

# Development of Agricultural Statistics from Design to Publication of Data

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## Abstract

Agricultural statistics have the longest and richest past in the history of the independent Hungarian statistical service. During the 150 years history of Hungarian statistics agricultural statistics have always been in the forefront of developments and their implementation. The developments that were realized through the years concerned equally the functioning of the system of agricultural statistics, the methods used, the technical solutions applied, but they also brought numerous novelties in the communication of agricultural data. It is maybe not a lack of modesty to mention that in the majority of cases, developments in the field of agricultural statistics have influenced the whole Hungarian statistical system. It does not happen frequently either that thanks to statistics, new concepts are introduced in agricultural terminology, statistical data influence the development of agricultural policy. It is not easy and would maybe be unworthy to qualify or rank the developments presented in this article. Nevertheless I would like to highlight among them –due to their novelty and specificities- two major developments, the elaboration and use of spot maps, and the setting up and introduction of the unified (electronic) data processing system. I hope however that the solution we used to publish quickly preliminary census data, the database of the plantation survey using geo-coordinates, or the agricultural atlas and interactive graphs used in agricultural statistics will also arouse the interest of the reader.

## Keywords

*Agricultural censuses, spot-map, unified data processing system, communication tools*

## JEL code

Q1

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## INTRODUCTION

### Hungarian agriculture in a nutshell

Due to the natural characteristics of the country, Hungarian agriculture has played an important role in Hungarian economy over the past decades, and this is still the case nowadays. In 2014 the share of Hungarian agriculture in GDP was 3.7 percent. The total gross output of agriculture was 2410 billion HUF, out of which crop products represented 58 percent, animals and animal products 35 percent, agricultural services and secondary activities 7 percent.

From the 9.3 million hectares surface area of Hungary 5.3 million hectares are agricultural land area (in the European Union it is only in Denmark that this proportion is higher), forest area is close to 2 million hectares.

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The greatest share in crop production is the output of cereal crops, in 2014 it represented 68 percent of sown area. In the composition of animal husbandry the proportion of poultry stock (39 million heads) is higher than cattle stock (802 thousand heads) or pig stock (3.1 million heads).

In the period of the Agricultural Census 2010 8.6 thousand enterprises and 567 thousand private holdings performed agricultural activity. 54 percent of the enterprises was exclusively engaged in crop production, 6 percent in animal husbandry only, while the proportion of enterprises with mixed activity amounted to 40 percent. The proportion of the different types of activities performed by private holdings differed to some extent. In 2010 nearly half (49 percent) of private holdings dealt exclusively with crop production, 22 percent with livestock production and 29 percent with both activities (KSH, 2011).

The surveys have been observing for more than ten years the purpose of the production of private holdings as well. According to census data in 2010 60 per cent of private holdings produced exclusively for own consumption (which corresponded to the data of the previous full scope census). There has been a change in the proportion of private holdings producing specifically for the market, it increased from 8 percent to 20 percent between 2000 and 2010. The remaining private holdings sold the surplus remaining after own consumption (KSH, 2011).

In 2014 labour input amounted to full time work (1 800 hours/year) of 445 thousand persons. Three quarter of the total labour input is not salaried labour input (which corresponds basically to mainly part-time agricultural activity performed in private holdings). The proportion of the persons employed in national economy (working for the majority 8 hours a day) in the branches of agriculture, game farming, forestry and fishery represented 4.6 percent of total employment.

The distribution according to the legal forms of farming of agricultural product output provides also important information on the structure and efficiency of Hungarian agriculture. This is especially the case when the proportion of the output is presented for different legal forms of farming, size categories and private holdings according to the purpose of the farming.

**Figure 1** Share of agricultural gross output by type of organizations, 2012

Corporations, enterprises (49.9%)	Private holdings (50.1%)
Agriculture, forestry and fishing under 5 employees 5.4%	Producing for own consumption 8.0%
Agriculture, forestry and fishing over 5 employees 39.8%	Marketing surplus over own consumption 9.5%
	Market oriented private holdings 32.6%
Other Industries than agriculture, forestry and fishing producing agricultural products 4.6%	

Source: Laczka (Gazdálkodás Journal, 2014)

