UDS 681.518:631.1

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Synergies of information systems in agriculture

Introduction. Worldwide, agricultural sector faces a number of unprecedented challenges. Just to name some of them: the growing food demand; the diminishing agricultural utilized area due to the growing human activities; the decline of agricultural productivity due to the degradation of natural resources, the increasing market power; the fluctuation of several agricultural products prices. Regarding the market structure, and as a consequence of liberalization, globalization and expanding agribusiness, small farmers are not able to gain significant share in market economy [7]. On the other hand, the establishment of common farming and trading rules at national and regional level set as a prioriry to the policy makers the task of monitoring and evaluating the impact of agricultural policy measures effects.

Counterweight to modern assymetries is the systematic diffusion of information. Prerequisite for a successful agricultural planning is the information existence about physical resources, production constraints and market structure. As such, the flow of information concerns all the production factors, that is land, labour, capital and managerial ability [17].

But now the questions at issue are "what information" and "which source". Do the financial statements alone ensure the timeliness and the quality of the decision-making process, since they are mainly used for calculating tax allocation and state support [1], [11], [15]. On the other hand, the plethora of information channels that are available to the farmers through advisory services, public or private, educational institutions and media, extend farmers' knowledge regarding production processes and increase their opportunities in finding new markets, making its substantial contribution or being the trigger of the adaptation procedure [10]. However a new challenge arises: The integration of information and its effective transformation into knowledge. Modern information algorithms and systems may contribute towards this direction [6].

The present paper proposes a schema of an entity which facilitates the systematic availability of highly qualified output of specific resources to the users who, in the present case are policy makers and farmers themselves. As a case study we consider the monitoring of production activities. The objectives are to increase the systematic collection of data, in the present case farm accounting data, to increase the quality of information, to lessen the evaluation risk and further policy-makers to gain a foothold on planning efficient agricutural policy measures.

Methological aspects. Regarding the transformation of data into information, Roling [14] proposed a systematic approach while Cavallo

[3] proposed a conceptual framework for improving the existing information systems and the establishment of a new one. In the general theory of systems, information system is defined as a system, automated or manual, focused on the systematic collection of data, the transformation into information and the distribution of the information produced.

Under this context, an information system in agriculture comes from a systematic analysis of inputs, outputs and restrictions and provides information useful for monitoring and evaluation. Methodologically, the systematic analysis is distinguished in two phases. The first one is the recording of the individual components and the second one is the synthesis into logical entity, mutually influenced.

Farmer decision support framework, information flow and accounting information systems

Agricultural production exhibits some minor characteristics. To name some, unpredicted weather conditions, locally differentiated soil parameters, products' sensitivity, post-harvest treatments, competitive markets, price volatility. Farmers, through their efforts to take timely and appropriate decisions, face a major challenge: the transformation of data and the management of the information produced, both internal and external [18].

Decision theory provides a framework for defining the stages in this decision-making process: problem identification, generation of alternative solutions, selection of the appropriate one and its implementation [12]. The Farmer Decision Support Framework (FDSF) takes into account the information that agricultural producers need, defines its flow as well as the processes that allow achievement of an appropriate level of information utilization. It includes a series of primary steps one of which is the gathering of information from different sources. The variability of sources enables the comparison and further the integration into a common end-user format. This framework can serve as a basis for an integrated approach at macro level and for a desicion support procedure at micro level (farm level). Figure 1 presents the generic information flow and the interaction between the key stakeholders, that is the sources of the information, and the information processes themselves.

