

## INFORMATION MANAGEMENT OF AGRICULTURE PRODUCTS – AN EXAMPLE OF AGROKOSZTY DATA COLLECTION

ALDONA SKARŻYŃSKA<sup>a)</sup>, KRZYSZTOF ZMARZŁOWSKI<sup>b)</sup>, ARKADIUSZ ORŁOWSKI<sup>b)</sup>

<sup>a)</sup> *Institute of Agricultural and Food Economics – National Research Institute*

<sup>b)</sup> *Department of Informatics, Warsaw University of Life Sciences (SGGW)*

In this paper authors want to find out what is the role of information in the process of management, costs simulations and yields taking into account agricultural products. The study concerns Agrokoszty which is the Polish system of agriculture data collection. The authors want to exhibit how data is collected, the way in which it is validated and evaluate how helpful this data is in the decision management process. The technical aspects of the data collection system and the practical use of this data were additional elements taken into account.

Keywords: data collection, agriculture information, information management, Agrokoszty

### 1. Introduction

Accurate information is a fundamental component of today's decision-making processes. Its quality depends first and foremost on the reliability of those who supply it and of IT systems that collect it [4]. Additional validation of the correctness of stored data is an extremely complex process which depends on the purpose for which they are collected. The aim of this paper is to describe the process of collecting and managing agricultural information as well as using it further for research and decision-making at the level of the farm.

There are many systems for collecting and verifying data and then making them available. In agricultural holdings, the most important information system which

includes all records and calculations concerning the past, the present and the future, is agricultural accounting. Over the years, the system has undergone numerous content- and technology-related modifications; also the use of information supplied has evolved. Recent changes in the accounting system resulted in the necessity to adjust national agricultural statistics to EU standards; these tasks are fulfilled by the Polish FADN. However, the scope of data collected in that system does not allow for calculating unit costs for particular agricultural products. Considering the expectations of recipients, one should aim at collecting more detailed data, i.e. at the level of agricultural production activities, bearing in mind the purpose for creating the AGROKOSZTY. Despite many differences, the databases of both systems, i.e. of the Polish FADN and AGROKOSZTY, are compatible with each other at many levels, which allows for a flow of information.

It must be added that source data concerning the economic changes that take place in agriculture periodically are collected by various entities. The format of research is then adapted to the specific needs of recipients, which often makes the results incomparable. This is because of the different scope of data collected, different concepts and terminology, and applying different calculation algorithms to obtain the results. For the sake of the accuracy of analysis and drawing the correct conclusions, it is necessary that research be uniform in its methodology, both when collecting data and when generating results. Research into agricultural products within the AGROKOSZTY system meets this condition, which is undoubtedly its great advantage.

## **2. Organisation of research in the AGROKOSZTY system**

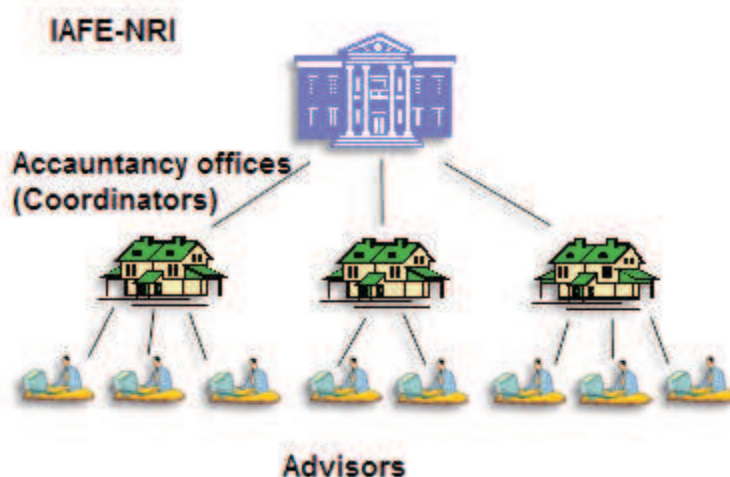
The surveys of agricultural production activities in the AGROKOSZTY system are conducted on individual farms, selected from a representative sample. The selected farms are located across the country and are under the surveillance of the Polish FADN. Such an approach is applied so as to allow for supplementing data in the AGROKOSZTY system with data from the system of the Polish FADN.