**Table 1** System of agricultural statistics (1950–2000)

Year	Corporations, enterprises (State farms, cooperatives between 1950–1990)				Private holdings					
	land use		crop production		land use		crop production		animal breeding	
	census	sample survey	census	sample survey	census	sample survey	census	sample survey	census	sample survey
1950	●		●		●		●		●	
1951	●		●		●		●		●	
1952	●		●		●		●		●	
1953	●		●		●		●		●	
1954	●		●		●		●		●	
1955	●		●		●		●		●	
1956	●		●		●		●		●	
1957	●		●		●		●		●	
1958	●		●		●		●		●	
1959	●		●		●		●		●	
1960	●		●		●		●		●	
1961	●		●		●		●		●	
1962	●		●		●		●		●	
1963	●		●		●		●		●	
1964	●		●		●		●		●	
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1995	●		●		●		●		●	
1996	●		●		●		●		●	
1997	●		●		●		●		●	
1998	●		●		●		●		●	
1999	●		●		●		●		●	
2000	●		●		●		●		●	
Annual survey										+
Quarterly survey										+
Agricultural census	●		●		●		●		●	

● Survey conducted every 4th month  
 ○ Survey conducted every 4th month  
 + Agricultural census  
 Source: Laczka, E. *Statistical and economic interpretation of the farm concept* (PHD Dissertation)

### **Hungarian agricultural statistics in brief**

Hungarian agricultural statistics can pride itself on the longest and richest history in the independent Hungarian statistics. The Hungarian statistical service was founded in 1867, year when the predecessor of the current statistical office was set up under the leadership of Károly Keleti, the first president of the national statistical office. The newly founded statistical office considered as priority tasks the development of the Hungarian system of agricultural statistics and demographic statistics. The contribution of the Office to the international statistical work is illustrated by the fact that the European methodology of vineyard and wine statistics was elaborated with the guidance of Károly Keleti serving as the basis for the vineyard and wine census conducted by the Hungarian Statistical Office in 1872. The publication analysing the results of the census is still available to the readers in the Library of the Hungarian Central Statistical Office (HCSO).

The Hungarian statistical office has carried out until now 7 agricultural censuses and nearly as many vineyard and orchard surveys. Since the turn of the Millennium, besides the regular decennial agricultural censuses farm structure surveys compulsory in the European Union are carried out every two or three years on big samples.

It was in the second half of the 19<sup>th</sup> century that Hungarian agricultural statistics were transformed from descriptive statistics – mainly based on tax and other state registers – into a system of statistical surveys based on methodologies elaborated by the statistical office. The elaboration of macro statistics (national accounts) started as well in the first half of the 20<sup>th</sup> century. The creation of the territorial network of the statistical office was a milestone in the life of Hungarian statistics – including agricultural statistics. The 19 county directorates of the statistical office were created in 1952 with the task of implementing data collections and primary data processing. Beyond creating the conditions of statistical data collections, our predecessors strived to ensure that data collections reflect properly the changes in the economy, society and policy, and provide proper information on agriculture for users.

The above mentioned activities are illustrated in Table 1 which presents the censuses, the regular annual and periodical surveys and their changes in the period between 1950–2000. The table is a good illustration of how after the fifties, sixties – when in Hungary land use was prohibited for households (private persons) – the conditions resulting from the gradual removal of limitations were mirrored by agricultural statistics. The regular full scope and representative surveys covered at the turn of the Millennium the observation of agricultural activities performed by households.

### **1 INNOVATIONS MOTIVATED BY AGRICULTURAL STATISTICS**

Beyond improving the coverage of agriculture, numerous initiatives of Hungarian agricultural statistics have later influenced the whole Hungarian statistical system. I would like to highlight the following examples:

- the first representative survey was conducted in agricultural statistics,
- the notion of “small scale production” was introduced in Hungarian agricultural economics on the basis of the publication analysing the results of the Agricultural Census of 1972,
- it was in the field of agricultural statistics that the first division of labour was elaborated – between the Statistical Office and the Ministry of Agriculture,
- the methodology of the quick publication of preliminary data was developed for the Agricultural Census 2000,
- the idea of “spot-maps” emerged during the preparation of the vine and orchard survey of 2001,
- the first dataset with geo-coordinates was prepared with the data of the vine and orchard survey of 2001,
- the first electronic data processing system – governed by statisticians . was introduced in the field of agricultural statistics,

- the vine plantation survey of 2009 was the first survey where three quarter of the data came from administrative sources reducing considerably respondents' burden,
- last but not least, I would like to present the new tools used for the communication of agricultural data.