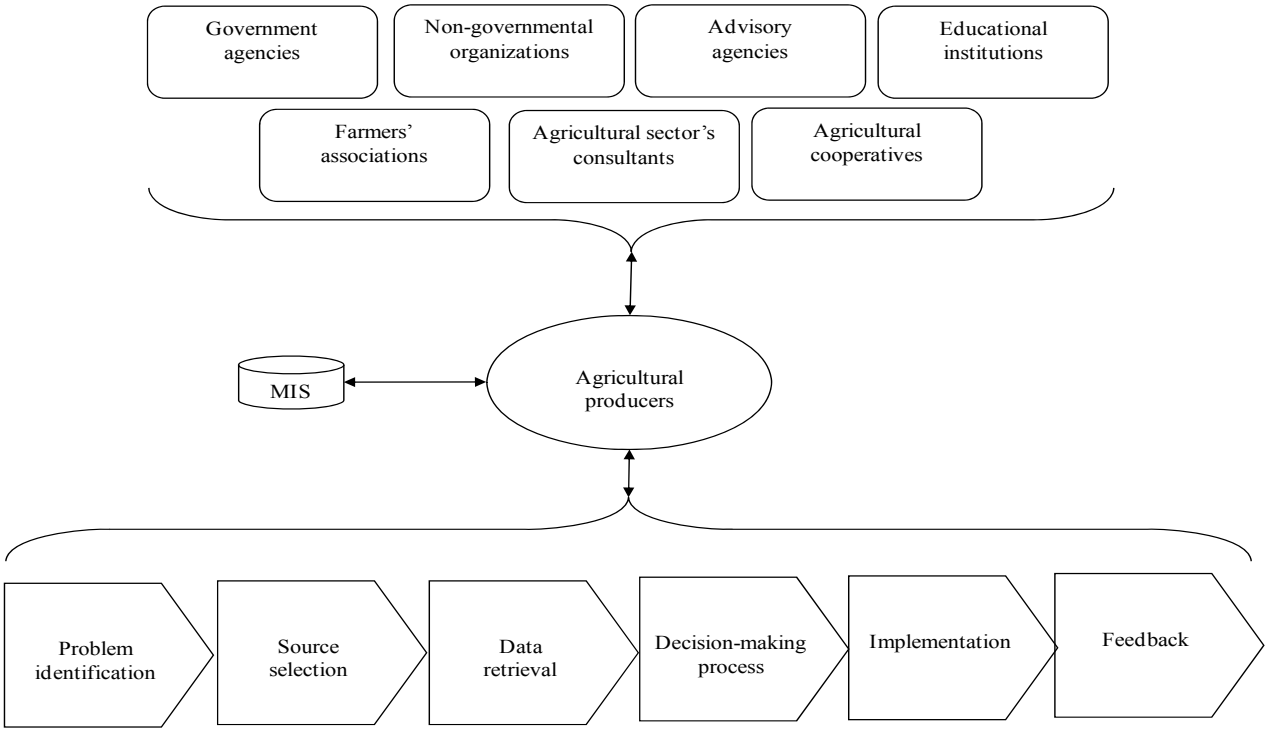

Figure 1. Interaction between agricultural producers, key stakeholders and information processes through an MIS

The environment that farmers act is formulated, apart form others, by the presence and/or the activities/decisions of other actors. To name some, public sector intervention, agricultural raw products retail chains, intermediate inputs supply chains, agricultural cooperatives market

power. The interactions within this environment is affected by certain characteristics. To name some, farm size, the age of the agricultural holder and his educational level. The more the interaction within this environment, the more the complexity of the decision making process is but the more the information that flows. This allows for agricultural holders to exploit timely new opportunities or to adapt and obtain a significant comparative advantage.

Theory about decision-making processes on operational research, is primarily based on accounting information. Rational decisions based on evaluation are the outcomes of the accounting information systems [9]. Monitoring economic activity at farm level is essential for producing the necessary future feedback. This enables farmers to gain insight into their production capabilities and a better assessment of success/failure indicators [20].

Information as public good

An agricultural holding is a complex production system, the structure of which consists of certain business activities and processes of transformation of matter, energy and information. In order to evaluate the farm results, first it is necessary to quantify inputs and outputs. The evaluation usually is quantified due to some economic/financial indicator(s). Consequently, evaluation is in direct conjunction with an adequately conceptualized system of information flow. For the needs of this paper we shall focus primarily on the accounting information systems. On macro level, the establishment of such systems provides governments with the necessary data for monitoring and evaluating the implementation of agricultural policy measures while on the other hand enhances the role of the advisory services, public or private.

The content of the accounting records of the farm should reconcile two opposing tendencies: The first one is the necessity for daily recorded business events or for detailed recorded business activities. This will create the necessary information base for an in-depth business analysis. On the other hand, there should be an effort so that farmers to be subject to a minimal of burden regarding the activities that are not directly related to production process and records to be as understandable as possible by the farmers themselves.