Data concerning the activity are collected with the use of forms designed especially for that purpose. Records are made in accordance with the methodology adopted, which is described in instructions. External experts, i.e. advisors and coordinators who at the same time work in accountancy offices of the Polish FADN, are involved in the activities related to keeping the accounting records. The offices are located in Agricultural Advisory Centres across the country. Within the AGROKOSZTY system, organisational procedures and the tasks of advisors and coordinators have been specified in detail. It must be added that surveys are only carried out with the consent of the farmer.

### 3. It support for research in the AGROKOSZTY system

The surveys of agricultural production activities are supported by a computer system called Agricultural Products Data Collection System. Its software is compatible with the structure of forms and was developed based on the guidelines established on the basis of EU methodology in the context of the gross margin account. The programme allows for IT operation of research carried out for commodity crop production (e.g. winter wheat), animal production (e.g. dairy cows) and the related non-commodity crop production (e.g. green forage from meadows).

Numerous calculating algorithms, constructed in the context of the profit and loss account, as well as tests to check the correctness of data, form a multi-level system of logical links not only within a single type of production activity, but also between those activities. In general, the system makes it possible to register, control and aggregate data about crop and animal production activities, to compare some of the data with records from the Polish FADN system database, and to create output databases.



**Figure 1.** Organisation of data collection in the AGROKOSZTY system

The software of the Agricultural Products Data Collection System is available in several dozen field units (accountancy offices). The programme is used by their employees, i.e. advisors (the operator role) and coordinators (the administrator role). Advisors are responsible for maintaining ongoing contact with farmers, mainly through visits on farms where surveys are conducted. The task of advisors is to feed the data registered in forms into the programme, and then to control their correctness. Coordinators, on the other hand, have a superior role: they collect data sets from advisors in a given area. They are also obliged to constantly manage and administer the software and databases at the level of the accountancy office – see Figure 1.

### 3.1. IT system structure

The Agricultural Products Data Collection System is composed of four modules – see Figure 2. Each module is a closed sequence of commands which performs a specific task within the programme and operates independently of the other modules. This makes it unnecessary to install all modules for every software user. It was appropriate to adopt such a solution because not all users use all modules. For example, advisors who collect data from farmers only use the module for inserting and controlling source data (DOG), which makes the installation of other programme modules unnecessary.

The rights for users of individual modules have been strictly defined; the system differentiates between rights for advisors, coordinators, and for the IAFE-NRI. Within each module, each user is required to select an appropriate authorisation, relevant to the task performed. Depending on the module, the following rights have been defined: administration, data entry, generation of acceptable values (ranges), data aggregation, creating databases.

The solutions presented guarantee an easy use of the programme and organisational order. They eliminate the risk that a user makes undesirable changes through a module that is not their area of competence. Thus the software ensures security and reliability.

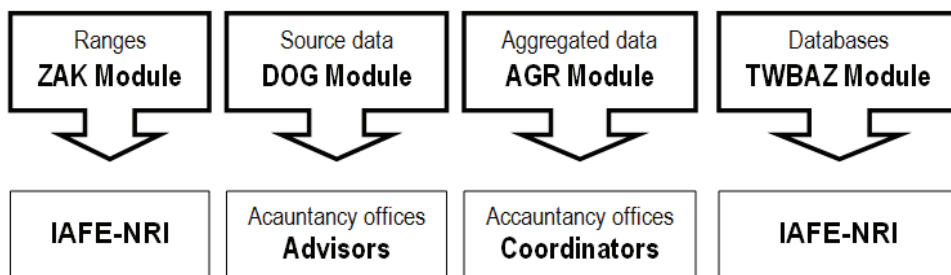


Figure 2. Structure of the programme

**The ZAK Module.** Through this module, ranges established every year for the activities studied are entered at the level of the IAFE-NRI. The ranges are acceptable value ranges for parameters that describe individual activities. These include acceptable activity codes, VAT rates in line with applicable law, upper and bottom format-related brackets, as well as minimum and maximum ranges specified for a number of features (variables) of each activity, e.g. minimum and maximum crop or the use of different animal feedstuff per dairy cow.