The above mentioned developments influence directly or indirectly Hungarian statistics even nowadays, their results are integrated in the statistical system.

### **1.1 The first representative surveys**

In Hungary experts considered for a long time the relative proportion of the two main branches (livestock and crop production) as the indicator of agricultural development. In the seventies the proportion of animal husbandry reached the level of crop production, and surpassed it in the nineties. Unfortunately as a result of the economic and social processes after the turn of the Millennium this balance was disturbed. The need to have information on livestock appeared already at the beginning of the 19<sup>th</sup> century but the current practice of animal counting, different for agricultural enterprises and private holdings was created in 1949. While state farms and cooperatives reported the number of livestock quarterly, in the fifties the Office developed for the first time a system of representative surveys to cover the livestock of the population. The statistical office has been continuously developing the methodology of quarterly representative surveys.

- In the fifties and sixties complete villages were integrated into the sample which was determined with the help of grids placed on maps. The sample size was 30 percent.
- In the seventies the areas of the sample were selected on the basis of the intensity of pig farming (the most important animal species), which allowed to reduce the sample size to 10 percent.
- Since 1995 the selection of the sample areas has been done according to the size of the holding, on the basis of the data from the districts the estimation was done at the beginning with ratio estimation, and later with the spreading of computers with regression estimation. This made possible to reduce sample size to 4–5 percent.

Nowadays according to the requirements of the European Union quarterly livestock counting is not implemented any more, data on livestock are collected in the framework of the representative agricultural surveys carried out in June and December, using the previous methodological experiences as well.

### **1.2 The notion of small scale production**

In the sixties detailed and accurate statistical information was available on big farms. State farms and agricultural cooperatives represented only two third of agricultural production. – The badly organized supply and low salaries – gave rise to small scale backyard farming in the villages, a well delimited division of labour was formed between the two sectors. In order to have a clear picture of the situation the need of a comprehensive agricultural census emerged. As domestic needs were coupled with the strengthening need to follow FAO international recommendations Hungary announced in 1970 that the country would join the agricultural world census round. The agricultural census was carried out in 1972 with the aim of satisfying as far as possible information needs. As statistics on state farms and agricultural cooperatives were satisfactory in most fields, the emphasis was put on the surveying of the agricultural activity of households. Statisticians decided to survey private holdings with a full scope survey and eight representative surveys based on it. Data were collected on many aspects of agriculture previously not known. The census revealed that nearly half of the population participated in some form in agricultural production and consumed the agricultural products produced by the households. Social stratification showed also that “small scale” agricultural production was not only the prerogative of peasants, but was performed to a considerable extent by all the social categories. The data of the census contributed to a notable extent to transforming the policy previously applied in relation to small-scale agricultural production. This notion firstly used by statisticians became part of the specialized literature.

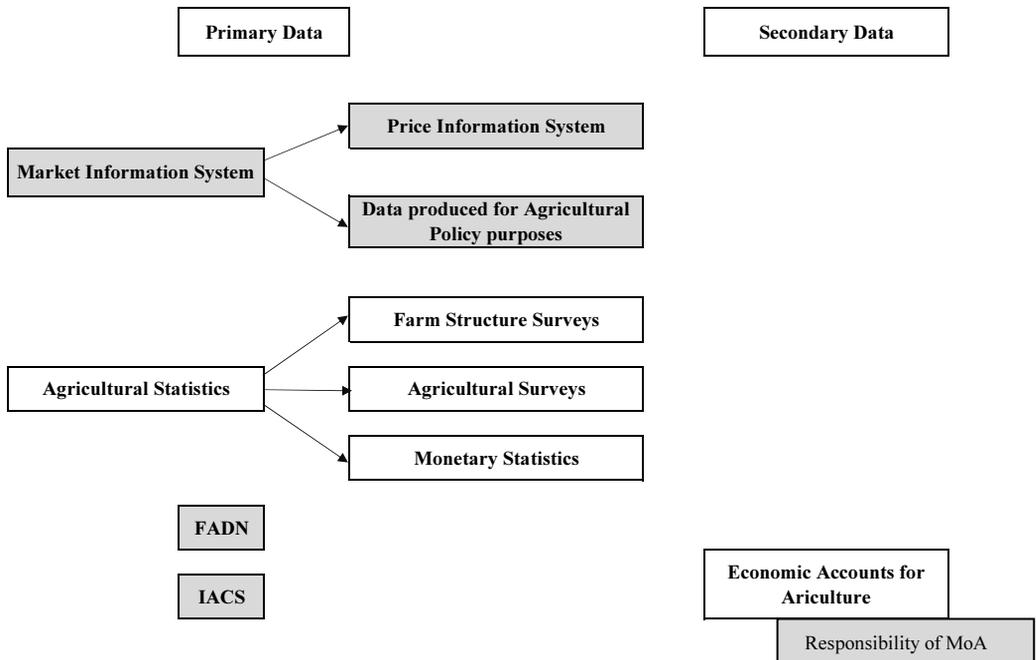
### 1.3 Division of labour between the Statistical Office and the Ministry of Agriculture

