen). In that case, the linkage between the variable and the outcome should be well-established and the implementation of the target should be as close as possible to the point of impact (*e.g.* application of manure to cropland) in order to minimise uncertainties in the chain of action/reaction and any resulting distortions. Targets may include spatial/geographical, quantitative and qualitative dimensions, and the characteristics of a targeted population. All these define information needs for policy formation and implementation.

Quantification plays a key role in setting targets that are consistent with policy objectives, in assessing the effectiveness of policy measures adopted and in comparing benefits and costs. This is not to minimize the important role that qualitative information plays in the design, implementation and evaluation of policy. Such information is particularly important for assessing actual or likely future behaviour of targeted populations (*e.g.* the response of farmers to measures designed to reduce nitrogen levels in water). In most cases both qualitative and quantitative information will be required to guide policy formation. While it will not be possible to quantify all aspects of a policy issue, addressing information deficiencies should have quantification as a central aim. As stated elsewhere: "Ideally preparations for the introduction of a new policy initiative, for example in the context of policy reform, should include a full fledged cost-benefit analysis" (OECD, 2003*a*, p. 4). Recent studies conducted by the OECD, in particular those dealing with

the evaluation of the transactions costs associated with agricultural policies (OECD, 2006b) and the use of cost-benefit analysis for environmental policies (OECD, 2006b), illustrate the central role played by quantitative information in guiding policy design and implementation.

It will not always be possible to conduct a full benefit cost analysis of policy measures. The technical relationships that underlie a particular outcome may not be fully understood or may involve random elements that make quantification difficult. Alternatively, data required to understand policy impact might be difficult to obtain. The importance of information asymmetry in this regard is elaborated further below. A given policy instrument might affect several variables (have multiple outcomes) which are difficult to summarise in a single measure, such as a benefit-cost ratio. Even in such cases, however, quantification can still play a central role. An early study focusing on the commercial decisions of firms demonstrated that objectively measurable impact indicators relating to clearly identified objectives can result in major improvements in private decision making (Baumol and Quandt, 1964). By extension, appropriately designed indicators of policy impact can play a major role in improving public decision making, justifying the investment of time and effort in their construction. As discussed later in this paper, increasing effort has been devoted in many OECD countries to the construction of policy indicators, most notably in the environmental area. Such indicators can play an important role in guiding the formation of policy and in evaluating its impact.

In order to satisfy the criteria identified by OECD ministers for meeting their shared objectives, there must be a system in place that is capable of generating policy-relevant information. Such a system must be aligned with the interests and concerns of policymakers and be responsive to their changing needs. A major issue is how to achieve this in a policymaking environment that is becoming increasingly complex.

Several conceptual models address the role of information in the policymaking process (Fernagut *et al.*, 2004). Despite differences in assumptions, all the models recognise the importance that access to information exerts in the policymaking process and that the degree to which usable information is transferred to policymakers is a central issue.

One stylized representation of the process is illustrated in Figure 1. In this rational-comprehensive or linear model, policymakers identify a policy issue and interact with data providers in identifying information needs and sources. Providers acquire, organise and supply the necessary information to policymakers, who interpret the information and use it in making their decisions. There is a feedback loop in which data providers repeat the process of acquiring new information and supply this to policymakers in order to allow them to evaluate outcomes. Despite its simplifying assumptions, the model highlights several key issues:

- The provision of useful information requires an understanding of policy issues by data providers, as well as an understanding by policymakers of what providers are able to supply to aid the policymaking process. Effective provision requires close and constant interaction between policymakers (or at least policy advisors) and data providers so that supply can be tailored to the needs of policymakers, both for policy formation and for ongoing evaluation of impact.

- The generation of useful information is a value-added activity, in which knowledge about the processes that underlie collected data is used to interpret those data. Information differs from data in two important respects: first it is context specific, and second it is decision focused. Information is created when data (empirical observations) are combined with knowledge (theory or analysis relating to a particular process or set of technical relationships). In the diagram this is viewed to be a major function of the policymaker, but in reality it is likely to be performed partly by those in data collection agencies who are involved in defining what data should be gathered

and organizing these for use by others, and by policy advisors who further process data into forms that are useful for final decision makers.

- The generation of more information does not necessarily mean better or more-informed decision making. For information to be effective, it must address specific needs and be in a form that can be accessed, processed and used by policymakers. This requires an understanding of information needs and the existence of a system that meets these. Information management presents particular challenges for meeting the needs of decision-makers. This simplified view of the process illustrates that the design of the information-generation system and ensuring its close linkage to policymaking are critical if policymaking needs are to be met.

Information can be viewed as a resource or input that results in a reduction in a decision-maker's uncertainty (Wolf *et al.*, 2001). From this perspective, improved information plays a key role in reducing policy uncertainty, in particular by helping to identify the impact of policy measures and for assessing how effective these are in achieving their aims. There will always be an element of uncertainty in policy implementation, since many outcomes are likely to be probabilistic rather than deterministic, but improved information can help to manage the uncertainty inherent in policy formation and implementation. Sources of information uncertainty and their implications for policymaking are discussed in more detail later in the paper.

The challenge of obtaining information to improve policymaking is increasing for two main reasons: 1. an expansion of the range of policy concerns and objectives that are associated with agriculture; and 2. the inherent difficulties in obtaining accurate information relating to some of these objectives. Some of the difficulties are due to a lack of knowledge about technical relationships or the challenge of monitoring these, for example, positive externalities. Others relate to the problem of information asymmetry. Ways in which this can be overcome are a central focus of this paper.

Summary

- In order to achieve the stated objectives of OECD Ministers accurate and complete information (qualitative and quantitative) is required to guide the formation, implementation, monitoring and evaluation of agricultural policies.

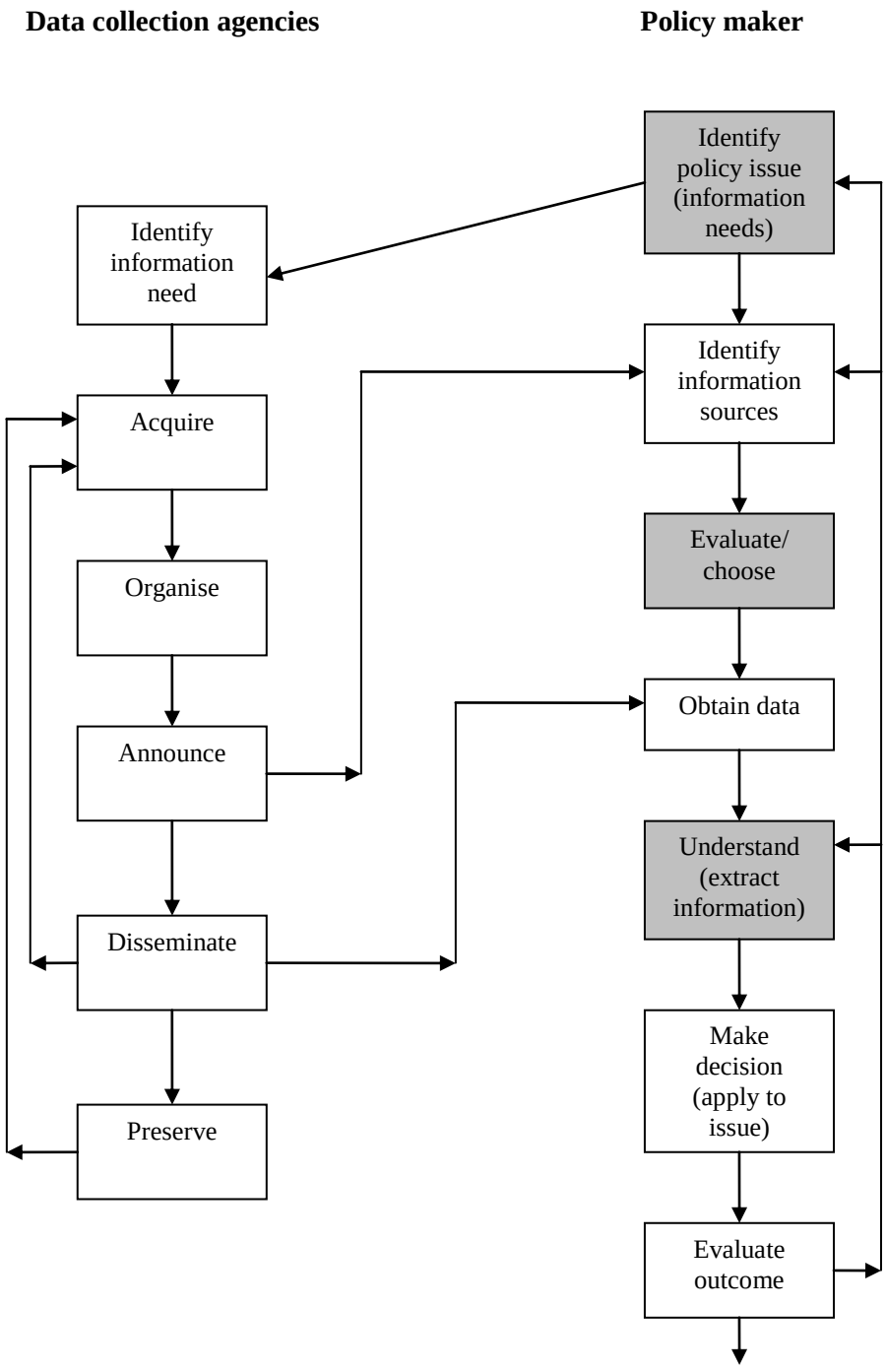
- Quantification is vital for identifying targets that are consistent with policy objectives and for the evaluation of policy outcomes. Quantification aids decision-making, and is essential for conducting formal benefit-cost analysis of policy measures.

- The provision of information useful to the policymaking process requires an understanding of policy issues by data providers and an understanding by policymakers (or their advisors) of what providers are able to supply. Effective provision requires constant and close interaction between providers and users.

- Information and data are not equivalent. The generation of information is a value-added process in which knowledge of underlying processes is employed to interpret and present data in a form that increases understanding of policy issues. Data provision agencies have a major role to play in this process.

- The challenge of obtaining improved information for policymaking is growing due to an expansion in the range of concerns and objectives for agriculture and inherent difficulties in obtaining accurate information on these.

Figure 1. A simple model of information and the policy-making process



Source: Adapted from Thornsbury *et al.* (2003).

3. The cost of information

Supplying information to policymakers is not costless. Much of the data and basic information needed to inform agricultural policy is furnished by farmers and landowners. Costs are imposed on the small firms (measured in terms of the number of employees) that typically characterise farming. These costs can be in the form of actual expenditures required to gather, process and deliver information to government agencies or the opportunity costs of the time spent in record keeping and reporting.

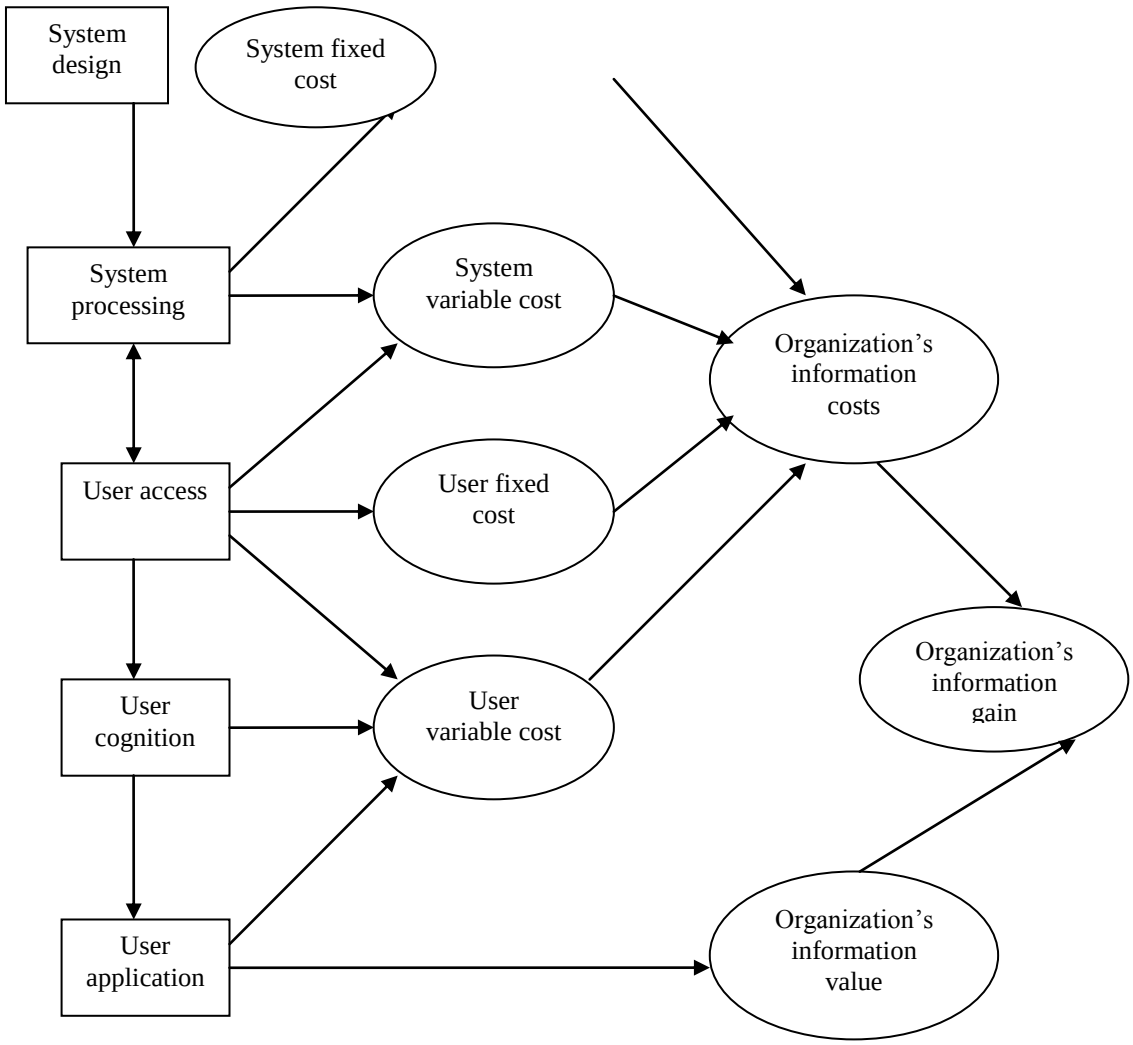
As policy concerns relating to agriculture have broadened, information needs and the demands placed upon firms have increased. Relatively little information must be supplied by farmers if they simply sell their product in the marketplace to benefit from market price support. Only where individual farmers interact with a government agency acting as an intermediary will there be a need for farmers to supply much information. As other forms of support have become more prevalent, particularly direct payments, the information demands placed upon recipients have increased. Other things being equal, demands are greater the higher the "conditionality" attached to payments, *i.e.* the number and scope of requirements that producers must satisfy.