The ranges are necessary for controlling the quality of source data fed into the system. Their particular types are used in the subsequent stages of verifying data correctness. The ranges are established or updated exclusively at the IAFE-NRI,

and no unauthorised person may influence their definition and modification. Files with up-to-date information for a given year are sent to coordinators to be entered into the programme at the level of the accountancy office. Threshold values for particular variables are specified in cooperation with experts from various institutions and agricultural universities, as well as on the basis of feedback directly from the farms where surveys are conducted.

**The DOG Module.** This module is used by the advisor, who is the operator. It allows for feeding into the programme the source data from forms collected on farms. The data entered are then subject to control. After eliminating critical errors which block further verification of data correctness, the data undergo several stages of control. They are also checked against links between the activities of animal production and non-commodity crop production. Through the DOG module, the advisor is able to modify erroneous data, and then files with accurate data are sent to the coordinator in the accountancy office.

**The AGR Module.** This module is used by the coordinator in the accountancy office, who controls the files with data sent by advisors once again. Then the data are aggregated. Aggregation is a process of processing data through which, on the basis of calculation algorithms, particular variables that describe the activities studied are generated from the source data entered into the programme. Aggregated data are sent to the IAFE-NRI for further control and processing.

**The TWBAZ Module.** Through this module, output databases are created for particular activities at the IAFE-NRI, which receives the data from accountancy offices and is the only user of this module. Three types of databases are created, i.e. for commodity crop production, animal production and the related non-commodity crop production. Databases are created on the basis of aggregated data received from coordinators. It must be noted, however, that each data set is additionally verified at the IAFE-NRI, independently of control carried out in accountancy offices. Some data are also compared with records in the Polish FADN database. The TWBAZ module also allows for creating reports from data controls carried out earlier at the accountancy office.

### 3.2. Data quality control

Every well-designed and properly operating computer programme should be equipped with a system that controls the correctness and quality of collected data. Also the AGROKOSZTY system software is equipped with relevant verification tools. Data correctness control is carried out on multiple levels, i.e. at the level of the advisor (the DOG module), the coordinator at the accountancy office (the AGR module), and at the level of the IAFE-NRI (the TWBAZ module), thus ensuring a high quality of data that describe particular production activities. It must be noted, however, that in fact data are verified already on site, i.e. at the agricultural holding

advisors who work in the field and contact the farmers directly, ensure the reliability of data even before the latter are entered into the computer programme.

The process of control is composed of four stages, and its course is facilitated by a testing programme which comprises numerous tests to check the data. At each stage of control, there may be errors of varied significance, i.e.:

- critical errors that preclude control at a subsequent level,
- warnings, which allow for conducting control at subsequent stages when ignored or clarified as to their cause.

**Stage 1.** The input is controlled for completeness and compliance with relevant format ranges. At this stage, also the logical links between animal production and non-commodity crop production are controlled.

**Stage 2.** At this stage of control, the values processed by the programme are checked whether they fit in the acceptable ranges. This is done using the minimum and maximum ranges established for specific variables. Considering the number of ranges and the number of activities involved in the study, several thousand ranges may be fed into the system every year.

**Stage 3.** This involves a comprehensive control module for animal production activity which employs tests that verify the use of different types of feedstuffs per animal and per 100 kg of net livestock production.

**Stage 4.** The purpose of control is to check the compatibility of selected data collected in the AGROKOSZTY system against data from the Polish FADN. At this stage, control is only carried out at the level of the IAFE-NRI.

All stages of control end with generating an error report. Erroneous data are corrected, and when the ranges exceed the thresholds adopted yet the data are consistent with the actual situation on the farm, it is possible to accept them. However, a comment is necessary then to explain the causes of the event. Accountancy office employees involved in research within the AGROKOSZTY system have organisational and expert support guaranteed, which enables them to contact the IAFE-NRI team through the Internet platform [www.agrokoszty.pl](http://www.agrokoszty.pl).

#### **4. Possible application of information generated within the AGROKOSZTY system**

The AGROKOSZTY system databases generate cost and income reports for production activities. These may be generated according to different criteria for the aggregation of specific variables and contain data with a degree of detail that depends on the needs of recipients.