In Hungary the compilation of agricultural statistics has traditionally been the common task of the statistical office and the Ministry of Agriculture, and this applies for today as well. The basic concept of the division of labour was already at the beginning that estimations were the task of the Ministry of Agriculture, while the statistical office was in charge of data collection serving the “statistical measurements of facts”.

The reconsideration of the division of labour became even more important before the accession to the European Union (at the end of the nineties and during the first years of the turn of the Millennium). One of the most important task was to assess the degree of harmonisation of agricultural statistics at that time, to see to which extent the practice followed by the country was in line with the legal requirements of the European Union. The first screening, assessment took place in 1999. At the time of the screening one third of Hungarian agricultural statistics was conform with the requirements of the European Union, and one third needed minor or major corrections with a view to harmonisation. The screening revealed completely new tasks to be implemented by Hungarian agricultural statistics, like the introduction of the system of Economic Accounts for Agriculture, the implementation of plantation surveys and several previously not covered statistical fields.

In order to establish a clear division of labour we have redefined the tasks being the exclusive competence of the statistical office (for example census implementation,) and the tasks being entirely the responsibility of the Ministry of Agriculture (for example forestry statistics). We have also identified common tasks (like the compilation of the Economic Accounts for Agriculture) with a clear and detailed distinction and indication of the indicators that had to be compiled by each institution. The division of labour determined at the turn of the Millennium is still valid nowadays, as shown in the Figure 2.

**Figure 2** Division of labour between the HCSO and Ministry of Agriculture



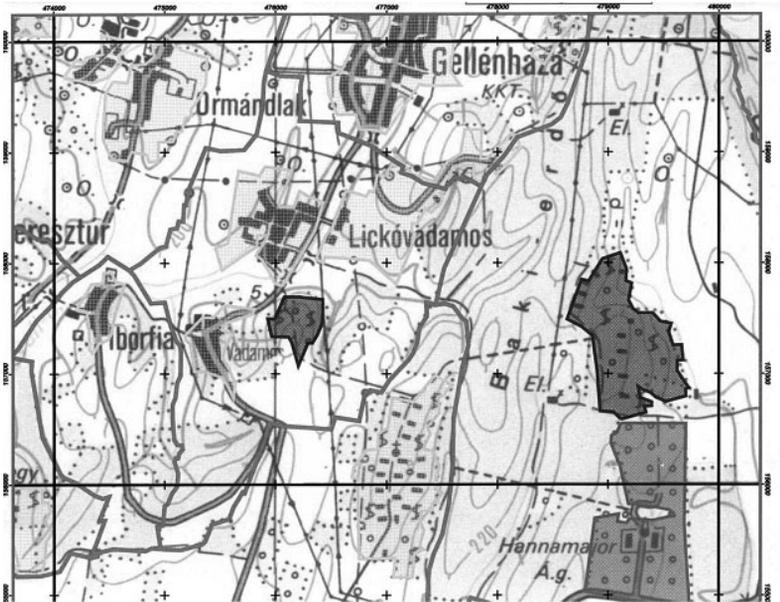
Source: Own construction

#### 1.4 Publication of preliminary census data within six months after the census

The sixth full scope Agricultural Census was implemented at the turn of the Millennium (in 2000). The conduct of the census was necessary because the conditions of agricultural production were most deeply affected by the change of the political system. There had been a radical change of ownership in agriculture, the focus of the production shifted from the big agricultural enterprises to the private holdings. The conduct of the census was also urged by the accession to the European Union, a stocktaking of the situation in agriculture before accession was a necessity. The census was composed of a full scope census of all the units performing agricultural activity and of representative surveys implemented for the units selected from the whole population surveyed. The reference period of the full scope census was the 31<sup>st</sup> of March 2000.