Integrated accounting information systems in the field of agriculture that meet the information needs of decision-makers at all levels, are distinguished in two basic levels (subsystems), namely a micro system (at farm level) and a macro system. These two subsystems are closely related and mutually conditioned. Micro level data are transformed into macro level information. On the other hand macro level data are transformed into micro level information so that decisions on this micro level are taken after considering the agrarian sector as a whole (structural and environmental restrictions, global trends in supply and demand etc.).

Agricultural producers individually can not perceive all the necessary information formulated in macro level. This characteristic is enough in order macro level information to be classified as public good. Under this perspective, public sector should provide the farm sector with all the adequate information set that is needed and cannot be obtained otherwise. On the other hand, micro level data are a prerequisite for macro level decision makers. Their transformation into information not only improves the understanding of the production procedures that take place in farm level but also is instrumental in the macro decision making process regarding the adoption of agricultural policy measures.

Information flow is a continuous, cyclical process. Integrated accounting information systems at micro and macro level establishes a systematic and comprehensive way to increase the quality of information. On the other hand, the autonomy of the two distinct subsystems enables the distinct combination of various information sources, while the integration of the external and the internal data sources comes next.

From the macro level point of view, quantitative and qualitative data and their interchange between the various institutions aim on monitoring and evaluation. There are a number of stakeholders in data collection, including research and educational institutes, extension services, farmers' associations, cooperatives, non-governmental organizations which, within the framework of their activities, have a self-interest. Their key role is the generation, the transmission and the delivery of information through the information flows and their inter-

relationships. Data pertaining to agricultural sector are important for interest groups such us traders, suppliers, distributors, financial institutions, the interest of which lies in quality assessments.

On the other hand, since data refer to various scientific fields, there is not only one institution that is involved in data collection. For example, a statistical office may has the obligation to collect data regarding the utilized agricultural area or the average yield. At the same time, a certain research project may be carried out by another stakeholder, such us the ministry or a research institute, collecting the same or similar data set. Under these circumstances, in order to lessen the administrative burden, two procedures should take place: The first has to do with the respondent farmer and the implementation of the principle of "unique questions". That is, no respondent farmer should be asked twice the same question by different institutions. The second one has to do with the "integration" of the information. Here the usage of different information systems by the various stakeholders, makes appropriate the management of meta-data or the management of a Questions-Answers module. That is the user asks each system not for primitive data but for processed data in the form of meta-data or in the form of answers to questions he has previously asked. The establishment of coordination between the various institutions and the "integration" itself is the cornerstone for achieving highly qualified output. And this is another perspective.