Difficulties may arise when the information needed is novel or complex in character. This is the case for externalities associated with agriculture, which may give rise to information needs that are particularly costly to fulfil because the information needed is not directly available and can only be generated by research.

In order to improve the targeting of policies in line with the Ministerial statement reproduced at the beginning of this paper, it is virtually inevitable that additional costs will be imposed on farmers through the need to obtain information. Where public funds are involved there will be a demand for accountability. Public support for policies may require a demonstration that money is not only being spent as intended but also results in desired outcomes (*e.g.* expenditures on environmental programmes lead to measurable environmental benefits). Nevertheless, there are strong arguments for ensuring that any additional costs imposed on farmers are kept to a minimum. Controlling transactions costs will not only help to maintain support for policies among target groups but will also result in a higher benefit-cost ratio for society as a whole.

In addition to the costs imposed on farmers and other businesses, there are those incurred by public agencies in obtaining, processing and supplying information to policymakers. The "production costs" of information need to be considered (Figure 2). There are five processes that contribute to the generation of both costs and value, reflected in the left-hand column of the diagram. The various costs associated with these processes are depicted in the central column. Costs can be fixed or variable, depending on the number of different users or distinct uses of the information. All costs are ultimately borne by the organization as a whole (government and its agencies), but the incidence of costs can vary, in particular among the generators and users of information. The division of costs among these two entities is significant, since it will influence the overall behaviour of the information generating system and will determine the organization's information gain.

Figure 2. Information system accounting



Source: Adapted from Lawrence (1999).

In this framework, the only value of information results from its application in decision making, all other processes and activities merely contribute to costs. From this perspective there is no difference between changes in the system that result in an increase in the value of the information produced at the same cost, or a reduction in the cost of obtaining information that has the same decision-making value. One practical example of the importance of this distinction relates to the use of farm surveys to gather data for policy purposes. If value-added enhancements can be made to such surveys (*e.g.* the use of questions that throw light on emerging policy issues) then the value of the information generated can be increased at little additional cost. Alternatively, costs could be reduced if questions yielding information of limited value are eliminated, or possibly the entire survey is discontinued. It should be noted, however, that within this framework only the value of information to the policymaking process is taken into consideration, rather than any public good benefits. These may be significant is some cases.

In order to minimize production costs the following are important: a thorough understanding of the environment within which the information will be used; willingness to make the fixed-cost investments in the internal infrastructure of data resources, technological capability, human expertise and physical capital; willingness to finance access to external data sources, including consulting services when these are less costly; design of data processing activities that transforms data into forms that will maximize the expected information gain (Lawrence, 1999).

One of the important implications of the expansion of the areas of policy concern in agriculture is that the costs of obtaining and using information need to be controlled by using a "matrix" (covering several areas) rather than a "vector" (covering only one area) approach. Policy areas overlap and data sources must be adapted to satisfy multiple needs. It is neither sufficient nor appropriate to focus on the information required to improve policy formation in a single area. Exploiting complementarities is central to the design of a cost-effective system for improvements across the range of policies that affect agriculture. This implies that the design of current mechanisms (*e.g.* surveys) must take into account the various uses to which resulting information will be put. Economies can be achieved if mechanisms can serve multiple purposes (*e.g.* data on farm practices related to environmental concerns is generated at the same time as data on the use of inputs). The use of a matrix approach requires that agencies involved in the implementation of agricultural policy co-ordinate closely on their information needs.

Finally, costs cannot be viewed in isolation. The application of basic economic principles suggests that any decision on whether to expand the amount of information sought for policy purposes should be based on the principal that the marginal benefit exceeds marginal costs. This requires that a systematic approach be taken to assessing the likely benefits and costs of modifying existing collection instruments or introducing new reporting requirements.

Summary

- Requirements to provide information impose costs on farmers and others in the agricultural sector, including government agencies. There is a tendency for costs to increase, particularly as greater conditionality is attached to instruments used to achieve the ever-widening range of policy objectives.

- It is reasonable to expect that those who receive public funds provide sufficient information to permit policy impact and effectiveness of expenditures to be evaluated, but there is a need to control policy transactions costs to increase both private and social benefits.

- The design of delivery systems has important implications for the costs of supplying information. It is particularly important that a matrix approach be taken through which sources of data can be used to satisfy needs across a range of policy areas.

- Data creation, especially in novel or complex policy domains, may be particularly costly.

4. Types and sources of information deficiencies

Information deficiencies can be classified by type and source (van der Slujis, 1995). The type of deficiency characterises how persistent it is likely to be. Following Ben Abdelaziz *et al.* (1999) we can distinguish between two major categories:

- missing information – this concerns information that is not currently available for various administrative or operational reasons, *e.g.* it is collected but does not flow to where it is needed, is potentially available but not collected, or is difficult to obtain because those who have the information choose not to reveal it (asymmetric information)
- uncertainty – this relates to information required to assign probabilities to outcomes.

The distinction between these two types of deficiency is often time-related. Missing information often relates to the past (historical outcomes), whereas uncertainty relates to the future. This section reviews the implications of these categories of information deficiency for agricultural policy.

The main types of information deficiencies

Missing information

Not all information that actually exists is available everywhere and at all times, particularly since acquisition can be costly. Arrow (1974) was the first to identify the importance of the information paradox in economics. The value of information can only be determined by a user (*e.g.* potential purchaser of a product) if he/she already knows the information, but once it is known, there is no need to pay for it. Therefore, it is impossible to define *ex ante* the optimum amount of information to acquire in making economic decisions. Two of the major causes of missing information are management issues and information asymmetry.

Information Management

The flow of information to policy-makers is strongly related to the design and management of data acquisition and processing. The simple model presented in Figure 1 assumes that the system for obtaining and processing data is highly coordinated and that there are well-functioning communication mechanisms between supplying agencies and policymakers. Figure 1 also assumes a degree of centralisation in both policy making and the provision of information.

In reality, the policy making process and information provision may be relatively decentralized and communication may be imperfect. As the range of issues affecting agriculture has expanded, an array of ministries and government agencies have become involved in the formation and implementation of policy. Rather than simply being the primary province of ministries such as agriculture and finance, other agencies are likely to be involved in the formation, implementation and monitoring of environmental, food safety, and rural development policies, among others. Responsibilities for providing information to inform policy in these areas may be widely dispersed, as well as the competencies needed to add value to inform policy decisions. Analytical competency can also reside in non-governmental entities, such as research institutes or universities, and there is the issue of how to draw upon this in the policymaking process. Communication, collaboration and coordination are essential ingredients in ensuring that the flow of appropriate information is maintained. The development of agri-environmental indicators discussed later in the paper provides an example of how this might be achieved.

A second challenge is posed by the sheer volume of data that needs to be processed. Advances in information technology have made a major contribution to our ability to manage and use data, but

significant problems remain. Major software companies devote enormous effort to developing systems that simplify access to information (Internet search engines are a case in point). The value of these systems is reflected by their widespread use among the general public. Policymakers have similar needs for mechanisms that allow a complex array of information to be navigated in order to generate usable results in a timely manner. New technologies have a contribution to make in this regard and several examples are provided subsequently.

A third challenge is posed by the fact that the demand for information is not driven solely by the policymaking process. Information on agriculture is important to a range of stakeholders and often has a significant public good dimension. Some have argued that because policy-makers have an unclear perception about potential benefits or the role of public extension, the free information flow to farmers is increasingly coming under pressure (Coutts, 1995). The flow of information may be vital to farmers and others if productivity in the agricultural sector is to increase. In many countries, solutions have been found by standardizing the delivery of information to farmers in forms that are consistent with the needs of policy-makers. Just *et al.* (2005) describe how the US government utilized the partly public good characteristics of information by building up public extension services for farmers. The technical progress which this service induced was considerable. Examples of how the blend of private, public and policymaker interests can be satisfied in designing information systems for agriculture are also provided in the paper.

The determination of how much to invest in the quality and quantity of information requires an assessment of benefits relative to costs. As noted earlier, a substantial amount of data is already collected on agriculture in many countries. Other things being equal, the more data acquired, the more precision will be possible in using agricultural policy to address specific issues, but additional resources might be needed just to maintain the *status quo*. Efforts to increase the flow of policy-relevant information may impose significant costs on farmers who may become increasingly resistant to providing it. While the public can reasonably expect that the recipients of public funds should have an obligation to disclose sufficient information to allow impact and effectiveness to be monitored, some steps can be taken to ease the reporting burden or to make this palatable. Efforts to remedy data deficiencies may need to be accompanied by streamlining data collection to eliminate low-priority information and by measures that increase the usability of information for farmers themselves. Examples in both of these areas are provided later.

A range of government and non-government institutions can be involved in collecting statistical data for agriculture. Most basic data are usually in the public domain, but some are private. Consulting firms and farmers' organisations are very active in collecting and disseminating market and policy information in some countries. Non-governmental entities have also become increasingly involved, particularly in the environmental area, although this often applies at the sub-national rather than the national level. Anielski and Winfield (2002) report on a non-profit organization in Halifax, Canada, that has been actively developing local sustainability indicators and collects data in order to monitor these. The Royal Society for the Protection of Birds in the United Kingdom is actively involved in organising the collection of data on bird populations by the general public. While providing useful contributions, a potential problem with data collection by commercial and non-profit organisations is that they will tend to cover only a subset of policy-relevant data since these are assembled with their own specific interests in mind.

Missing data may increase uncertainty about the appropriate policy to be pursued and policy effectiveness. For example, the evaluation of the effectiveness of income support measures for farm families is difficult if comprehensive information is not available on sources of income. In other cases, missing data may make the implementation of some policies impossible. Wurzel (2003) notes that pursuing environmental quality as a policy option was, for a long time, excluded for the European Community because the data required to implement such a policy could not be supplied at the European level.

In terms of future priorities, addressing deficiencies due to information management problems must rank very high. As noted earlier private and public cost implications must be considered, but where information of high policy value can be obtained simply by addressing data collection and processing issues there is a strong case for doing so.

Information asymmetry

Information asymmetry is an aspect of the principal-agent problem that has been the subject of intensive study in the economics literature since the 1980s. The issue applies when two parties have different levels of information on a given issue to the disadvantage of the one that possesses less. In terms of the supply of information for policy purposes the principal, in this case the policymaker, requires information from an agent, in this case a farmer or an agribusiness firm, in order to design a policy or to determine its impact. The problem is that the agent may not have an incentive to provide that information to the principal.

Information asymmetry is of growing importance in policy formation and evaluation in agriculture. As the focus of policy evolves, the information required can be more complex and difficult to obtain. As indicated by the Ministerial statement at the beginning of this paper, policymakers need information from the individuals who are targeted by policy measures and/or who benefit from them. The individuals involved may be reluctant to provide this or there may be no mechanism in place that causes them to do so. There are a number of aspects that need to be considered:

- The information that policymakers need from farmers is changing. Thus, for example, rather than simply needing to know how many inputs have been purchased, units of product produced, and prices received, policymakers may need to know more about production practices employed (*e.g.* to ensure that product standards are being met or to monitor environmental externalities). The farmer will usually be better informed about the opportunity costs of environmental measures than governments and is in a highly favourable position when negotiating payments under environmental programmes. As a result "when serious information asymmetry exists between a regulator and landowners, the design of efficient environmental policy is hampered" (Goeschl and Lin, 2003, p.9).

- As noted earlier, farmers incur costs in providing information. They may be reluctant to provide it because the benefit cost ratio is perceived to be too low. They may believe that future benefits from government programmes will be reduced, or that they may be subject to additional regulations. As a result they have an incentive not to provide the information. In the area of income support for agriculture, Bourgeon and Chambers (2000) show that inefficiencies through asymmetric information can be large, due the unwillingness of the recipients of support to reveal their needs.

- Structural change in the food and agricultural sector mean that traditional mechanisms for securing information (*e.g.* public auction markets that allow data to be gathered on product characteristics such as quality, flows, and prices) are increasingly replaced by private contracts and may no longer be effective. Increasing industrial concentration can mean that data that were previously publicly available are now proprietary and have private value. Agribusiness firms may be reluctant to disclose these data.

- Policymakers may be unable to determine the value of outputs. Markets may not exist for certain outputs of agriculture and as a result their value is difficult to determine – this is an externality/public goods issue. The general public may assign implicit values or costs to certain agricultural activities (non-commodity outputs) and policymakers need to know what these are.

- Consumers do not usually have the same knowledge as the farmer about the quality of (market and non-market) goods that the farmer provides. If the consumer does not know about positive quality attributes of certain farm products, he/she will not be willing to pay for them, and the market may provide an insufficient supply of quality. This clearly has an effect on producers who attempt to develop high–quality niche markets. Alternatively, if the consumer is not informed about aspects of food production for which he/she has a negative preference, the farmer receives a "rent" because of the lack of information (Rousu and Huffman, 2001).

Efficiency losses created by information asymmetries can be overcome. The government can, for example, carry out special studies on the benefits and costs of environmental measures. However, solving information deficiencies in this way is costly. Careful consideration needs to be given to the motivations of the holders of information (*e.g.* farmers) and incentives to provide the information that policymakers require. If policy implementation can be designed in such a way as to yield the necessary information at reasonable cost to both parties, then this needs to be pursued. Examples of ways in which this might be achieved are discussed subsequently.

Uncertainties

Causes of the lack of policy-relevant information discussed thus far typically refer to obtaining data on past events, *e.g.* how much income was generated by particular farm activities or what production practices were employed on the farm and their environmental implications. The notion of uncertainty usually refers to the future. It is necessary for a decision-maker to make assumptions about the future and it is useful to develop practical approaches to dealing with information deficiencies associated with inherent uncertainty.

One way to address uncertainty in policy making is through the use of a scenario approach. A series of alternative futures is constructed, typically based on information obtained from the past but employing a range of assumptions to generate information about the future. The scenarios together span the space of possible policy options. The scenario approach requires a high degree of knowledge about technical and behavioural relationships that influence policy outcomes (*e.g.* the implications of a particular approach to income support on farmers' activities and level of well-being). Through the interplay of various sets of assumptions in a series of "what if" scenarios, relevant information can be generated for the policy making process. The usefulness of the approach will depend on the quality of the models applied and that in turn will depend on the quality of the information underlying their construction. It is therefore not surprising that policy modellers are often strong advocates for improving the range and quality of policy-relevant information. A substantial expansion in the use of various modelling approaches for policy analysis in many OECD countries suggests that despite limitations this approach can be useful in reducing uncertainty in policy choice.

The theory of decision making under uncertainty also has some relevance for addressing information deficiencies in agricultural policy making. The extent of uncertainty depends to a large degree on the possibility of drawing samples from the past which will be representative of the future (Frey and Burmaster, 1999). Weikard (2004) discusses the example of decision making on ecosystem preservation taking into account expected changes in biological diversity and expected benefits and costs of species conservation through time based on assumptions about probabilities. In practice, however, unknown and missing probabilities provide a major challenge to the application of such formal decision models in many policy situations. Missing information is particularly prevalent in areas, such as environmental policy, where complex physical and biological systems are involved and where cause and effect relationships are difficult to determine.