Due to the changes that had taken place and the accession of Hungary to the European Union, decision makers, analysts, professional organisations were eager to know the results of the census. The door-to-door interviews of the 2 million respondents, the filling in of the questionnaire lasted only two weeks, but data entry, editing and processing was a huge task for statisticians. As the expectations were great, it would not have been a good solution to publish only a few important data among preliminary data, but it would not have been acceptable either to publish the data in a year's time only. These considerations gave rise to the idea to select – randomly – from the questionnaires completed in the first two weeks of April 2000 a 1 percent sample. After quality control these questionnaires were entered and processed by statisticians out of turn. The publication presenting and analysing the preliminary data of the census included all the important indicators of the questionnaire at country level. Preliminary data of the census were published within six months after census taking. The “idea” born in the case of the agricultural census 2000 is still applied, Hungarian statisticians used it for example for the publication of the preliminary data of the Hungarian population census of 2011.

Map 1 Spot-Map (Zala country), 2001



Dark grey spots = vineyard area

Grey spots = orchard area

Light grey spots = mixed area

Source: HCSO, Vineyard and Orchard Census 2001 documentation

## 1.5 Spot maps

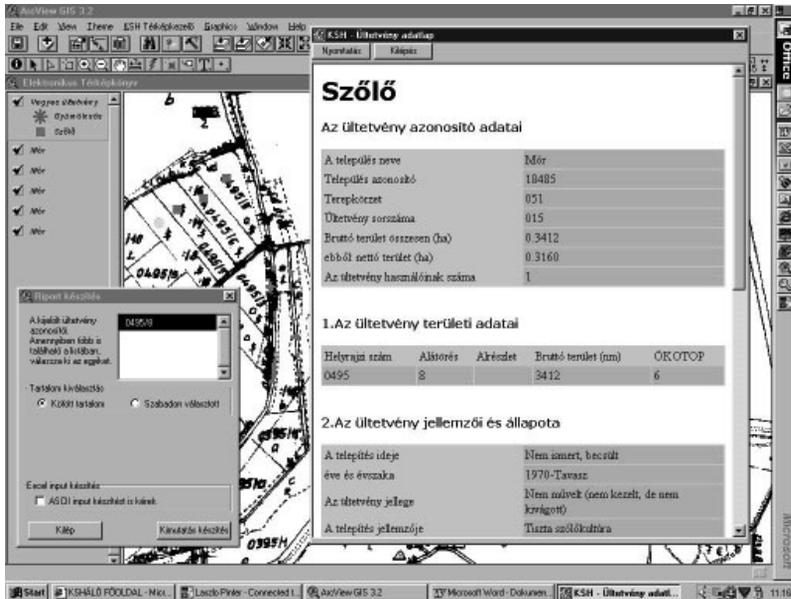
Due to its climate conditions, in Hungary vineyards and orchard plantations represent a higher proportion of agricultural area than the average of the EU Member States. In Hungary the first vineyard census was carried out in 1872 and the first orchard census in 1895. After the plantation censuses of the 19<sup>th</sup> century, vineyard and orchard censuses were conducted in 1935 only and later in the fifties and sixties.

Due to the importance of the sector in the Hungarian agriculture, the greatest challenge before EU accession was the implementation of the full-scope vineyard and orchard census (that was conducted in 2001). The greatest problem originated from the fact that the census population could not be defined neither from administrative nor from reliable statistical sources. The solution was to design the so-called “spot maps”. This meant that with the use of remote sensing data the place of vineyard and orchard (and mixed) plantations could be marked on topographical maps. Spot maps were excellent tools both for organising enumeration and validating the data collected.

## 1.6 The first database with geo-coordinates

The form of the published data is also an important part of communication. Information and data concerning farms are expected nowadays to be published with geo-coordinates. For Hungary the first database with geo-coordinates was created for the data of the vineyard and orchard censuses of 2001. This had been supported by the use of spot maps and the enumeration by parcels. In the case of the member states of the European Union, databases with geo-coordinates can be produced for the Farm Structure Surveys (FSS), which is also a requirement of the current FSS regulations.