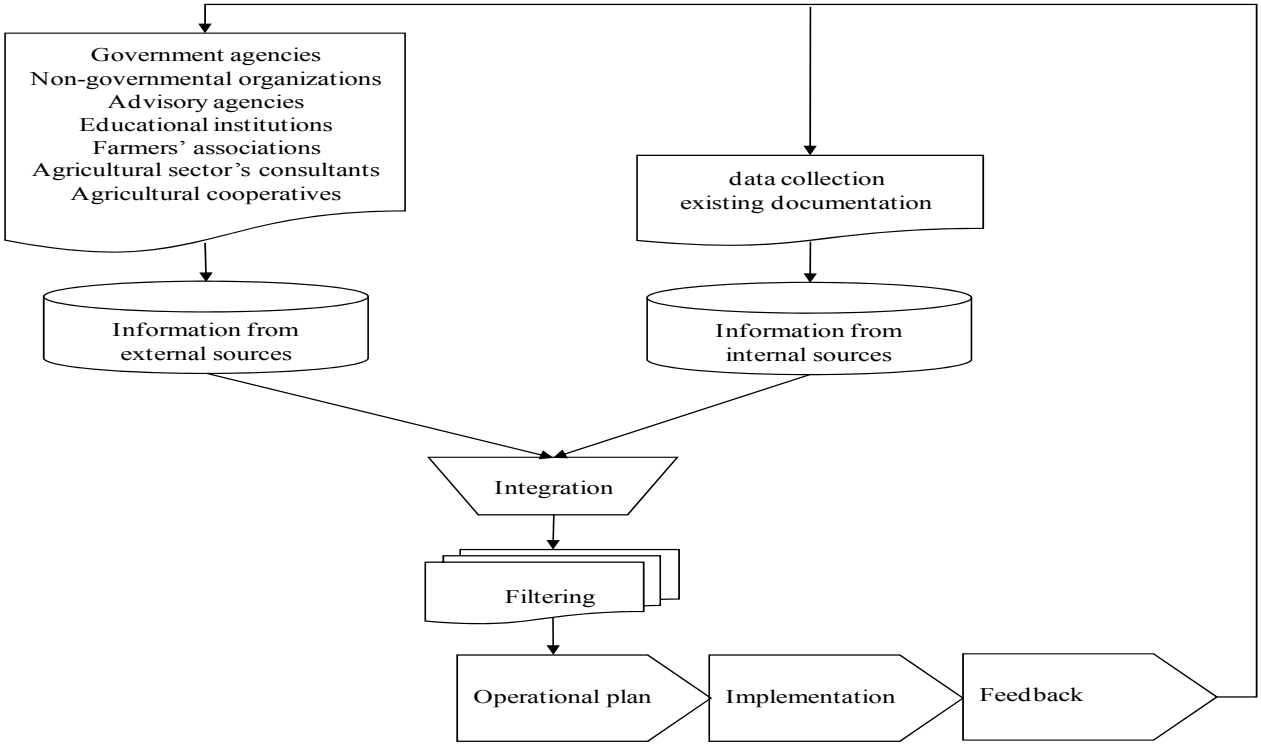

Figure 2. Conceptual model of an accounting information system in agricultural holding level

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The main obstacles that may influence the provision of adequate quality data are:

- Inadequate support of the enumerators and data collectors in the field, combined with poor control.
- Probable delays in data collection.
- Different methodologies in data recording.
- Poor coordination between the various institutions.
- Lack of sources in terms of system maintenance.
- Low utilization of data due to complicated structures or due to their format that is not simple enough.
- Limited access to data.
- Inadequate access to reports or to scientific findings.
- Insufficiently scientific analysis.

Regarding the feedback towards the farmers, it may be done either through an advisory system or through the agricultural extension services, and may concern:

- Dissemination of the information.
- Advisory services.
- Training
- Other gainful activities, related with agriculture.

The lack of willingliness by the farmers to keep records regarding production activities, factors of poductivity or cash transactions results in an incomplete insight of the production mechanisms and the cost centers. Further it hinders them from acting more as entrepreneurs since they are not in position to take rational decisions.

Discussion

The present paper supports information as public good and under this optic proposes a schema of an entity composed by a micro and macro level of information sources. It supports the idea that "integration" of the two levels may take different forms and is appropriate for monitoring and evaluation purposes.

Farmers and external stakeholders, each one from their own point of view, should gather systematically data and incoporate them into a common entity. Generating data from different sources and producing an information synergy, facilitates the efficient operation of end-users, who in this case are farmers and policy-makers.

Information management at macro level is a crucial factor for farmers to achive high efficiency scores at micro level. On the other hand, information management at micro level is a prerequisite for policy-makers to monitor and evaluate agricultural policy measures. Synergy effects may come out of an entity schema. As for example of this synergy schema, we shall consider a local advisory service. Younger farmers keep acounting records, as they understand that this is crucial for running their business [8]. On the other hand, older farmers lack the substantial training. In this case the local advisor service has a decisive interest in helping the latter in doing so, since it will facilitate its efficient operation.

Data collected may vary according the source. For example, in farm level it could be the balance sheet and income statement, cash flows statement, environmental and natural resources variables, market data or any other analytical reports that should be considered.

On macro level, there are institutions that have motivation in participoating in this synergy. As for example, we shall consider farmers' associations and agricultural cooperatives. They have initiative for such a synergy since it reduces the asymmetric information. One of the

reasons that the associations themselves as well as cooperations are established is the asymmetric information that chartacterizes both the market of agricultural products and intermediate consumption. Chamber of Commerce is also one of the participants in these information flows. The motivation comes from the fact that this institutional body should be aware of the investment opportunities in food processing sector.

Synergies of information systems in agriculture is a crucial requirement. Enough to say that provisions for a post-2013 Common Agricultural Policy monitoring and evaluation system are laid down in Article 110 of the Commission proposal. According to the Commission, these synergies will serve to help assess the efficiency and effectiveness of the policy in meeting goals such as vialable food production, sustainable management of natural resources and climate action, and balanced territorial develoopement.

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The article has been received 09.01.2015

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