One way to deal with the challenges posed by incomplete information on complex systems is through adaptive management (Hollling, 1978; Walters, 1986). In this approach, information generated in the process of implementing policy is used to revise both objectives and methods of policy implementation on a dynamic basis. The idea of "learning while doing" is attractive as a means of overcoming the challenges posed by incomplete information, and for applying Voltaire's maxim that the perfect should not become the enemy of the good (Lichtenberg, 2004). However, there are considerable challenges in applying this approach, particularly when irreversibility, for example the irrevocable loss of a plant of animal species, is involved (Bishop, 1978).

Uncertainty will always be present in policy making in agriculture. Often we simply do not have enough information to analyse technical relationships with sufficient accuracy or to determine exactly how individuals will respond to policy instruments. To some extent addressing missing information due to management issues or asymmetry can play a role in reducing policy uncertainty, but improvements in those areas will not entirely eliminate the problem. Process and behavioural uncertainties can be reduced through research, but this is often costly. In terms of future priorities, however, the role of research should not be neglected. The targeting of research effort (and funding) to priority policy areas to improve information on the impacts of food, agricultural and environmental policies should be pursued.

Information deficiencies and the implementation of agricultural policy

Information deficiencies can affect the efficiency of policy implementation in various ways. One of these relates to the impact of policy instruments on behaviour. Two other aspects, cited widely in environmental economics, are cost-related and benefit-related information deficiencies (Moore, 1995; Stavins, 1996).

Instrument-related information deficiencies

The central issue underlying this aspect of information deficiency is that human behaviour may change in response to a shift in incentives and that the result cannot be estimated *ex ante*. The significance of this issue was first identified by Lucas (1976) in the construction and use of macroeconomic policy models. Its implications have subsequently been analysed for such diverse areas as monetary policy (Gordon and Leeper, 1994), finance policy (van de Walle, 1998) and market policy (Lien and Hardaker, 2001).

In agricultural policy, a major instrument-related uncertainty is the relationship between government programmes and their uptake by farmers. This source of uncertainty has become more prominent with reduced emphasis on measures such as market price support through which every farmer who sells a supported product benefits from policy intervention to other measures, such as direct payments, for which recipients have to apply. Instrument-related uncertainties are relatively small for most general area or animal related payments, particularly if these are paid unconditionally. Uncertainties increase substantially, however, if payments are conditional upon the provision of public goods or are designed to stimulate investments in targeted activities. As voluntary programmes can only be effective if farmers make use of them, considerable attention has been paid to factors that influence participation (Knickel, 1993; Wilson, 1996; Kazenwadel *et al.*, 1998; Lobley and Potter, 1998; Wynn *et al.*, 2001). It has been found that a range of variables such as farm size, a farmer's age or educational level, or regional location can influence participation in agri-environmental programmes. However, many existing studies are only able to explain a small proportion of the variation in the rate of participation. This means that it is often difficult to predict accurately the number of farmers targeted by a particular programme that will actually take part.

When programmes have been in place for a long time, it becomes difficult to estimate how farmers will behave in the absence of the programme. Under stable policy conditions, it may not be possible to determine whether programmes are really effective in achieving desired outcomes or whether these would be forthcoming in any case. It has been argued that the principal impact of some types of financial incentives in agriculture is the creation of windfall gains, since recipients would have chosen to undertake activities without incentive payments. This argument has been made, for example, for investment subsidies (Auerbach, 1997), subsidies for education (Barbaro, 2005) and payments to induce farmer retirement (OECD, 1995a).

Instrument-related information deficiencies can affect policies that do not involve producer incentives, such as regulation. However, legal instruments often involve a smaller degree of uncertainty than market-related instruments. For example, banning certain pesticides will usually reduce their application close to zero, and an obligation to use biofuels in a certain region will increase its consumption. There are issues in verifying compliance and the role of sanctions and penalties, but instrument-related uncertainties for legal instruments are generally smaller than those associated with financial incentives.

Cost-related information deficiencies

Cost-related information deficiencies can arise for both a government that finances a programme and for those, such as farmers, who have to deliver something as a condition for inclusion in the programme. Table 1 summarizes the sources of the cost-related information deficiencies that can arise for the two actors.

Table 1. Origins of cost-related information deficiencies

Government	Farmers
Budget costs	Production costs
	Opportunity costs
Transaction costs	

For new programmes, in particular, instrument-related uncertainties can quickly translate into budgetary uncertainties. Penner (2002), for example, assesses the difficulty of predicting budget costs using examples drawn from the United States. Cost can be underestimated if predictions of the uptake of programmes are too low (in which case the programmes will run out of money) or overestimated (in which case the effectiveness of the programme could be questioned). Moreover, legal restrictions may limit governments' ability to spend more than budgeted amounts.

Production and opportunity costs mostly arise for farmers if they have to meet certain conditions in order to qualify for payments. Information deficiencies with respect to production costs are greatest when new projects are involved, for example, rural construction projects (Dillon *et al.*, 2002), but these can be minimised by careful planning. Opportunity costs are particularly important for agri-environmental programmes under which farmers are required to make changes in production and management practices, and so are the information deficiencies associated with these. Ideally for every environmental measure implemented, a farmer would know how much the yield of marketable outputs will be affected and what this will imply for revenue. The farmer would also know what additional costs may have to be incurred in changing management practices, for example, with respect to land use. For new programmes, in particular, where there is little historical experience to draw upon, significant risks can be associated with opportunity costs. However, the uncertainty is mainly short-term in nature and declines in importance as experience is gained from programme adoption and implementation.

The significance of transaction costs for agricultural policy has only recently attracted attention, but literature addressing the issue is expanding rapidly (Alberini and Segerson, 2002; Falconer and Saunden, 2002; Mann, 2002; OECD, 2007). The information deficiency issue relates primarily to the fact that there is no commonly agreed methodology for estimating policy-related transaction costs. The estimation of transaction costs for new programmes can also be complicated by a lack of information on the administrative effort that will be required. As noted earlier, there has been increasing concern about administrative complexity and the costs that this may create. Some OECD members are currently engaged in analysing this issue with a view to reducing such costs (*e.g.* CEC, 2005).

Although cost-related information deficiencies play a role in all aspects of policy relating to agriculture the issue is often most significant in the agri-environmental area. This is due to the lack of previous experience with many of the policies being pursued and the difficulties of determining their implications (Zhao, 2001). Nevertheless, it is reasonable to conclude that this source of information deficiency is one that can be largely overcome through analysis of programme implementation.

Benefit-related information deficiencies

Benefit uncertainty is a pervasive issue (Stavins, 1996). The degree of uncertainty varies considerably by type of policy measure. It is vital for framing the issue and for reducing benefit uncertainty that policy objectives be clearly defined, as argued earlier. Only when a desired outcome is clearly identified is it possible to determine what uncertainties exist in achieving it.

For the bulk of general farm support it is difficult to quantify benefit uncertainty because a number of objectives can be associated with a policy measure. Should the benefits of area payments for crops, for example, be measured in terms of agricultural production, the number of farms affected or average farm income? Such questions make it clear that targeting is an important precondition for framing the benefits of agricultural policy and for determining the uncertainties associated with these.

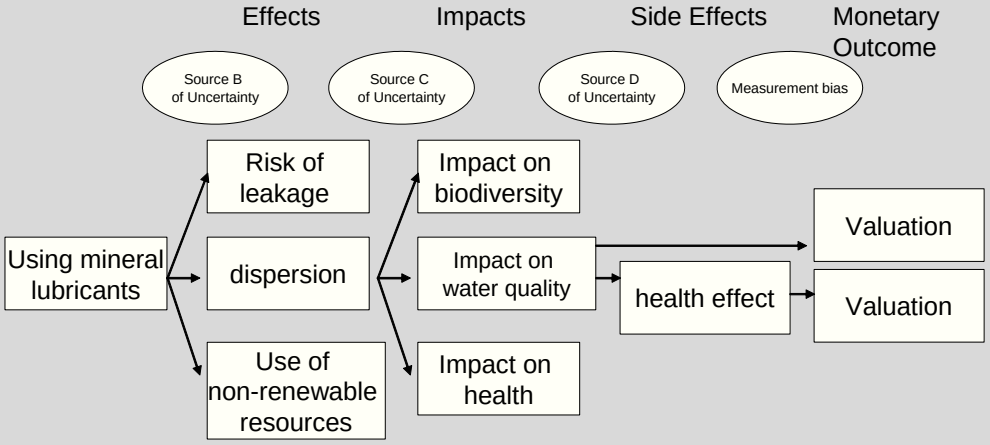
The relatively simple example provided by the figure in Box 1 illustrates the benefit uncertainty that can be associated with policy. In general terms, one should evaluate benefit uncertainty once policy objectives have been clearly defined. In agri-environmental policy, the degree of benefit uncertainty has the following characteristics:

- Benefit uncertainty is usually higher for non-point source pollution than for defined sources of emissions.
- An environmental issue that can be clearly delimited regionally has less benefit uncertainty than a global one.
- Benefit uncertainty is higher if the option value of the resource forms a significant part of its value.
- Benefit uncertainty is lower if the use value of the resource forms a large part of total value.
- Resources that are clearly visible have less benefit uncertainty than invisible amenities.

Using these criteria, it is possible to formulate "rules of thumb" with respect to benefit uncertainty for agri-environmental issues. Biodiversity issues tend to bear a high degree of benefit uncertainty, whereas the perceived benefits of landscapes can usually be measured more easily.

Box 1. Sources of benefit uncertainties in using mineral lubricants

Agri-environmental policy often has concrete objectives. The figure below relates to an example where targets are reasonably well defined but benefit uncertainty is high. In agriculture and forestry, lubricants derived from petroleum are regularly used in such diverse equipment as combined harvesters or chain saws. In many applications it is possible to substitute biodegradable lubricants derived from vegetable oils. As biodegradable lubricants are typically more expensive than mineral ones, such a substitution will only occur if supported by the government, for example, through a lower rate of tax. The positive externalities which might prompt governments to adopt such a policy are difficult to evaluate.



The first issue is that mineral lubricants can have a range of detrimental environmental effects. There is a risk of leakage, particularly for hydraulic systems, with consequent environmental damage. However, this depends heavily on the quality of equipment used, handling of lubricants, and specific environmental conditions. It is extremely difficult to forecast the probability of damage given the range of variables involved. Even without leakage, the use of equipment will inevitably create some level of emissions to the environment. In some cases, national balances are prepared based on the sale and disposal of lubricants (Umweltbundesamt, 1997). From such balances it is clear that only about half of all the lubricants sold are recorded as being disposed of properly. What happens to the other half is unknown. While mineral oil is a finite resource, it is unclear how large world oil reserves are, at what cost they can be exploited and how successful society will be in finding substitutes for oil. All of these unknown relations are reflected in Source B of the uncertainties depicted in the figure above.

Next are the uncertainties associated with the environmental and ecological impact of the release of mineral oil to the environment (Source C in the figure above). Oil residues in the soil or groundwater can be toxic to sensitive species. It is not clear, however, what actual damage the dispersion of, say, one kilogramme of oil will create. The same applies to the health of humans whose skin or lungs come into contact with dispersed mineral oil. It is important to know whether any damage is irreversible.

The indirect effects of environmental damage are another source of uncertainty (Source D i in the figure below). If water quality in a particular region is affected, this could have a direct impact, such as through the potential for fishing. An additional effect may be generated if individuals continue to fish despite warnings and their health is affected by consuming the catch. This would be an indirect effect of pollution from mineral lubricants.

To assess the potential benefits from reducing potential environmental contamination from mineral lubricants, the impacts depicted in the figure below need to be valued. Much has been written about the problems involved in valuing non-market goods and potential sources of bias (*e.g.* Whitehead *et a*l., 1993; Schulze *et al.*, 1996; Morrison *et al*., 2000). In the current example, even if all current and future damage resulting from the use of mineral lubricants is known with certainty, there is the challenge of ascertaining willingness to accept these damages or willingness to pay to eliminate them. Consideration of the time dimension makes evaluation even more complex. It may well be that future generations would have very different preferences with respect to the environmental issues involved than the current generation. These uncertainties are central to the debate on environmental sustainability (Weikard, 1999)

Summary

- The need to address information deficiencies in policymaking is driven by the requirement that the benefits and costs of policies should be clearly identified to the maximum extent possible.
- There are two main types of information deficiencies: lack of current information available to all parties and uncertainties.
- Lack of current information can arise because of information management problems, missing data, or information asymmetry. The problems these pose can generally be overcome, but information deficiencies due to uncertainties, which often relate to future outcomes, are more difficult to address.
- Three main sources of information deficiency are important for agricultural policy: instrument-related deficiencies that relate to uncertainties about farmers' reactions; cost-related deficiencies relating to budgetary, transactions, production and opportunity costs; and benefit-related deficiencies due to uncertainties about the chain of action and reaction in policy implementation.
- Uncertainty in policymaking can be reduced, particularly through research and the use of analytical models, and by exploiting available qualitative information, but can never be completely eliminated.

5. Traditional sources of information for agricultural policymakers

In this section of the paper, a brief review is provided of some of the principal types of information that have traditionally been available to agricultural policymakers. The aim is to determine a baseline from which current information deficiencies can be identified. OECD countries differ substantially in data collection systems and methods, and in the range of information generated. As a result, not all the sources described below will apply in all OECD countries.

National accounts data. Aggregate estimates of output value and input use in agriculture are derived as part of the process of preparing national accounts. These estimates are based on a variety of sources, mostly at the industry level, rather than from farm level surveys. Estimates of net value added can be used to generate various income indicators. Methodological changes introduced in the late 1990s have sought to improve these indicators, in particular by broadening the definition of what constitutes agricultural income. Aggregate data on output and input use are also used to examine changes in productivity.

Rural development data. In many countries there is increasing interest in economic activity and resource use in particular geographical areas, for example rural regions that are considered to be economically disadvantaged. Traditionally, much of the data collection in rural areas has focused on agriculture. In regions for which agriculture is a major user of land and natural resources and a major contributor to economic activity such data remain useful. However, there is increasing recognition that rural development is much broader than agriculture; as a consequence many countries are seeking to expand the coverage of information relating to rural development. This requires data on local economic structure and activity, overall resource use and environmental quality, the provision of services (*e.g.*. health and education), and overall quality of life (*e.g.* housing and living conditions). The provision of accurate and complete information to support a broader focus in rural development policy, one which extends beyond agriculture, is a considerable challenge. Some of the key issue are discussed subsequently.

Natural resource data. Data on agricultural land use have traditionally been collected in many OECD countries, for example, through a periodic agricultural census. Growing interest in a range of resource use issues, such as the conversion of agricultural, forested or uncultivated land to other uses, soil erosion, and water use and quality have resulted in an expansion of data collection in this area, using sample surveys or newer technologies, such as remote sensing. As noted earlier, some countries are also increasing data collection at the farm level relating to environmental issues, either by modifying existing censuses or surveys, or through conducting special surveys. The acquisition of additional data in this area poses challenges which are discussed subsequently.