Picture 1 Vineyard parcel data (Mór, Fejér county) presented in the geo-coordinated database (2001)



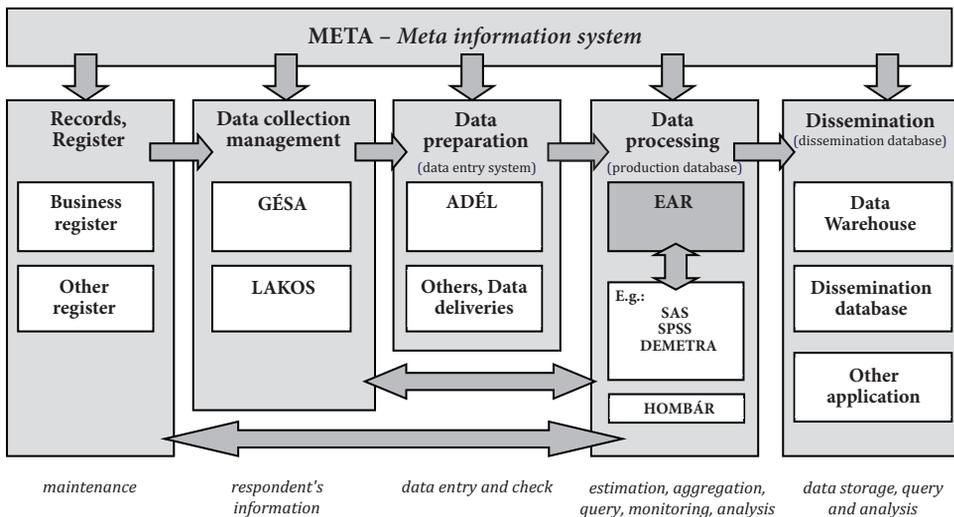
Source: HCSO, Vineyard and Orchard Census 2001 Database

## 1.7 The Unified Data Processing System (HOMBÁR/EAR)

After the turn of the Millennium Hungarian statisticians dealing with agricultural statistics applied successfully for an EU-tender aimed at developing agricultural statistics. The resources of the project

made possible to review the data processing tasks of agricultural statistics. The renewal of data processing was justified by the fact that the traditional data processing system was relatively slow, it was not adequate for the efficient implementation of quality control, it was not sufficiently well-documented, and last but not least it required important human resources. Agricultural statisticians and IT developers developed a special, new data processing system that was called HOMBÁR (meaning granary). The concept of HOMBÁR is quite similar to the LEGO game; agricultural statisticians and IT experts created LEGO bricks (statistical operations) of different forms that were programmed by the IT experts. Using a comparison, the system functions in such a way that statisticians chose or assemble LEGO bricks according to their purpose of building a horse or a tractor. This means that if the statistical process changes, statisticians reorder the LEGO bricks (as the system can react to the changes in a flexible manner). In this way data processing is led and managed by statisticians, the task of the IT team is “just” to secure the IT operation of the system and produce the new LEGO bricks (statistical operations). The development lasted 3 years and further 2 years were needed before the processing of agricultural survey data with the new system became a routine for statisticians. The use of the HOMBÁR system made possible to reduce by half the time of data processing and by 30–40 per cent the human resource needs. The HOMBÁR provided a proper documentation, relation with the databases, and integrated more efficient quality controls. At that time agricultural statisticians thought that the HOMBÁR was not suitable to process account type of data, like the Economic Accounts for Agriculture. On the basis of the experiences of HOMBÁR, the Hungarian Central Statistical Office decided in 2008 to extend the system to the whole statistical production of the office. As the whole statistical system is broader than agricultural statistics, and is in a certain sense more complex, further development was needed. The new, extended system was called the Standardized Data Processing System (EAR). The development work accelerated at the beginning of 2013, and the routine operation of the system in the whole statistical office is expected by the end 2015. Another tender supported the office in introducing the processing of national accounts data in the EAR system for which the EAR was complemented by a supplementary “control system”. Nowadays the processing of the production accounts of national accounts is done with this system. The purpose of the paper is to present the concept, the functioning and the advantages of the new data processing systems.

**Figure 3** EAR in the statistical data production process



Source: NTTs 2015 Conference presentation

### 1.8 Use of administrative data sources, the first administrative data based Vineyard census

In relation to agricultural censuses, the use of administrative data sources for statistical purposes has always been a key issue. At the beginning its most important function was to determine the survey population of the surveys and support the organisation of the data collections. During the past decades, administrative data sources acquired a growing importance in the validation of the collected data, which is valid still nowadays. In the past years the need to reduce respondent burden became a central issue, and as a consequence subject groups of the census questionnaires were increasingly replaced by administrative data. The greatest change was the vineyard census in 2009 when two third of the census data was based on administrative data sources (only one complementary sample was needed). The vineyard census of 2015 will be based in its entirety on administrative data sources.