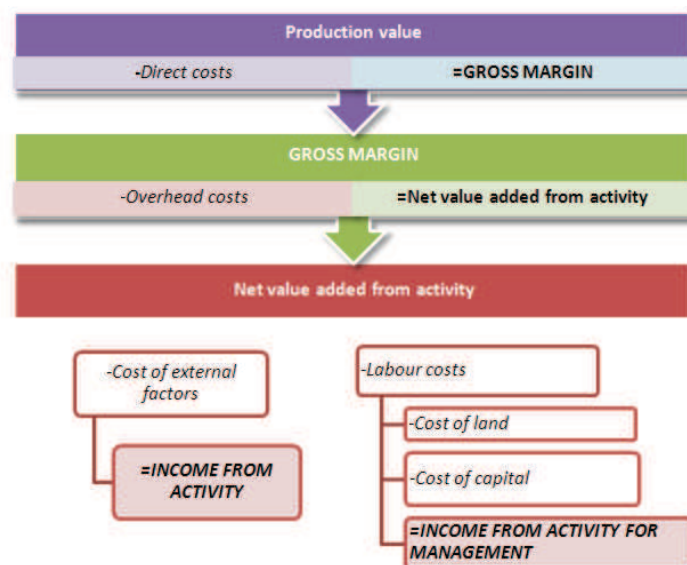
Reports are also prepared for the farmers who participate in research. These include the results of activity in a given holding as compared to the results for the same type of activity in individual groups of holdings. On their basis, the farmer and the

consultant that cooperates with them may recognize the strengths and weaknesses of production that is subject to evaluation and analysis.

The results of surveys of production activities are a valuable decision-making tool for the farmer, a self-employed entrepreneur who constantly makes decisions regarding production and organisation that are often laden with risk. The greater the access to information that facilitates making more suitable decisions, the lesser the risk. Farmers have no influence on the changes in prices of agricultural products. They can only analyse the changes that occur and make appropriate decisions, and to a great extent their effectiveness depends on the knowledge they have. Costs play a significant role as well, and their impact on the final financial result (income) is considerable; in addition, they are a category influenced from within the holding and thus depend on the farmer. This forces the farmer to obtain information about cost, and – more importantly – forces them to take action to manage the costs.

Thus, in the production process the farmer is constantly accompanied by economic calculation – this consists in analysing the profitability of the activity conducted, i.e. in putting together the costs and effects of each of the available options, comparing them and choosing the best one.

Three levels may be distinguished in economic calculation for agricultural production activities in terms of the purpose the information generated is meant to serve. Categories of income have been adopted as determinants for those levels, i.e. gross margin, income from activity and income from activity for management – see Figure 3.



**Figure 3.** The formula for calculating particular categories of income for production activities

The first level of calculation is represented by the **gross margin**. That category makes it possible to correctly evaluate the competitiveness of production activities, as it includes the value of output obtained and strictly defined direct costs incurred. If the calculation takes account of the change in the prices of the means of production and prices of agricultural products, then the calculation will refer to the future and allow for establishing the effects of changes on the farm. Calculating the gross margin may help the farmer in making various decisions, e.g.:

- the choice of activity and line of production, i.e. **what to produce?**
- specifying the volume of output, i.e. **how much to produce?**
- the choice of the level of production intensity, i.e. **how to produce?**

A second level of economic calculation is **income from activity**, which is the margin obtained by deducting both direct and overhead costs from the value of output. This category is suitable for evaluating the results of production activities in the longer term, assuming that the farm's production capacity is maintained at the same level. One must add that it is not the absolute values that are significant, as those may be treated with some caution; rather, it is the direction of the changes that take place. Calculations correctly show the tendencies in changes over time, e.g. the increasing or declining profitability of production.

The third level of calculation is **income from activity for management**. It is an economic category clear of all costs of production, referred to in the literature as economic cost [5]. That income reflects the margin left to the farmer due to engaging their own knowledge, experience, entrepreneurship and management skills in the production process. Income may take a positive or negative value. Negative value proves that economic cost was not covered entirely. Farmers may continue to produce below economic cost, yet they will not be able then to reconstruct their own capital when it wears out, nor to achieve return on their own factors of production.

The results of economic calculation for production activities may be used in a variety of ways and on a wide scale, depending on the goal defined. Analyses point out phenomena and dependencies that are important from the perspective of the profitability of production, but also from the perspective of environmental protection and the quality of products. They even indicate the supremacy of the technology that involves less intensive farming. Research has shown that lesser outlays for the means of production contribute to a better use of land resources and its natural fertility, but also of labour and tangible assets [7]. Research results prove that high intensity does not ensure the highest crops or income [2, 8].