Commodity statistics. These often involve monthly or quarterly data on supplies and use of commodities collected through surveys. Estimates of crop area, yields and production, and livestock inventories may be used to derive production forecasts. Data on prices obtained from auction or publicly regulated markets may be collected on a regular basis; data may also be collected on prices paid by farmers. Statistics on imports and exports are obtained from customs authorities. By combining the various sources of volume data, supply/utilization balance sheets can be prepared and estimates of per capita consumption derived. These data are also used in demand and price analysis and for short-term forecasting. Commodity data are heavily oriented to providing information about supply and demand trends and prices to farmers and others in the agricultural industry, and are used by governments to monitor these trends.

Marketing, food consumption and nutrition data. Data on prices at various levels in the food marketing chain, when available, provide information on farm-retail price spreads and the composition of the food marketing bill. Such data are used in the construction of various price indices, for example, the consumer price index and in monitoring inflation. Household level data may be collected on food consumption and expenditures. Such data are used to examine household well-being (*e.g.* incidence of

poverty) and nutritional issues. In some countries these data are important in guiding consumption-oriented policies (*e.g.* food assistance programmes). Interest in food consumption data is expanding in many countries because of the growing policy emphasis on diet and health (*e.g.* the increasing incidence of obesity).

Firm-level data. These are collected from farms or from other firms in the agricultural sector. Farm-level analysis is typically oriented towards data on gross income from farming, production expenses, and the calculation of residual net farm income. Data can also be collected on assets and debt that allow the calculation of a balance sheet. Census and survey data can be used to keep track of changes in farm numbers, the size of farming operations and other structural characteristics, such as the age of operators. Farm level data can be used to track receipts of government payments and their distribution across types or sizes of farms. In some countries collection has been expanded to include data on non-farm sources of income and assets, the use of certain business practices (for example, contracting and risk management) and information on farm practices of relevance to environmental issues. Census or survey data collected on agricultural firms (input suppliers, processors of agricultural products) typically focus on output and employment. Data collected at the micro (farm level) have become an increasingly important source of information for policy purposes.

A considerable amount of data is collected on agriculture in many OECD countries. From the perspective of its contribution to policy formation and assessment not all these data are relevant and some may be obsolete. For example, agricultural census data in OECD countries often contain a very high level of detail on crop and livestock production, even for relatively minor products. In contrast, less detail may be provided on the use of inputs and production practices, even though such information is valuable for considering environmental implications of agricultural practices. One of the challenges in meeting information deficiencies is to determine how data collection systems can be adapted to meet policy priorities. However, it is clear that a feasible approach to reducing information deficiencies for policymaking must involve a heavy reliance on traditional sources and methods of obtaining information. One of the major needs is to identify traditional components that have the highest value and to ensure that these are maintained. A second requirement is to add value to existing data sources, either by using existing information to generate policy-focused indicators that can be used as the basis for targets and for monitoring and evaluating policy impacts, or by selectively augmenting data gathered through traditional approaches. Methods for obtaining information through policy design and implementation and the use of new technologies can also play an important role. Options for using these approaches are illustrated subsequently with respect to several policy areas. The aim is to provide an assessment of how current available information corresponds to that needed for better policy formation and to use examples to identify how to address some of the major deficiencies.

Summary

- A range of agricultural data is collected in OECD countries. Changes in policy priorities are affecting data needs, reducing the usefulness of some existing sources, such as those relating to commodity markets, and increasing needs in other areas, such as at the farm level.

- To align the provision of data with the needs of policymakers the utility of existing data should be assessed so that key traditional components can be maintained, additional value can be added to existing sources, and methods for filling critical information gaps can be identified.

6. Some issues in obtaining and using policy-relevant information

As indicated earlier, in order to meet the shared objectives of OECD Ministers there is a need for information that permits policy outcomes (benefits) and policy costs to be determined. Benefit-cost assessment can be an important element in the initial design of a policy, as well as in monitoring impact and effectiveness. It is therefore relevant to discuss some of the issues involved in obtaining information to permit an assessment of policy benefits and costs.

Some components of policy costs can be determined in a relatively straightforward manner. For example, if governments provide various forms of payments to farmers, the transfers involved can be estimated using market and budgetary data. This is the approach used by the OECD Secretariat in computing support estimates (PSE/CSEs) and estimates of total transfers to agriculture. As with all policy indicators there are possibilities for methodological enhancements to improved the quality of resulting estimates. This has been a continuing aspect of the work in this area. The investment of time and resources by OECD countries and the secretariat in the analysis of support has made a major contribution to improving understanding of the transfers created by agricultural policies in OECD countries.

Some more recent OECD work has focused on providing more comprehensive estimates of policy costs, including transactions costs (OECD, 2007). Policy-related transaction costs (PRTCs) occur at all stages, from design and enactment to final evaluation, as a result of interactions between and within government agencies, private organizations and programme participants. The OECD's work examines methods for measuring PRTCs and the information required. One suggested approach is the standard cost model used in a number of countries to examine the administrative burden that regulations place on business. The application of this model requires information on labour costs and operational expenditures in implementing agencies, contracted agencies, and the targeted group (*e.g.* farmers). The provision of some of the last category of information can be built directly into existing surveys or reporting systems (*e.g.* in completing a survey farmers report how long it took them and this can be costed). Efforts to improve the information on transactions costs would make an important contribution to the ability to perform a formal benefit-cost analysis of policies.

Some areas of policy are more amenable to deriving estimates of costs than others. For example, by using economic models it is possible to examine the transfer efficiency of various types of support programmes, *i.e.* the net effect of transfers from taxpayers and consumers on farm income. The OECD has done a considerable amount of work in this area (*e.g.* OECD, 2003a). This has made a significant contribution to improving understanding of the effectiveness of policy transfers in increasing net farm incomes.

An issue that affects the ability to evaluate policy benefits and costs relates to legal restrictions on the use of information, particularly those relating to confidentiality. The widespread development of electronic databases containing personal information has stimulated public concern about who has access to the information they contain. In many OECD countries this has stimulated legislative activity on privacy policies. In the European Union, for example, privacy protection is addressed by omnibus legislation covering both the public and private sectors. The data protection directive of 1995 was designed to harmonise national legislation in this field (CEC, 1995). Under this directive "data controllers" in both the public and private sector are subject to restrictions on how data collected from individuals can be used. A key requirement is informed consent (free agreement on the provision of information on the basis of knowledge about what the information will be used for). It is specified that the processing of data shall either be necessary for the performance of a contract involving the individual, required by legal obligation, or necessary to perform tasks in the public interest or carried out by official authorities. Individual EU members implement these general principles through national legislation. Canada has a privacy act, dating from 1983, providing similar protections to EU legislation. For example, farmers applying for payments

under certain payments programmes are required to indicate their consent to the use of the information collected. Applicants for payments are required to agree to the use of the information they provide for: 1) administration of the programme; 2) auditing and evaluation of its effectiveness; 3) verification of information relating to other farm income payment programmes; and 4) sharing of information with provincial Ministers of Agriculture and the administrators of other federal and provincial farm programmes (AAFC, 2007). In contrast to the use of broad legislative protections, the United States addresses privacy issues through specific and narrowly applicable legislation (Stratford and Stratford, 1998). For example, information collected on individuals by the U.S. Census Bureau is protected under Title 13 of the U.S. Code of Federal Regulations.

Regardless of legal requirements, agencies that collect and use data obtained from farmers in OECD countries typically provide assurances that confidentiality will be respected. The National Agricultural Statistics Agency of the U.S. Department of Agriculture, for example, indicates that it is committed to safeguarding the privacy of data providers and the security and confidentiality of the data that it collects, while reporting the facts on American agriculture through the provision of objective and unbiased statistics (NASS USDA, 2007).

While privacy provisions may have broad implications for the use of data collected from farmers, particular restrictions may be in place on the use of information relating to income. There is considerable variability in the extent to which countries are able to use tax records to determine the economic status of farmers and farm households. Canada, Denmark and Sweden are three countries that make extensive use of taxation data for this purpose (UNECE, 2005). In some other countries data on total income (income from sources other than agriculture) are obtained as part of farm surveys. As discussed subsequently, the ability to obtain accurate and complete information on income is vital for assessing the well-being of farmers and the impact of income support programmes.

A final issue that must be addressed in obtaining the information needed to assess the benefits and costs of agricultural programmes is information asymmetry. As discussed earlier, it can be increasingly challenging to obtain the information needed to inform policy from farmers and other individuals who possess that information. The reluctance to provide needed information can be overcome if the agent has a direct incentive to provide the information that the principal requires. In that case there is an alignment of interests between the agent and the principal. There are several mechanisms through which such an alignment might be achieved:

- ***Altruism***. The agent has a personal set of values that promote the sharing of the required information with the principal. For example, individual farmers may believe that it is important to protect wildlife (as part of their contribution to society) and are willing to share information voluntarily on wildlife populations on their farms or on practices that affect these populations. The latter is much more likely if such practices are viewed to have a positive impact.

- ***Moral suasion.*** In this case a particular set of values is actively promoted by the principal (*e.g.* the importance of protecting wildlife populations) and those values are accepted by the agent. The agent responds by providing the necessary information. This approach may work because the agent is sensitized to a particular set of values (*e.g.* the contribution that the maintenance of wildlife populations makes to the social good) and is willing to accept those values and act upon them. Moral suasion is likely to be more effective when a given set of values is promoted by local or peer groups, *e.g.* the local community promotes a set of shared values or farmers' organizations promote these values. Training, extension, and measures to increase awareneness by government or non-government agencies can also be important in promoting shared values, particularly in the environmental area.

- ***Recognition of personal advantage***. The agent recognises that there is a personal advantage from acting in ways that are consistent with the objectives of the principal and responds accordingly, For example, technical information on the role of wildlife in ensuring a healthy local environment might be provided, so that the agent responds from perceived self interest. Alternatively, through access to improved information the agent may determine that a socially beneficial practice can be changed or an attribute provided at low cost, and so now chooses to do so. Educational activities, for example through farm extension, should not be underestimated as a vehicle for increasing the willingness of farmers to provide information and as a means of delivering improved information to farmers, particularly in the area of environmental policy.

- ***Personal reward through market mechanisms***. In this case the disclosure of information provides an economic return to the agent. The agent becomes aware that a change in practices will increase productivity and reduce costs in addition to providing a broader social benefit. Alternatively the market place could generate a direct return. For example, by meeting a higher production standard it is possible to extract a price premium from consumers. As a result the agent has an incentive to meet the standard and to provide information to this effect.

- ***Personal reward through government mechanisms***. In this case the provision of information is made a requirement for receiving a payment from public funds. Examples would be the provision of information on income or wealth in exchange for a targeted income transfer or the disclosure of information on production practices for the receipt of payments under an agri-environmental scheme.

- ***Avoidance of penalties or costs***. The provision of information may be made a condition for avoiding sanctions or penalties. For example, a farmer might be required to disclose the amount of animal manure being applied to cropland in order to avoid potential penalties or taxes designed to reduce nutrient loadings in drinking water. The disclosure of information on product standards (*e.g.* practices that affect animal welfare) might be required in order to avoid future regulation and the costs that this would impose.

A high priority should be assigned to eliminating key information gaps that exist as a result of information asymmetry. Some examples of how some of the mechanisms identified above can be used to do this in three policy areas are discussed in more detail below.

Summary

- Two issues that must be addressed in overcoming information deficiencies are confidentiality and information asymmetry.

- Legal restrictions can constrain the acquisition and use of personal information for policy purposes. Regardless of any legal requirements, the protection of confidentiality is a key requirement for safeguarding the supply of such information.

- Information asymmetry can be addressed if the aims and objectives of the policymaker (the principal) can be aligned with those who are targeted by the policy (the agent). Incentives play a key role in overcoming the unwillingness of agents to disclose information.

7. Illustrations for three policy areas

Economic performance and competitiveness of the agricultural sector

The economic performance of the agricultural sector is a basic concern of policymakers in OECD countries. A number of dimensions can be identified, but a traditional focus has been on the ability of the sector to provide food and agricultural raw materials of sufficiently high quality at 'reasonable' prices. The achievement of this goal rests on the satisfactory performance of all the participants in the food and agricultural system – ranging from suppliers of inputs to producers of food and agricultural materials, to those who process and distribute these materials, and others involved in marketing and delivery to final consumers. Some of the information challenges that have emerged in this area are the product of structural change in the food and agricultural sector, others relate to expanding public expectations of what constitutes acceptable performance. These have broadened the focus to product attributes in such areas as organic products, animal welfare, and food safety.

Competitiveness

The competitiveness of agriculture and the food system is an important policy concern in most countries. Its importance increases with policy reform – agricultural firms are often shielded from competition through policies that control markets, subsidize outputs or inputs, and restrict trade. When such policies change, assessing agriculture's ability to compete in a more open economic environment will be a natural focus of interest.

At the most basic level, the economic performance of the agricultural sector rests on the competitiveness of individual firms. In an industry producing relatively homogenous products, an uncompetitive firm will be one in which the average costs of production exceed the value of the goods and services it produces. In that case the value of the resources that the firm uses will exceed their opportunity costs; resources are being misallocated and national income will be reduced. A firm may be uncompetitive relative to its competitors because its productivity is lower, or it pays more for its inputs, or both. Productivity may be lower because the allocation of inputs is less efficiently managed by the firm than its competitors or the firm operates at an inefficient scale. Efficiency also has dynamic aspects; firms may be less productive than their competitors if they fail to innovate or adopt new technologies. If a firm is producing a differentiated product, an additional source of inefficiency may be the failure to offer a sufficiently attractive product to consumers. This may reflect past inefficiency in the use of resources, such as in research and development or in advertising.

Basic indicators of competitiveness at the firm level are provided by profitability, cost, productivity and market share (McFetridge, 1995). The competitiveness of an individual firm may be assessed in terms of performance with respect to domestic counterparts. Profitability may be a useful indicator of competitiveness, particularly if examined over an extended period of time. Market share may also be a relevant indicator but only if this is not being gained at the expense of future profitability (*i.e.* firms are not sacrificing current profits simply to gain market share or have access to subsidies that allow them to undercut competitors).

Average cost can be a useful indicator of competitiveness in a homogenous-product industry (again providing that low costs are not achieved as a result of subsidies or at the expense of future profitability). The total factor productivity (TFP) of individual firms might be evaluated, *i.e*. the efficiency with which a firm converts its entire set of inputs into output. Some of these indicators, such as indices of TFP, require considerable data and effort to construct and, as a result, are computed infrequently (OECD, 1995b). All have their limitations. For example, if output is measured in physical terms (say, tons of grain) TFP will not reveal anything about the extent to which this output satisfies the qualitative requirements of

consumers. Nevertheless, changes in productivity are a key aspect of competitiveness. Effort devoted to examining these changes can be extremely valuable in monitoring the economic health of agriculture and changes in its competitive position.