In broader terms – despite its importance – the use of administrative data is not yet unhampered even nowadays. The legal obstacles of the use of administrative data sources need to be removed. There are still several examples when the legal acts regulating certain registers do not allow the use of administrative data for statistical purposes. The definitions, concepts used by administrative registers differ frequently from those used in statistics which is a source of further problems (the implementation of the 2009 and 2015 vineyard censuses are good examples of how to solve it).

The developments linked to Big Data can open new possibilities in the case of agricultural statistics as well. In this respect developments are only starting even if Hungarian agricultural statistics have been using remote sensing data for already 20 years now for the most important early crop production data.

### 1.9 Communication tools applied in Agricultural Statistics

As in other statistical areas, the publication and dissemination of agricultural data is also a great challenge. Furthermore data must be published in a different “style” according to the targeted audience: respondents, experts, decision makers and the general public.

One of our most popular communication tool for respondents was the so-called “Calendar” of agricultural statistics. Relying on Hungarian traditions we had prepared a special calendar that beyond serving as a normal calendar presented the monthly agricultural surveys to be carried out with the details of their implementation. It also contained useful information for farming, crosswords, but also recipes.

Without being exhaustive, I would like to mention only some examples. The plantation database with geo-coordinates previously mentioned served to inform experts.

Thanks to the technical development that has taken place since that time we have now at our disposal very useful visualisation tools as well. Examples of these tools can be found on the homepage of the HCSO. I would highlight two examples. One is the “Agricultural radar”, the interactive radar chart presenting for the period 2000–2012 the annual volume changes for the main product groups from the production account of the Economic Accounts for Agriculture ([www.ksh.hu](http://www.ksh.hu)).

The other example is the interactive tool “Macroeconomic processes in agriculture” which presents for the period 2000–2013 the annual changes in the macroeconomic processes of agriculture with the main indicators of the EAA (output of crop products, output of livestock and animal products, total agricultural output, intermediate consumption, gross value added, income of production factors, entrepreneurial income) ([www.ksh.hu](http://www.ksh.hu)).

In Hungary the use of map applications has also its traditions in agricultural statistics. Despite this fact the “Agricultural Atlas” can be considered as a new result. More than 100 cartograms illustrate with visual tools the results of the last two agricultural censuses and the changes between the two periods.

Last but not least, the broad dissemination of census data enhances statistical culture, improves the knowledge and responsiveness of respondents. Good examples are the two events that we organized after the last Agricultural Census in one of the open-air (village) museums of Hungary. We tried to make attractive to the visitors of the museum the world of numbers by showing them old books on the history

of agriculture, colourful statistical publications and graphs, the statistical quizzes organized allowed also an interactive exchange between statisticians and visitors.

## CONCLUSION

We could ask why agricultural statistics can be an ideal basis and starting point of developments. I think that several factors lie behind the reasons. Agricultural statistics are in the different countries – almost without exception – the statistical field with the richest traditions and the longest history. This could happen because already during the years of the birth of statistics people wanted to know how many persons were living in their country and which were the sources of food supply for the population. The more developed countries in Europe had implemented already in the second half of the 19<sup>th</sup> century the first agricultural censuses and population censuses. Based on the censuses (providing the statistical population) it was possible to elaborate the system of the regular (annual and infra-annual) data collections, and later of the representative surveys. At the beginning of the 20<sup>th</sup> century, after the setting up of national accounts (macro-statistics) – built on the results of micro-statistics – the compilation of agricultural macro-data was required. In the case of Hungarian statistics, EU accession (2004) gave a new impetus to the development of agricultural statistics. The European Union required among others the compilation of the satellite account of agriculture (Economic Accounts for Agriculture). This means that agricultural statistics are “mapping” the statistical systems, starting from micro statistics to a system of macro statistics, they form a complex system. The complexity of the system, the systems approach require increased efficiency in the field of quality criteria, technical development which is considerably facilitated by the IT explosion of the past years. The huge databases resulting from the complex systems entailed the elaboration of new solutions in communication, which relied also the excellent possibilities provided by technical development.

## ACKNOWLEDGEMENT

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