Analyses carried out on the output database for production activities allow, *inter alia*, for:

- establishing the competitiveness and labour-intensity of production,
- calculating unit costs of producing agricultural products, as well as the income that a farmer may obtain from a particular line of production,
- establishing factors that determine the level of income,



- evaluating the impact of Common Agriculture Politic (CAP) mechanisms on the economic performance of agricultural products,
- performing various types of production and economic analyses.

Yet another way of using AGROKOSZTY system data is in short-term forecasting of costs and income, as well as in medium-term forecasts. There is a change in the focus of calculation from retrospect to future and anticipatory orientation. With the use of regularities observed in the past, short-term cost and income forecasts as well as medium-term forecasts are prepared for particular agricultural products [6].

Cost calculation is yet another use of databases, and it allows for process management [1]. Management then focuses e.g. on eliminating unnecessary actions that entail specific costs without adding value. Cost management based on the process-oriented cost calculation means making constant decisions on which processes to wind up and which to develop from the perspective of obtaining income [3]. Such an approach allows for assessing the real effectiveness of resource management and specifying the costs of resources that have not been employed. The concept was developed in the United States towards the end of the 1980s. Over the years it has become popular also in Europe and in Poland. Although it is more widely used in other industries, there have been attempts in recent years to apply it also to agriculture.

Cost calculation as a tool of management accounting is meant to inform rational economic decisions. Access to precise and timely information on the costs of pursued activity is a starting point for both operational and strategic decisions. The modern (creative) management of the farm, based on knowledge, imagination, as well as creativity and courage, should be supported by reliable information. Information, treated as a strategic resource, should reduce the level of uncertainty involved in the decisions made, facilitate developing contacts with the environment, support the processes of change and provide advantage over competitors.

Publications, expert opinions and diverse studies on the costs of producing agricultural products and income obtained from them have a wide audience. They are used by farmers and agricultural advisory services, decision-making centres that shape agricultural policy, universities and various scientific establishments and other institutions. Research results are an important premise in making various economic decisions, and the details they provide allow for explaining the changes observed.

## 5. Conclusions

For any type of activity, pure expertise becomes insufficient when faced with the economies of scale. Collecting historical data has become important so that future developments may be predicted with greater probability. Databases, data warehouses and other systems for managing data have become so common that today it is difficult to imagine someone making management decisions without taking into account the his-

torical information. However, the exploration of knowledge that comes from the data must be based on reliable sources. Agriculture is a field where the reliability of information provided is particularly significant for the development of the farm or for state aid to agriculture. Unfortunately, the process of collecting agricultural data is very arduous and costly. Human knowledge is the main source of information supplied. Then, when the data have been obtained, they must be verified and systematised accordingly. The paper presented the whole process on the example of a system for the collection of agricultural information that is already operative. It also presented the possible uses of information collected.

#### **REFERENCES**

- [1] Cooper R., Kaplan R. S. (1992) *Activity-based systems: Measuring the Cost of Resource Usage*, Accounting Horizons, 6/1992, 1-12.
- [2] Jończyk, K., Kuś, J. and Stalenga, J. (2007) Produkcyjne i środowiskowe skutki różnych systemów gospodarowania, *Problemy Inżynierii Rolniczej*, 1/2007, 13-21.
- [3] Kaplan R. S., Cooper R. (1998) *Cost and Effect. Using integrated costs systems to drive profitability and performance*. Harvard Business Scholl Press, Boston.
- [4] Mullins, L.J (1993), *Management and Organizational Behaviours*, 3rd ed., Pitman Publishing.
- [5] Nordhaus S. (1995) *Ekonomia 1*, PWN, Warszawa, Poland.
- [6] *Projekcja dochodów wybranych produktów rolniczych na 2013 rok (2011) Praca zbiorowa pod kierunkiem A. Skarżyńskiej*, Raport PW nr 5, IERiGŻ-PIB, Warszawa, Poland.
- [7] Skarżyńska A. (2012) Cropping intensity vs. profitability of selected plant production activities in Poland, *Studies in Agricultural Economics*, 114/2012, 31-38.
- [8] Tuomisto, H.L., Hodge, I.D., Riordan, P. and Macdonald, D.W. (2009) Assessing the environmental impacts of contrasting farming systems, *Aspects of Applied Biology*, 93/2009, 167-172.