Competitiveness is a dynamic concept and meaningful measures need to take this into account. Thus for example, the on-going profitability of a firm may be revealed through an examination of its balance sheet. Even if a firm appears to make a profit (surplus of receipts over operating costs), if the market value of its debt and equity is less than the replacement value of its assets, this is an indicator that the firm will be uncompetitive over the longer term. The ratio of debt and equity to replacement cost (Tobin's q) can provide an indicator of a firm's competitiveness. Other long-term competitiveness indicators can be provided by an examination of the composition of expenditures, for example, the proportion spent on research and development, or through data on product innovation (number of new products developed and brought to market). Research and development activities and innovation-related investments have been identified as critical to the long-term competitive success of firms (OECD, 1992).

Indicators based on firm-level data can provide useful information about the overall economic health of an industry. If the majority of firms display favourable characteristics – *e.g.* rapidly increasing productivity, reasonable levels of profitability in comparison to firms in other industries – or if industry averages are favourable, this can indicate an acceptable level of performance. However, it will not necessarily reveal anything about the international competitiveness of firms or the industry as a whole. It is possible that an individual firm could have a large domestic market share and be profitable, but be internationally uncompetitive if it operates in a market that is protected from international competition. Similarly an industry's performance might appear to be favourable in comparison to other domestic industries, but unfavourable in comparison to international counterparts. A firm (or industry) can only be judged to be inter-regionally and internationally competitive if it displays favourable performance in an open market. As a result, international comparisons of performance are highly relevant from a policy perspective both in terms of identifying under-performing domestic industries and in evaluating the potential implications of changes in trade and domestic policies.

International comparisons at the industry level frequently focus on costs and productivity. Thus, for example, we might focus on an international comparison of TFP or unit average costs to determine the competitiveness of a domestic agricultural industry or the sector as a whole. Given the considerable data requirements for calculating TFP and total costs, partial productivity or unit cost measures (*e.g.* relating to labour) are sometimes used. These can be useful for components of the food and agricultural sector where labour is a key input and a large proportion of total costs (*e.g.* in certain areas of food processing) but they are less useful where labour forms a minor proportion of total costs (*e.g.* in capital-intensive farming activities). In addition, international comparisons of costs can be subject to limitations, particularly due to changes in exchange rates and to differences in the legal and fiscal context.

Other indicators of international competitiveness focus on trade and market shares. Thus, for example, Balassa (1965) proposed a measure of revealed comparative advantage (RCA) for an industry or class or products (denoted by *i*) in a given country (denoted by *j*) as:

$$RCA_{ij} = \frac{\text{(exports of product } i \text{ by country } j\text{/world exports of product } i\text{)}}{\text{(total exports of country } j\text{) /(total world exports)}}$$

Under this measure if RCA has a value greater than unity the industry or class of products in revealed to be internationally competitive.

Numerous factors can affect the international competitiveness of a particular industry. Often these influence the competitiveness of the economy as a whole. The World Competitiveness Yearbook, for

example, provides benchmarks for the performance of 61 national and regional economies based on 312 criteria measuring different facets of competitiveness. These include economic performance, government efficiency, business efficiency and quality of infrastructure (Garelli, 2006). This indicates that a comprehensive assessment of competitiveness cannot be achieved by using a uni-dimensional approach.

In an environment of policy reform, the international competitiveness of the agricultural sector is likely to be a significant issue. As indicated by previous work, assessing international competitiveness does not rely solely on sector-specific measures, such as unit costs or trends in productivity, but must also draw on a range of indicators of national economic competitiveness.

In the context of policy reform it is important to bear in mind that reform can alter the cost structure in agriculture. Certain agricultural support policies result in distortions, in particular by increasing relative returns to land (Floyd, 1965). When such policies change land values can also change and this can alter the structure of production costs. For this reason, simple static cost comparisons may not provide an accurate indication of future competitiveness. This is an example of where raw data on cost structure has to be enhanced using economic models to assess likely changes with policy reform to provide useful information on the future competitive position of the sector.

Implications of structural change

Firm level data are often collected and analyzed for agriculture in OECD countries, particularly for individual farms. Micro data provide the basic material for deriving indicators of economic performance and competitiveness at the industry or sectoral level. Such data may contribute to the information needed to assess the economic health and well-being of farm households (discussed below). However, as a result of structural change these data have become less useful as an indicator of the economic performance of the sector as a whole. The share of total value added in the food and agricultural sector contributed by farms has declined substantially over time. This is due to the expanded use of industrial inputs in agricultural production and the expansion of embodied services by processors and distributors in final products. As a result, the overall economic performance of the sector depends increasingly on the performance of its non-farm components. Although some OECD countries collect data (*e.g.* through a census of manufactures) that allow some performance measures for non-farm parts of the agricultural industry to be computed, the required information can be difficult to obtain. This is because public collection mechanisms either do not exist, or because existing mechanisms do not routinely collect the necessary information. There may be difficulties due to the proprietary nature of the information. Structural change has important implications for meeting the need for information on the performance of the food and agricultural sector.

Significant structural change, particularly increased concentration, complicates the task of evaluating performance. In many OECD countries a declining proportion of food and agricultural products is marketed through traditional auction markets and a growing proportion is supplied through private contractual arrangements. This can make it difficult to compute prices at various stages in the production/marketing chain. The growing significance of differentiated products also makes it difficult to make price comparisons. Products may possess different attributes or be produced under different systems (*e.g.* organic). Unless these differences are taken into account, simple price comparisons can be misleading since like products are not being compared. These issues are not unique to agriculture and have to be faced routinely in the calculation of consumer price indices.

Growing concentration in the food industry in many countries is placing increased emphasis on competition policies. In some cases competition authorities restrict the acquisition of information to a limited range of basic indicators (*e.g.* concentration ratios) as a means of ensuring that markets remain broadly competitive. In other cases, particularly if an investigation is launched into a particular market, extensive information can be collected on purchasing and selling practices and on prices and margins.

Although much of this information is proprietary and cannot be made public it can play an important role in allowing policymakers to assess the performance of particular components of the food and agricultural sector (UKOFT, 2005). In the context of agricultural policy reform, the key role that can be played by information generated under competition policies is illustrated by the mandated performance review of regulations governing fluid milk markets in Australia in 1999-2000 (OECD, 2006*b*). As a result of a review under the National Competition Policy measures that had supported the price of fluid milk were eliminated and major reforms in Australian dairy policy were implemented.

With growing concentration in the agricultural sectors of OECD countries, unless proprietary information can be obtained from private sources (*e.g.* private data collection agencies), mandatory reporting by food system intermediaries may have to be the primary mechanism for meeting the need for performance evaluation. Government oversight is likely to be more important with increasing concentration in the food system in order to ensure transparency.

Product standards

As noted earlier, performance expectations for the food and agricultural sector now extend far beyond the availability of food and its price. Rising expectations have broadened the focus to product attributes in such areas as organic products, animal welfare, and food safety. Information deficiencies in these areas are primarily due to asymmetry. It may be difficult for consumers to determine what attributes apply to particular products (*e.g.* whether organic methods of production are used or if a product is labelled as organic the methods of production involved). It may also be difficult for the government to ensure that standards for ensuring public health and safety are being met. Two mechanisms can be used to generate the necessary information to monitor performance in such areas: private mechanisms and regulation.

A major example of the role of private mechanisms in providing information on performance is the voluntary development and application of product standards. Farmers and others involved in the food and agricultural system may perceive that there are commercial advantages in developing and applying standards and respond accordingly. A recent study of the development of farm animal welfare standards in North America indicates that while there has been increased regulatory activity in this area, a number of major initiatives are being driven by commercial incentives (Farm Foundation, 2006). Food retailers and the food service industry are demanding higher production standards in some areas in order to maintain consumer acceptance of their products and to protect market share. Producers are responding to these demands by introducing codes of practice supported by independent auditing. Government can play an important role in helping to develop standards and in auditing compliance. Federal and provincial governments in Canada are playing an important role in this regard in animal welfare standards. The U.S. Department of Agriculture played a leading role in the development of U.S. standards for organic products. It also certifies agents who review applications from farmers and processors for certification eligibility, and the inspectors who conduct annual onsite inspections of their operations (Dimitri and Oberholtzer, 2005). In the United States the development of traceability systems for several categories of agricultural products is also being motivated by economic incentives (Golan *et al.*, 2004). Firms are introducing such systems in order to improve supply-chain management, increase safety and quality control, and to facilitate the marketing of foods with particular credence attributes (such as organic products).

Regulatory mechanisms can also play a role in providing the necessary information to monitor performance and monitor outcomes. In some countries legislation forms the basis for the implementation of product standards and for mechanisms to ensure that these are met. The European Union, for example, has legislation requiring traceability for food and feed products through all stages of production, processing and distribution (EC, 2002). Requirements that came into force in 2005 mean that businesses must be able to identify their immediate supplier of a product in question and its subsequent recipient, with the exception of sales by retailers to final consumers. As a result of this regulation bar codes are now

commonly used in the European Union to maintain the information required by government agencies in the event of a food safety incident. In Japan, a Beef Traceability Law was put in place in 2003. All domestically raised cattle are assigned a 10-digit ID number which is used to track the origin and subsequent disposition of animals by the National Livestock Improvement Center. The ID number is used throughout the beef supply chain from farms to the retail level. Several major retailers in Japan have installed systems that allow consumers to view information on the beef they are purchasing from a computer database linked to the unique code on the label.

The central aim of traceability systems is to permit rapid identification of sources and location of products in the event of animal health events or foodborne illnesses. In addition to serving this important function, tracking systems using bar codes or radio frequency tags permit extensive information to be generated on the geography and efficiency of product flows. Whether introduced on a voluntary basis or in response to regulatory requirements, such systems can play an important role in increasing the information available to policymakers on food system performance, providing that policymakers can actually gain access to that information.

Agriculture and the national and rural economies

A final set of performance issues for agriculture relates to the general economic contribution of the sector. In most OECD countries agriculture's contribution to national output and employment has declined sharply with the growth of the economy. The percentage of total income and employment contributed by agriculture in many countries is relatively low; it is higher if the definition of the sector is broadened to include processing and distribution activities. Data on agricultural output and employment are still routinely collected in many countries in order to provide completeness in national accounts and employment figures, but such data have limited applicability to policy issues at the sectoral level. Despite this, there is often interest in monitoring the sector's contribution at the sub-national level, particularly in regions where agriculture is a major part of total economic activity. The policy interest in rural development in many OECD countries clearly involves consideration of the economic position of agriculture in rural areas.

Statements of rural development policy objectives in OECD countries reveal a wide array of aims (OECD, 1998*b*). These include:

- Enhancing the competitiveness of rural areas so as to maximise their contribution to economic development.
- To provide opportunities for rural residents to enjoy a standard of living comparable to national norms.
- To maintain rural population and reverse out-migration.
- To diversify and promote increased employment opportunities, particularly in response to declining employment in agriculture and related industries.
- To improve the quality of rural life and reduce disparities in living conditions and to conserve and protect the cultural environment and heritage of rural areas.

Other policy objectives can relate to the economic status (income and wealth) of farm households, and to natural resource and environmental issues. Information issues relating to those aspects are discussed in more detail below.

In order to examine the issues identified above a range of information is required. One review of available information for England concluded that while data on agricultural structures and activities is

readily available, broader information on rural economies, quality of life, and other aspects relating to rural areas are not in a readily accessible form (Hill, 2003). The most significant problem is that existing "statistics are not often available that facilitate the separation of the rural from the non-rural" (p. 6). In order to develop a policy-driven system of rural statistics four main issues need to be addressed:

- Coverage – determine what aspects of rural areas need to be addressed, what indicators are appropriate for each of these, and what data are needed to construct them.
- Availability – determine what data exist, who the owners are, and how to access the data. As part of this process data gaps can be identified and decisions made on whether to fill these.
- Methodology – determine what geographical unit is to be used for data aggregation and the criteria for classification into rural versus other categories.
- Data acquisition and management – determine what organisational issues need to be addressed to establish a system of rural statistics, in particular those associated with combining data sets across various government entities.

A recent detailed study of statistical needs and availability by the Intersecretariat Working Group on Agriculture Statistics and Rural Indicators proposes two schemes that can be used for constructing rural development indicators (IWG.AGRI, 2005). In the first of these the focus is on the components of rural development (natural environment, social well-being, and conditions for economic well-being) and the potential of rural development (territory with respect to population, economic structure, and communications). In the second, the focus is on the development process in terms of key assets (natural, financial, human, physical and social). In developing indicators under each of these schemes three dimensions are proposed: 1. state (current situation); 2. dispersion (concentration or variability) and 3. tendency (trends over time). Detailed examples are provided of indicators that fall under each of the two schemes. For both schemes the emphasis is on the use of data which are already available in deriving necessary indicators.

As is the case in evaluating the economic performance and competitiveness of the agricultural sector, policymakers may wish to make international comparisons of performance in rural development. There are particular challenges in doing this, as illustrated by the OECD's work in the development of approaches and indicators (OECD, 1994). The OECD's work has been based on three basic principles:

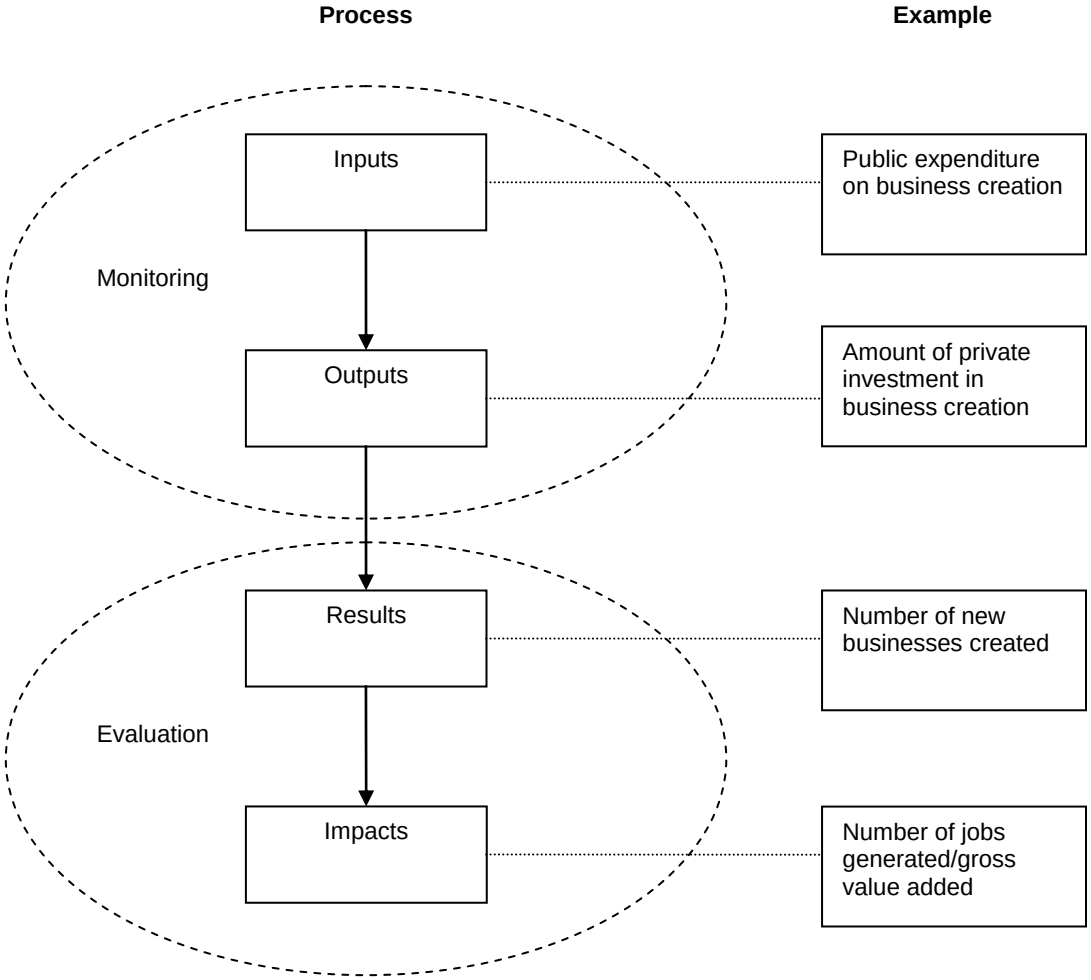
- Relevance – serving a clearly defined purpose.
- Reliability – having a sound scientific basis.
- Realisability – built upon available statistical data.

While the notion of "rural" is universally used by OECD Member countries, official definitions do not always exist or countries use a range of criteria to designate rural areas (*e.g.* size of population, population density, share of agriculture in the local economy). Within a given criterion, for example population density, different thresholds can be used to define the demarcation between rural and other categories. Recognizing these differences the OECD's approach is to use two hierarchical levels of geographic detail for comparative purposes: *1)* the local community level (small, basic administrative units appropriate to the country concerned) that can be classified as being either rural or urban; and *2)* the regional level (larger administrative units or functional zones that can be classified as being more or less rural. Population density is used as the criterion to distinguish among rural and other communities or regions. On this basis international indicators relating to four areas have been computed: population and migration; economic structure and performance; social well-being and equity; and environment and sustainability.

A recent example of expanding the use of data in implementing rural development policies, and the challenges that this poses, is provided by the European Union. Under the rural development programming for 2000-2006 a process was created for monitoring the implementation of policies by EU members and for evaluating outcomes. Its conceptual basis is illustrated in Figure 4. Ideally, inputs associated with policy, for example, public expenditures on business creation are compared to their corresponding output, for example, the amount of private sector investment in the creation of new businesses. The results of these expenditures, for example, the number of new businesses created, are then evaluated. Finally, the impact of a policy measure, in this case the value added and employment generated by the new businesses, is assessed. In order to implement this approach a common set of evaluation questions with associated criteria and indicators was developed (CEC, 2000a). The actual implementation of the framework has not proved to be easy and the system continues to evolve. A recent assessment identifies a number of operational difficulties relating to the identification of suitable evaluation criteria, alignment of indicators with these criteria, definition of impact as opposed to output indicators, and the measurement of additionality (Bradley *et al.*, 2006). Challenges are posed by missing data and by the heavy demands placed on administrative arrangements and processing systems. One issue identified is that the requirements for record keeping and reporting for participants in programmes may have acted as a disincentive to participation. The impact of transactions costs on the supply of data is not unique to this particular case and has more general implications for meeting information gaps in the formation and implementation of policy.

In a recent statistical report on rural development in the European Union two particular problems are identified in deriving a set of baseline indicators that can be used to evaluate the impact of rural development programmes for 2007-2013 (CEC, 2006a). These are the limited availability of the required data in many member states and the lack of a commonly accepted definition of what constitutes a rural area. The second issue complicates finding a solution of the first, since it is difficult to collect relevant data if a single basic geographical unit of observation cannot be defined. Given such methodological difficulties, which relate in part to the difficulty of clarifying the policy focus in rural development (*i.e.* what is policy trying to achieve and where) it is perhaps not surprising that there are major challenges in assessing policy impact. Although it will not be easy to reach agreement on the basic aims of rural development policy that permit the identification of targets and quantitative indicators of policy outcomes, more progress needs to be made in clarifying these issues and achieving a greater degree of consensus across OECD countries if information deficiencies are to be overcome.

Figure 4. EU model for monitoring and evaluation of rural development measures



Source: Adapted from Commission of the European Communities (2004).

Summary

- The economic performance of the agricultural sector has been a traditional concern of policymakers in OECD countries. Concerns, such as competitiveness, remain important in an environment of policy reform. New performance criteria, particularly relating to product attributes, are becoming increasingly important in many OECD countries. Information on performance can be generated through the application of both market and regulatory mechanisms in policy.

- Structural change in the agricultural sectors of many OECD countries makes it more difficult to generate meaningful information on the economic performance of the sector. The declining share of total value added at the farm level, the growing use of contracts as opposed to auction markets, and product differentiation make it difficult to obtain necessary information and increase the complexity of interpretation. Mandatory reporting may be the only realistic option for obtaining performance data when the level of industrial concentration is high.

- The economic contribution of the agricultural sector (measured by its share of national income of employment) has declined substantially in many OECD countries, but its contribution in some regions can be important. As a result, the information focus has tended to shift towards broader indicators of rural development.

- Considerable challenges are created by this change in focus, not least in terms of coverage, availability, methodology, and data acquisition and management. Some of these issues are being addressed in OECD countries as part of the monitoring and evaluation of rural development programmes.

- A major challenge for identifying information priorities in the area of rural development is the lack of clarity and consensus in policy focus. Efforts to clarify basic aims and the quantitative targets that can be used to monitor these would help to identify priorities for meeting information deficiencies.

Income and well-being of farm households

The well-being of farm households has traditionally been an area of concern for agricultural policymakers. Many of the current support programmes in OECD countries have their origins in measures introduced to address the depression in agriculture and rural economies in the 1930s. Although the current scale of economic problems is small in comparison to that period, there is still a considerable emphasis on ensuring that farmers have a reasonable level of economic well-being. While an explicit goal may be difficult to identify in many countries, it is apparent that information on economic well-being is of considerable importance in establishing policy needs and in monitoring the effectiveness of policy measures (OECD, 2003b).

In many OECD countries, the primary focus is on measuring the income associated with farming, generally referred to as "farm income". In others, the focus is on income of farm households. Some of the questions for which information may be sought include:

- Do farmers or farm households achieve, on average, incomes on a par with other groups in society?
- Is the incidence of low incomes higher in agriculture than in the rest of the economy?
- How large are income differences (inequalities) in agriculture?
- Is the variability of income through time greater than in the rest of the economy?

If one takes the view that agricultural support is primarily provided to address equity issues, it would seem appropriate that the definition of income employed should parallel that which would be used in addressing similar concerns for other groups. This would imply that a measure of total income (the sum of income from farm and off-farm sources) would be preferable to partial measures. Whether the income measure should extend beyond the farm operator to include other members of the farm household also depends on how more general income support policies function. In many OECD countries general income support programmes take into account the income of the principal and other members of a household (typically a spouse) on the assumption that some sharing of resources will take place among household members. On that basis, broadening the definition of income to include that of other household members (operator plus spouse) is appropriate.

For many farmers and farm households in OECD countries, the income obtained from farming is just part, and in many cases a declining proportion of their total income (OECD, 2004). An increasing number of farm households in OECD countries derive significant income from non agricultural on-farm and off-

farm activities, and from investments and social transfers. As a result, if the aim is to evaluate the well-being of farm households it is desirable to have information on income from sources other than farming. This will require the modification of data collection approaches in some OECD countries. A second issue is that income alone may not be sufficient to capture well-being. Farming involves the use of valuable assets, both short-term assets such as crops and livestock for sale and stocks of inputs, as well as long-term assets such as farmland, buildings, and machinery and equipment. If the ownership of such assets is taken into account (*i.e.* wealth, in addition to income) this provides a more accurate picture of economic status (Hill, 2000). The net worth of the farm business can provide a more complete indicator of the financial health of a farm than its net income, as is also the case for other socio-economic categories. The net worth of farm households, taking into account both farm and non-farm farm assets permits a more accurate assessment to be made of economic status than income alone.

There are two basic approaches to measuring agricultural income. The first focuses on aggregate measures using national accounts data in which farming is seen as one branch of the economy. Estimates can be derived by focusing on production activities – using physical inputs and outputs and their prices to infer net value-added. Such estimates can then be used to derive additional indicators, such as returns to factors (land, labour and capital). Income estimates can also be derived by focusing on payments to/from institutional units (households). These estimates are broader than those derived from the production method, since they will capture other sources of income in addition to those from agriculture. The second approach to measuring income is based on micro-economic data collected through sample surveys or censuses. As with the national accounting approach the focus can be primarily on production activities – the collection of data on costs of production and product receipts – or based upon household expenditures through household budget surveys. As noted earlier, in some countries it is possible to obtain income data from taxation records.

While it is possible to examine broad trends in income and relativities across sectors from macro (national accounts) data, in-depth analysis of the income and wealth position of farmers requires micro (individual farm) data. Most countries collect information on farm income, costs and returns, and farm size through farm surveys. Some collect additional information on assets and debts that allow the net worth of the farm operation to be calculated. However, data on the income obtained from non-agricultural activities (on and off the farm) and non-agricultural assets are seldom collected. It may also be the case that certain categories of farmers (*e.g.* small and pluriactive) are excluded from the sample frame. As a result, it may only be possible to form an incomplete picture of the income and wealth position of those who are engaged in farming. From the perspective of policy formation and evaluation in those countries where the objective relates to farm household incomes it would seem to be particularly important to ensure that farm-level data are collected on non-farm activities and sources of income, as well as comprehensive information on assets, and that coverage is representative of the range of farms and farm types by avoiding narrow definitions of what constitutes a farm or a farmer. Where direct payments provide the main form of income support for farmers such information can be collected as part of the process of administering the payment programme.

Improved targeting in this area, as required by the Ministerial statement cited at the beginning of this paper, requires accurate information on economic status. Recent OECD work on the evaluation of policy efficiency suggests that formal benefit-cost analysis is both possible and desirable in this particular area (OECD, 2007). The efficiency of transfers and targeting effectiveness are key issues that can be assessed through the use of improved information at the level of the farm household. For this reason some countries have sought to refine the micro (farm level or farm household level) data collected on sources and levels of income and assets. Farmers who have benefited from untargeted transfers may have an incentive not to provide accurate information, *i.e.* to understate their income or wealth either to preserve existing levels of transfers or to increase them. This moral hazard problem might be overcome through a variety of approaches:

- Procedural – data collection methods, *e.g.* the use of personal interviews for particularly important groups of respondents, obtaining information through indirect questions, checking data for internal consistency (within farms, among comparable farms), and cross-checking with other surveys.

- Incentives – the payment of monetary inducements, the use of a non-response option to allow opt-out for selected questions (sensitive areas) under the assumption that obtaining some data is better than none.

- Compulsion – a requirement to respond for recipients of direct government payments or the incorporation of data collection in mandatory reporting systems, *e.g.* as part of the process of delivering direct payments or in preparing tax returns.

- Protection of confidentiality – a commitment on the non disclosure of individual records and no cross reporting (*e.g.* to taxation authorities).

One example of the modification of a traditional survey instrument to address structural change and to meet the changing needs for information is provided by the Agricultural Resource Management Survey (ARMS) of the U.S. Department of Agriculture. Sponsored jointly by the Economic Research Service and the National Agricultural Statistics Service, ARMS is a national representative sample survey that provides information on field-level farm practices, the economics of the farm business, and the characteristics of the American farm household. ARMS data underpin USDA's annual estimates of net farm income, subsequently provided to the Bureau of Economic Analysis for the development of annual estimates of gross domestic product and personal income. ARMS fulfils a congressional mandate that the USDA provide annual cost-of-production estimates for commodities covered under farm-support legislation. The ARMS survey also provides data on chemical use on field crops required under environmental and food safety legislation. ARMS data are a key resource for the Economic Research Service in the provision of policy-relevant information and for analysis covering a range of issues. Survey content and the data collected have evolved through time to reflect both structural changes in U.S. agriculture, as well as the evolving debate on policy issues. The earlier focus on costs and returns has been broadened substantially to reflect the need for information on other aspects of farming in the United States. If funding can be obtained the ARMS approach will be extended to provide a longitudinal data set (through the collection of panel data). This would permit changes in economic well-being to be tracked through time. Important policy issues, such as those relating to variations in income and wealth, are difficult to address in the absence of such longitudinal panel data.

A further issue is raised by the increasing separation of land ownership from land operation in some OECD countries. For a variety of reasons land owners may decide to rent out their land, rather than farming it personally. Owners who do this may be engaged in other economic activities or are retired. Farmers use the rental of farmland to take advantage of economies of scale and size. The separation of land ownership from operation has important implications for policies that are designed to improve the well-being of farm households. As observed earlier, it has long been established that transfers from commodity price supports and income support that is closely linked to farming tend to become capitalized in part into agricultural land values (Floyd, 1965). As a consequence, it is difficult to assess the transfer efficiency of support policies at the level of individual farms or classes of farm without information from both land operators and land owners. Such information may also be important in assessing the impact and efficiency of certain environmental programmes, particularly those involving investment decisions and changes in land use. It is relatively rare for survey information to be collected from land owners, as distinct from land operators. The United States conducts a land ownership survey, roughly every ten years, in conjunction with the agricultural census. The last such survey was completed in 1999. This type of survey provides

vital information on land ownership and rental arrangements, and the participation of land owners in farm decision-making.

In some countries, it may be difficult to adapt existing survey instruments to provide data needed to enhance the assessment of policy impact and effectiveness relating to farm household well-being. For example, the Intersecretariat Working Group Study notes the difficulties (both legal and technical) in trying to adapt the European Union's system of farm accounts to provide more complete information on the well-being of farm households (IWG.AGRI, 2005). Other sources of information, such as household budget surveys or related panel sources of data may potentially be useful in providing information to guide policies oriented to the well-being of agricultural households. However, in order for that potential to be realised improved coverage of agricultural households would be needed, in addition to an expansion of the information collected on income and assets. A trade-off would also would have to be made between a reduction in the detail on agricultural activities than could be obtained from such surveys, and the broader picture of well-being that they could provide.

As noted earlier, a key challenge is that farmers or landowners may be reluctant to provide the information needed to assess economic well-being, particularly if they expect that this might result in policy changes. It may be difficult to maintain response rates in surveys that rely on voluntary participation if the range of information collected on income and wealth is broadened too much. To address this issue it may be necessary to strengthen the linkage between the provision of certain types of information and payments, by making the former a requirement for the latter. This would permit improvements to be made in the targeting of payments and increase accountability. Alternatively, if the basis of payments is changed from income support to the provision of environmental goods and services, the focus can shift to gathering information on the supply of those rather than on income and wealth. Farmers and landowners are likely to be less resistant to providing the information needed to target environmental payments than income support payments.

Summary

- The economic well-being of farmers and farm households is an important policy concern in many OECD countries. This can centre on income relative to those in other occupations, the incidence of poverty, income inequalities within the sector, or the variability of income through time.

- In many countries the primary focus is on measuring the income associated with farming, although the income obtained from farming is just part, and in some cases a declining proportion of the total income of farm households.

- Well-being is not captured by measuring income, since wealth is an important consideration. Net worth, taking into account both farm and non-farm assets, provides a more accurate picture of economic status than income alone.

- Although macro-economic estimates can be computed, the primary source of data on income and wealth is farm-level surveys. From the perspective of policy formation and evaluation for farm households it is particularly important that data are collected on non-farm activities and sources of income, as well as information on assets, and that coverage is representative of all farm types. In countries where the renting of land is important, data on both land owners and operators is needed to improve the evaluation of policy impact.

- A number of OECD countries have been taking steps to improve the quality of information relating to farm household well-being. Recent work by the Intersecretariat Working Group on

Agricultural Statistics and Rural Indicators provides a foundation for further improvements in this area.

- The targeting of income support and other payments to farmers and landowners may require that the voluntary provision of information be supplemented by a requirement to provide certain types of information in order to be eligible for payments.

Externalities and public goods

In recent years there has been increasing recognition of the contributions that agricultural activities can make to society, beyond those reflected in the crop and livestock products generated by the sector. In the environmental area, for example, agricultural practices can make a positive environmental contribution by helping to preserve the landscape or providing wildlife habitat. Conversely, certain practices can make a negative contribution by causing soil erosion or pollution, or by reducing biodiversity. The interests of the public and of policymakers in the non-commodity outputs of agriculture have expanded and so has the need for information to inform policy decisions. This has led to efforts to develop suitable indicators of the impact of agriculture on the environment – agri-environmental indicators (AEIs).

As noted earlier, indicators can play an important role in improving policy formation and evaluation. In this respect, the development of monetary (or common numeraire) methods for assessing environmental outcomes are particularly important since these open the possibility for benefit/cost analysis. There are advantages in using a systematic approach to evaluating benefits and costs of environmental policies and considerable progress has been made in the development of techniques that permit this (OECD, 2006*a*). Challenges remain, such as the problems created when technical relationships are uncertain (*e.g.* impact of specific farm management practices on biodiversity) or when it is difficult to measure outcomes (*e.g.* the impact of policy measures on non point source pollution) or because it is difficult to assign a value to a particular outcome. In such cases, it may be necessary to focus on obtaining information that will allow the construction of indicators that permit an assessment of 'movements in the right direction'. Indicators of this type can either be input focused (*e.g.* the adoption of management practices that are believed to result in improved environmental performance), or output focused (*e.g.* physical indicators of improvements in water quality or the size and diversity of wildlife populations).

Environmental indicators

Many OECD countries generate AEIs. The OECD's latest comprehensive publication on indicators that will be published shortly reviews recent developments in a range of countries – Australia, Canada, Finland, France, Italy, Switzerland, the United Kingdom, and the United States (OECD).

An important example of the use of a range of existing sources of data to create environmental indicators is the European Union's IRENA project (Indicator Reporting on the Integration of Environmental Concerns into Agriculture Policy). The objectives of the project were set out by the European Commission in 2000 (CEC 2000b). The underlying methodology to be used to develop 35 core indicators and the sources of data were elaborated subsequently (CEC 2001). The derivation of the indicators has required pooling of skills across the European Environment Agency and a range of Commission directorates or other entities (Agriculture, Environment, Eurostat, and the Joint Research Centre), as well as agencies in EU member states. Assembly of the indicators was completed by 2005. Of the 42 indicators and sub-indicators finally developed roughly one third are based on data at the regional level and roughly half have a time series. The longest period covered is 1990-2000. Several of the indicators were developed using models or case studies. On the basis of these indicators, a report was prepared assessing progress with environmental integration into EU agricultural policy (EEA, 2006). The report notes that it is only possible to provide a partial assessment, particularly in terms of the effectiveness

of existing policies, but the work permits some important conclusions to be reached, such as the need for improved geographic targeting in EU agri-environmental schemes.

Another example of AEIs is the periodic publication of indicators on agricultural resources and the environment in the United States. In the latest report by the Economic Research Service of the U.S. Department of Agriculture a range of information is provided on developments in the use of land and farm resources, water and wetland resources, knowledge resources and productivity, agricultural production management and conservation and environmental policies (ERS, 2006). A wide variety of data sources are used, including periodic farm and land use surveys (for example, the ARMS data referred to earlier) and special projects and surveys to provide information on a variety of policy issues. The results of research are integrated with summary data to examine these issues. This approach provides an example of how data and analysis can be combined to provide information relevant to policy formation and evaluation relating to land use and environmental issues.

At the international level, the OECD's work on agri-environmental indicators (AEIs) has focused on indicator definitions, methodologies and the calculation of indicators (OECD, 1997, 1999, 2001). Seven meetings have been held to bring together experts from OECD countries to exchange information and advance knowledge in a range of issue areas. Data have been assembled from questionnaires sent to member countries and from other sources. The OECD's work addresses four main areas:

- ***Agriculture in the broader economic, social and environmental context:*** the influence on agri-environmental relationships of economic forces (*e.g.* farm production, employment), societal preferences (*e.g.* rural viability), environmental processes (*e.g.* interaction of agriculture with biophysical conditions) and land use changes (*e.g.* agricultural land use)

- ***Farm management and the environment:*** the relationship between farming practices and systems and the environment

- ***Use of farm inputs and natural resources:*** trends in the use of farm inputs, covering nutrients (*e.g.* fertilisers, manure), pesticides (including risks), and water use

- ***Environmental impacts of agriculture:*** agriculture's impact on soil quality, water quality, land conservation, greenhouse gases, biodiversity, wildlife habitats and landscape.

The resulting indicators provide comparative information for those OECD countries for which data are available, much of which spans the period 1990-2002/3. Data are provided on trends in agricultural production and land use, nutrient balances (nitrogen and phosphorous), pesticides use and risk indicators, energy use, soil erosion (recent levels of risk from wind and water erosion), water use and quality, air quality (emissions of ammonia and other greenhouse gases and use of methyl bromide), biodiversity (indicators of genetic diversity in agriculture, wild species diversity, and ecosystem diversity), and farm management (use of environmental management practices).

Four criteria are used to identify indicators. These are:

- policy relevance – addressing key environmental issues faced by governments and other stakeholders in the agricultural sector.

- analytical soundness – based on sound science and continuous improvement as knowledge evolves.

- measurability – feasible given current and planned data availability and cost effective.
- ease of interpretation – communicate essential information that is unambiguous and easy to understand.

In its evaluation of progress on the development of indicators, the OECD secretariat observes that while considerable advances have been made on internationally comparable indicators some challenges remain. Two, in particular, may be highlighted for the purposes of this paper. The first is that the scientific and analytical basis underlying some agri-environmental relationships needs to be developed further in order to provide useful indicators. One area in which this is the case is the relationship between farm management practices and environmental outcomes (biodiversity is an example cited). A second issue is the lack of data availability in many countries relating to certain indicators. The areas in which it is difficult to obtain representative country coverage are: soil erosion, biodiversity, and organic carbon; water use and quality; biodiversity; agricultural landscapes and land ecosystem functions; and farm management indicators relating to the environment.

Improving data for the analysis of environmental policies is likely to be a major priority in OECD countries in the future. In the agricultural area, obtaining better information at the level of individual farms on practices that affect the environment is a key requirement for the formation, implementation and evaluation of agri-environmental policies. An OECD meeting of experts on farm management indicators and the environment provided some useful pointers to how information deficiencies in this area might be remedied. Some of the lessons were:

- **Linking existing farm-level financial data with environmental indicators**, particularly physical data, can make a contribution. One example discussed was the use of data from the Farm Accountancy Data Network (FADN) in Europe to link a typology of livestock farming systems to a range of management indicators (*e.g.* stocking density) and input use (Andersen *et al.*, 2004). There are difficulties in achieving the required integration of data, not least because physical data, as distinct from financial data, may not be available, and the difficulty of linking farm-level data on input use to specific land-uses, such as permanent pasture or arable crops. Nevertheless, as is also illustrated by extensions made to the ARMS data set in the United States, discussed earlier, it is possible to improve the environmental information obtained from on-going farm financial surveys.

- **Targeted surveys** can be a cost effective way of generating additional information on areas of major policy concern. An example discussed was the use of special follow-up surveys to the Agricultural Census in Australia (Vardon *et al.*, 2004). Such surveys focused on land management and salinity and water use. Sub-groups of farms were identified for more intensive data collection on the basis of information obtained from the census. Information obtained at the individual farm level (*e.g.* on management practices) was linked to that obtained from other sources (*e.g.* on water quantity and quality) to enhance the ability to examine the relationship between behaviour and environmental outcomes. A further example was provided from Finland of linking customized farm surveys to analytical models in order to determine environmental impact (Yli-Viikari and Lemola, 2004).

- **Data obtained through regulatory programmes** can help to improve the understanding of the linkage between practices and outcomes. In Norway, for example, a considerable amount of information is generated at the farm level through the requirement that all farms that receive general agricultural payments have to prepare an environmental plan (Lyssandtrae, 2004). Several information requirements are imposed, *e.g.* the need to prepare a map of agricultural land in use for each farm that identifies cultural monuments, areas of important biodiversity, and areas with a high risk of erosion. A plan for corrective measures for identified problems is required and

documentation of goals and actions taken. Although the system was designed for internal audit purposes, rather than the development of policy indicators, surveys could be used to collect data in a systematic way for that purpose. All farmers receiving direct payments in the European Union are now subject to compulsory cross-compliance – conformity with regulations applying at the farm level in the fields of environment, public, animal and plant health and animal welfare. The systems that are being created by EU members to monitor cross-compliance have the potential to generate additional information for monitoring policy effectiveness in these areas (Anderson, 2004). There are other examples in which regulatory requirements can be used as a means of delivering more accurate data relating to agri-environmental policies. One such example was the requirement in the Netherlands that farms be able to account for nutrient balances through the mineral accounting system (MINAS), although this system has been phased-out as a result of changes in the implementation of water quality policies (OECD, 2006*b*).

In-depth analysis of agri-environmental issues requires site-specific information and information that extends beyond the individual farm. The need for geo-referenced data can be met in some cases through the use of new technologies, such as remote sensing (discussed further below). Efficient policy may need to be local to address local environmental issues, *e.g.*, a water quality focus requires approaches centred on the watershed. Water quality goes beyond the farm to all emitters of potential pollutants. Many policy issues (relating both to rural development and environmental quality) require an explicit land use focus rather than simply a farming focus. This requires a broadening in the use of information beyond the traditional sources used by agricultural policymakers that were discussed earlier.

A recent report on the experience gained in the implementation of the IRENA project makes several recommendations on how data can be improved for developing agri-environmental indicators in the European Union (CEC 2006). For the purposes of the current report, the most important recommendations are:

- Further develop existing legislation with respect to agricultural data, both statistical and administrative, to cover more effectively data needs for the construction of indicators
- Set up and develop targeted surveys to address farm management practices and the use of inputs
- Examine the adaptation of the farm accountancy data network (FADN) to provide information suitable for environmental reporting and analysis
- Improve existing modelling frameworks for the development of indicators
- Focus on improving indicators in a number of key areas, such as biodiversity, habitats and landscape
- Expand the use of data obtained through environmental monitoring systems (e.g. those associated with existing directives relating to water quality), non-public data providers, and the use of new technologies, particularly for the development of geo-referenced information.

In addition, the report suggests that a high priority should be assigned to the establishment of a permanent and stable arrangement between EU institutions and those in member states to provide for the development, compilation, maintenance, and updating of indicators. The report demonstrates that making progress in improving the provision of data for policymaking purposes generally involves finding solutions to a range of both technical and administrative issues.

Summary

- There is increasing recognition of the contributions (both positive and negative) that agriculture can make to society, beyond those reflected in crop and livestock products. Interest in the non-commodity outputs of agriculture has expanded and so has the need for information to inform policy decisions.

- Considerable progress has been achieved in the creation of agri-environmental indicators (AEIs) at the national and international levels. The focus is on policy relevance, analytical soundness, measurability, and ease of interpretation.

- In its evaluation of progress to date, the OECD Secretariat has identified a number of challenges. Two are particularly relevant. The first is that the scientific and analytical basis underlying some agri-environmental relationships needs to be developed further in order to provide useful indicators. The second is the lack of basic data relating to some indicators.

- A number of approaches can be taken to improving information on environmental issues at the farm level. An OECD expert meeting on farm management indicators and the environment provides examples of how value can be added to existing data, These include expansion of information collected through existing farm financial surveys, the use of special targeted surveys, and the use of data obtained through regulatory programmes to reduce information deficiencies.

8. New approaches to meeting information deficiencies

Several technological and methodological developments have opened up the possibility of using new methods to obtain information that can help to meet the needs of policymakers.

Geo-referenced information

One of the key characteristics of agriculture is that it is a major user of land and other natural resources, particularly water. Monitoring and policy evaluation in the key areas of land use and the environmental effects of agriculture require information that is location specific. Advances in technology, particularly remote sensing using satellites, have made it technically feasible and increasingly cost effective to obtain and process geo-referenced data for policy analysis. A major application is the preparation of spatial inventories of land use. Through the use of geographical information systems (GIS) technology changes in land use patterns can be examined. One of the uses of this type of information has been to monitor the compliance with land use requirements under agri-environmental programmes (Askew, 1999; Slater, 1999). Efforts are underway in some countries to integrate geo-referenced data with farm management data in order to enhance the ability to link changes in economic conditions at the farm level to changes in land use (Fais *et al.*, 2005). Geo-referenced data can also provide an important management tool for farmers in dealing with environmental issues. In New Zealand, for example, GIS data are being used to improve farmers' understanding of the risks of nutrient and bacterial contamination of water sources on their properties (Quin *et al.*, 2004). Achieving the necessary integration of data sources to provide site-specific information involves a number of challenges and is relatively complex. However, it has considerable potential for improving understanding of a number of key policy issues relating to agriculture and land use. These include the role of geographic and economic heterogeneity in policy implementation and the impact of targeting on policy outcomes.

Electronic data collection

The increasing use of computers and the Internet by farmers and their families in many OECD countries opens the way to using these technologies in the collection of data for policy purposes. For example, for the first time farmers will have the option of submitting their data through the Internet in the compilation of the 2007 Census of Agriculture in the United States. Electronic submission has the potential to reduce the response burden of those involved in supplying data, increasing efficiency in data acquisition and processing, and improving the timeliness with which information can be generated for policy purposes. Controlling the response burden in data acquisition is a key issue. The quality and quantity of data provided in surveys can be undermined if data providers consider that the demands placed upon their time are excessive. Electronic data collection can reduce the perceived response burden by making data collection more automatic, providing a simpler, more interesting and more rapid way of providing data, and by virtue of the capacity to generate electronic reports, opens the possibility of giving something back to data providers (Sæbø *et al.*, 2002). For example, farmers may be more willing to provide information on the operation of the farm business if they are subsequently provided access to systems that allow them to benchmark their performance against other farms and to explore opportunities for increasing efficiency and profitability. This service is provided to participants in the ARMS survey in the United States. The Department of Environment, Food and Rural Affairs (DEFRA) in United Kingdom is developing an integrated on-line dataset that will enable farmers in England to supply more easily the data required under various programmes (including cross-compliance under the Common Agricultural Policy), as well as to provide access to advice and information to improve management practices (Anderson, 2004). Both of these examples contain important incentive components. As noted earlier, such components can be important in helping to address information asymmetry.

Dealing with information asymmetry[2]

As has already been noted, one of the challenges facing policy analysts is that in some critical areas information can be very difficult to obtain. Information may exist but the potential providers of information have no incentive to supply it. This information asymmetry is an aspect of the principal-agent problem in policy implementation. There are two key components (Campbell, 1995):

- the hidden characteristic problem – the principal may not know key characteristics that determine whether a desired outcome will be forthcoming, *e.g.* a consumer's preferences, a firm's production or cost function. This is sometimes referred to as the adverse selection issue through which policy effectiveness is reduced and economic inefficiency created.
- the hidden action problem – the principal may not be able to determine whether the agent has actually undertaken a desired action. The agent has information that the principal does not have. This issue is sometimes referred to as the moral hazard issue which arises when the agent acts in such a way that an undesirable outcome results.

We can illustrate these concepts with reference to payments to farmers for the provision of environmental goods and services. The principal (policymaker) wants the agent (farmer) to take some action that will result in the provision of an environmental good or service, for example, a set of practices that will increase biodiversity. The principal does not know what payment would be necessary to induce the agent to do this (the hidden characteristic problem). If a payment is offered to farmers, those who would incur high costs in the provision of the service may not participate, even though their participation could result in the largest gain to society as a whole (adverse selection). It may be difficult for policymakers to verify that farmers who actually participate in the programme are undertaking the actions that will result in greater biodiversity (hidden action problem); some farmers may take the payment in full knowledge that they are not fulfilling the conditions attached to receiving the payment (moral hazard).

There is a critical need for information to address these issues, but obtaining that information can be a challenge. In some cases the technological developments discussed earlier can help. Thus, for example, if farmers are required to use certain observable land-use practices these can be verified through remote sensing. If they are required to manage nutrients (fertilizer and manure applications) this could be monitored through electronic farm records data, combined with periodic auditing. In many cases, however, the solution lies in designing programmes that have incentive-compatible features (Fraser and Fraser, 2006), *i.e.* in which agents by acting in their own interests will also act in the interests of the principal. In the case of the environmental payments example used earlier the incentive provided by the payment (and the disincentive of non-compliance with the conditions attached to payments) would be such that farmers would choose to implement the practices needed to increase biodiversity, thus achieving the objectives of the programme.

This requirement has significant implications for programme design and for the provision of information. If programme mechanisms can be designed that result in the reduction or elimination of information asymmetries, policy effectiveness can be increased and information vital to policy formation and evaluation can be provided. One way in which this can be achieved in environmental programmes is through the use of auction methods (Weinberg, 2006). The Conservation Reserve Programme (CRP) in the United States uses a bidding system to set payment rates for the removal of environmentally-sensitive land from production. Farmers submit bids on the payment that they will be willing to accept to retire parcels of land from production. The characteristics of the land are compared against a set of selection criteria that target highly erodible land, among other environmental factors. Bids are subject to caps and producers

2. An OECD Workshop on Information Deficiencies in Agri-environmental policies examined this issue and the issue of valuing non-market goods and services which is taken up in the next section.

know the environmental score before placing their bids. Parcels that have the highest benefit-cost ratio are selected for inclusion in the programme.

This type of approach has a number of advantages in terms of meeting information needs for policy implementation. Farmers are made aware of the environmental attributes upon which a value is placed and the relative weights that are assigned to these. The bid cap indicates the maximum that will be paid for any piece of land that possesses these attributes. Both of these aspects increase transparency in policy implementation. Farmers who have lower opportunity costs by placing their land in the programme are likely to do so; it is often land that is least productive that is the most environmentally sensitive. The competitive nature of the programme means that there is less likelihood that farmers will be overpaid (paid in excess of opportunity costs), thus controlling costs, permitting targeting and increasing policy efficiency. The approach used in this programme makes policy implementation amenable to a formal assessment of benefits and costs.

The use of trading mechanisms for pollution control and environmental benefits may also help to address information asymmetry by creating incentives for agents to reveal their willingness to pay (WTP) and willingness to accept (WTA) payments for environmental goods and services. In the pollution case, a cap is placed upon the generation of a pollutant and allowances are issued to participants. Those who are able to reduce pollution below their entitlement can sell rights to pollute to others. In a variant of this approach a producer, who generates an environmental good (e.g. carbon sequestration), can obtain a credit for so doing that can be traded to others. Trading mechanisms are being used in a number of OECD countries to address a range of environmental issues, including the reduction of greenhouse gas emissions and improvements in water quality. Frequently, the government is involved in setting the cap that creates a market. An example is the EU's emission trading system to limit CO_2 emissions under the Kyoto Protocol. However, there are also examples of the creation of markets by the private sector (e.g. the Chicago climate exchange). Cap and trade schemes that involve agriculture are currently being used or evaluated in a number of countries. Australia uses the approach in managing the use of water resources as part of its National Water Initiative (Thompson, 2005). A range of schemes are in operation in the United States that address water quality issues, typically at the watershed level (Greenhalgh and Selman, 2005). Other OECD countries (*e.g*. Canada) are evaluating the use of the approach (Cantin *et al*., 2005).

There are many issues that need to be addressed in the design and implementation of programmes that use such "market-based" approaches not only in the agri-environment area, but in a range of other areas where non-commodity outputs or attributes are associated with agricultural practices. It is beyond the scope of this paper to analyse these issues in depth, but a key point in the current context is that such market-based approaches could play a role in overcoming information deficiencies in policy formation and implementation, in particular by revealing the valuation that individuals place upon non-commodity attributes of agriculture. In this sense such approaches may be able to play a role in helping to address problems posed by asymmetric information, reduce the costs of pursuing policy objectives and increase policy effectiveness.

Valuing non-market goods and services

A further example of the use of new approaches to meeting information deficiencies in policy formation and implementation relates to valuing goods or services that are not traded (Dupraz, 2006). In some circumstances various indirect methods can be used to infer the value of a non-market good (NMG). These include the use of tourist expenditures on travel costs or real estate values to provide indirect valuations of areas with different landscapes. Direct methods or stated preference approaches have also been widely used to derive estimates of consumers' willingness to pay for NMGs. In that approach survey methods or controlled experiments are employed to try to determine an implicit price for NMGs. There is a large literature on the use of these techniques and the challenges involved in obtaining meaningful

valuation. One of the key issues is a tendency for overvaluation to occur when individuals are presented with hypothetical choices. In cases where a comparison of valuation and market data is possible, for example, estimates for willingness to pay for particular attributes (such as organic products or welfare-friendly animal products) there appears to be a tendency for results to diverge – consumers appear likely to express a greater hypothetical willingness to pay a price premium for some of these attributes, than that demonstrated in their actual purchasing behaviour (Blandford *et al.*, 2002). Despite this, studies that employ these methods using the most up-to-date methodologies have the potential to increase the information available to policymakers on the relative value of goods and services that are provided for by agriculture for which it is difficult to create an effectively functioning market.

Summary

- Technological and methodological developments have created new opportunities for obtaining agricultural information to help meet the needs of policymakers.
- The ability to generate and analyse geo-referenced information, for example through remote sensing, expands the ability of policymakers to monitor changes in land use. Efforts are underway to link economic information at the farm level to such data in order to improve the understanding of key policy issues. These include the role of geographic and economic heterogeneity in policy implementation and the impact of targeting on policy outcomes.
- Developments in information technology have opened up possibilities for increasing the supply of information for policy purposes at lower cost. Electronic data submission has the potential to reduce the response burden for primary data providers, increase efficiency in acquisition and processing, and improve timeliness. It also offers the potential of supplying useful data to individual providers, increasing their willingness to incur the costs of participating in surveys.
- Information asymmetry poses challenges for the ability of policymakers to acquire the information they need, and for the efficient implementation of policy, particularly where non-market goods and services are involved. A key issue is whether incentive-compatible features can be built into programmes, through which farmers and others have a private incentive to provide the information required by policymakers. Market-based approaches, such as the use of auction techniques, may be able to overcome information deficiencies in policy formation and implementation in some areas, helping to reduce policy costs and to increase policy effectiveness. They can also provide the information needed to perform benefit-cost analysis.
- Indirect and direct approaches to valuation may be able to fill some information gaps relating to non-market goods. Despite methodological limitations and doubts about the quality of some of the estimates derived, valuation studies using current techniques could make an important contribution in areas of policy that are becoming increasingly important in many OECD countries.

9. Political issues in addressing information deficiencies

There are political barriers that may limit the ability to correct information deficiencies in policymaking, due to potential costs to policymakers. As indicated by the Ministerial statement at the beginning of this paper an economically rational approach to policymaking would require that accurate information be obtained in order to increase transparency, permit targeting and tailoring of policy measures, and to ensure that other requirements, such as flexibility and equity are satisfied. In reality, the pursuit of such an approach may not be without risks for policymakers and may be costly.

There is a long history of policy intervention in agriculture in OECD countries. Policies that involve transfers to farmers and others create incentives to try to protect those policies. The political support provided by beneficiaries can be important. In such cases, there may be disincentives to improving information for policy formation, if that improvement would lead to the abandonment of some existing policies and a loss of political support by those affected. The benefits of certain current policies are often highly concentrated among a small group of beneficiaries (big farmers who produce a particular commodity), the costs are dispersed across a large number of individuals (the consumers of that commodity). It is often the case that the beneficiaries will be particularly eager to protect the perceived benefits that accrue from a particular policy. Their ability to do so might be undermined if more accurate and complete information is made available on policy impact, and this makes it possible to compare benefits and costs. Consequently, there may be pressures not to collect or to publish information that threatens the interests of those who gain from existing policies. There is a risk that such pressures will undermine the quality of information generated by data gathering agencies. Data censorship or manipulation for political purposes is against the long-term interests of democratic societies and the professional independence of public statistical agencies needs to be maintained.

It is difficult to generalise about the importance of political factors in influencing the demand and supply of policy-relevant information in OECD countries, since much depends on individual structures and the political significance of various interest groups. There are considerable gains for society as a whole from the use of an information-based approach to policy formation. One can only hope that the benefits of objectivity and transparency for improved efficiency would outweigh any negative impact that the protection of existing interests could exert on moves to improve the information base for public policy making.

Finally, as has been noted throughout this paper, incentives play a central role in the willingness of individuals to supply the information needed to correct deficiencies. Incentives also play a key role in the willingness of policymakers to demand and use that information, and the willingness of data providers to respond to that demand. It is important that domestic institutions, in general, are aligned with the aim of improving policymaking in agriculture, rather than being at variance with that aim.

10. Conclusions and recommendations

OECD Ministers have identified a number of key requirements for policy measures for agriculture that are oriented towards increasing policy effectiveness. These drive information needs. Accurate and complete information must be available if policy measures are to be targeted, efficient and cost effective. Statistics and data provide a key input into the information base necessary for the formation and evaluation of agricultural policy. Key requirements are that data be relevant, objective, transparent, accurate, comparable over time and space, accessible and timely.

In order to improve the provision of information for policy formation at reasonable cost a number of issues need to be addressed:

- An information-based approach is needed to guide policymaking in agriculture. High priority should be attached to obtaining information that will permit better policy targeting, the quantification of outcomes and, to the extent possible, formal benefit-cost assessment of policy measures. An information-based approach is essential for monitoring policy needs and effectiveness, as well as for identifying existing measures that are obsolete or inefficient in achieving their aims. Sunset clauses requiring the re-examination of the *raison d'être*, the efficiency and effectiveness of a measure would be particularly important when it is known that the information basis on which the measure was based was incomplete.

- Data collection through existing mechanisms (*e.g.* surveys) needs to be kept under constant review. Close interaction is required between and among data providers and users in order that the usefulness of existing sources can be evaluated, additional data needs can be communicated, and solutions can be found to filling key information gaps. Value-added modifications to existing data collection mechanisms need to be made where possible. Given the continued emphasis in some OECD countries on farm household income support and the growing emphasis on environmental issues in agriculture, the enhancement of farm-level data collection to provide greater information on all sources of income, wealth and level of well-being, and the provision of information on farming practices with environmental implications should have a particularly high priority.

- Policy design and implementation need to take into account the reduction of information asymmetries and situations in which required information does not exist. In many cases it is possible to make the provision of information part of the policy implementation process. It is not unreasonable to require those who benefit from public funds to provide the information necessary to ensure accountability, and to permit an evaluation of the effectiveness and efficiency of expenditures. In some cases, the method of policy implementation may help to reduce the potential costs of missing information and thereby increase effectiveness. In this context, the use of market-based approaches such as auctioning in the provision of environmental goods and services is an area that merits particularly close attention. In general, however, much remains to be done in order to be able to evaluate externalities associated with agriculture. It is particularly important that the confidentiality of data collected from individual farms and firms be protected in order to maintain confidence in the data gathering system that underpins an information-based policy approach.

- Information is valuable, but its supply is not costless. Careful consideration needs to be given to controlling both the private and public costs of acquiring and processing data. New technologies, such as geographic information systems and electronic data collection, offer possibilities in this regard. In other cases the requirement is to design collection instruments in such a way that the costs imposed on the providers of data do not become excessively burdensome. The primary suppliers of data (*e.g.* farmers) are likely to be more amenable to absorbing the costs of provision

if data processors can find ways to make the data useful and usable by those suppliers. Maximum use needs to be made of incentives to induce the provision of data by the beneficiaries of policy.

- International collaboration among public agencies in the area of data collection and processing can play an important role in increasing the effectiveness with which existing data are used, as well as improving the policy relevance of information. Activities that involve the sharing of knowledge on concepts, data collection experiences, and processing techniques can play an important role. Two examples that show the relevance of this approach are activities undertaken on the measurement of farm household income by the IWG.AGRI group, and joint activities undertaken on environmental indicators by the OECD and other bodies.

Making changes that will improve the policy relevance of information for agriculture poses a challenge, particularly where current data collection mechanisms need to be modified. Stakeholders may view changes in data collection as a threat to their interests and may resist change. Data collection agencies that have become used to particular data collection mechanisms or to collecting certain types of data may also be resistant to change. The suppliers of primary data, particularly farmers, may be concerned that new requirements will increase the complexity and cost of providing data. There may be political risks from increased transparency in an information-driven approach to policy. Despite these challenges the reduction of information deficiencies is a key priority for achieving the aim of improving the effectiveness and efficiency of agricultural policy in OECD countries.

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