

The Need of a Parcel-Based Information System to Support Agricultural Sector

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SUMMARY

Agricultural sector has a very important role for its direct relation to manufacturing foodstuffs and nutrition, having a great number of active population and labour force, its contribution to income, and providing raw material and capital to industry. Therefore, some policies have been developed by international organizations (e.g., EU, FAO, World Bank) regarding this important sector. Many of these policies aim at reforming agricultural sector of developing countries and gaining a nutrition balance all over the World. In order to be able to adopt or apply these policies, nations must have an adequate and effective land related information system. Beyond just the adoption of these kinds of international policies, nations, especially developing countries, should have a parcel-based information system to boost their agricultural economy. By using such a system, they can control their land and labour force, generate or adopt new policies, finally reach an effective agricultural production and management level. In this context, in Turkey, in joining to the EU, to adapt agricultural sector to EU's *Common Agricultural Policy* (CAP), some nationwide re-structuring and reform projects were started as of the year 2001. After beginning applications of these projects, many difficulties have been encountered. The main cause of these difficulties is a lack of appropriate geospatial data infrastructure to support the projects. In this paper, a need of a parcel-based information system in support of agricultural activities and policies in developing countries was examined and analyzed on the light of Turkey's experiences and needs towards EU.

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1. INTRODUCTION

In the future, the countries may not be classified as developed, developing or underdeveloped countries. Instead, there will be two classes—*the countries reaching a certain level of information management and others* (Kutlu, 2002). In this respect, the maximum usage of the opportunities offered by the technology of the twenty-first century is needed in order to guarantee the effectiveness of agricultural reform applications and thus, reaching to a certain level in agricultural information management.

International organizations and unions have long been in an effort to get a sustainable development and management. It is impossible to be indifferent to these efforts because the agricultural issues on the Earth highly interdependent. That is to say, agricultural problems in a region may easily affect other regions and also countries. Therefore, common agricultural policies have been applied in some areas of the world. On the other hand, in EU, beginning from the foundation a Common Agricultural Policy (CAP) has been applied. Likewise, Turkey has some policies and applications in accordance with the CAP. In this way, Turkey has many experiences and issues. These experiences can be a guide both for Turkey and other developing countries in their future agricultural reforms and applications.

2. AGRICULTURAL REFORMS

2.1 The EU's Situation in Brief

Born 50 years ago (in 1958) when the founder members of the EU had not long emerged from a decade or more of food shortages, the Common Agricultural Policy (CAP) began by subsidizing production of basic foodstuffs in the interests of self-sufficiency. The CAP of today is moving increasingly towards direct payments to farmers as the best way of guaranteeing farm incomes, food safety and quality, and environmentally sustainable production (URL-3, 2004).

After the adoption, the CAP has been always re-formed over time. The reform of 1992 marked a major change in the CAP. In 1992, the CAP reform had an objective of the adoption of a direct aid system to farmers instead of the preceding prices support, favoring the increase of production even for products facing marketing problems (Delince, 2001; URL-4). Afterwards, in 2000, the new reform of the CAP took place within Agenda 2000. It confirmed the 1992 orientations and added the new pillar to the direct aid system. The Rural Development got a higher priority through, among others (Delince, 2001). Major reforms implementing the principles of Agenda 2000 were adopted in mid-2003. They represent the most radical changes to the CAP since it was founded in 1958. Not only are production subsidies being sharply curtailed in favour of direct payments to farmers, but eligibility for

those payments is linked to compliance with rules on the environment, animal welfare, hygiene standards and preservation of the countryside (EC, 2003; URL-3, 2004).

In EU, while radical changes of the CAP reforms have been occurred over time, the budget allocation for these reforms has experienced some slight changes. An average of 50% of EU's budget has been allocated for the CAP. This figure indicates the impact and importance of agricultural reforms in EU.

2.2 Agricultural Reforms in Turkey

Agricultural Policies in Turkey dates back 1960's when the process of joining to European Community started. Since then, Turkey's Agricultural Policies have developed slowly and intermittently (Eraktan, 2002). These policies, along with the process of join to the European Union (EU), had a significant importance and acceleration in recent years. And today, active nationwide agricultural policies which are parallel to those in EU are being implemented (Inan, 2004).

2.2.1 Agricultural Reform Applications

Agricultural reform applications in Turkey largely depend on the EU joint process. The Common Agricultural Policy is one of the elements that are of major importance in this stage. Within the CAP, the issues of agricultural subsidies have a considerable importance. As a result, to secure the management of agricultural subsidies the establishment of an operational Integrated Administration and Control System (IACS) is required for both member and candidates countries. IACS aims to adequately manage the applications for agricultural subsidies for a series of crops and for livestock. So, for Turkey, the establishment of an IACS is an absolute prerequisite to join the EU (URL-1, 2005). Indeed, the current applications in Turkey are caused largely by the need of meeting EU joint prerequisites.

In 2001, Turkey started the implementation of a new project titled Agricultural Reform Implementation Project (ARIP). This project is financed by the World Bank. Its implementation period starts in June 2001 and ends in December 2005. The loan amount of the project is \$600 million. The project has a total of four main components (URL-2, 2005; Kutlu, 2002; Anonymous, 2002). In Table 1, these components and brief descriptions are presented.

Because of their direct relation to spatial data, the components A and B sections in the table are of crucial importance for Turkish agricultural reforms. In fact, the current applications of agricultural reforms in Turkey are focused largely on the first component of the ARIP project—forming a National Registry of Farmers (NRF) via Direct Income Support (DIS) regime. The second component is not fully in demand, that is, there are only rare and small scale applications concerning Farmer Transition (FT). Because components C and D sections in the table are related to cooperation issues, they are not discussed in this paper.

Table 1. ARIP project components and their descriptions

Comp.	Title	Description
A	Direct Income Support (DIS)	The objective of this component is to set up a National Registry of Farmers (NRF) capable of identifying farmers who are eligible for payments under the DIS and delivering those payments. This component is at the heart of the whole program (URL-2, 2005)
B	Farmer Transition	The objective of this component is to cover the cost of converting from previously highly supported crops. Currently the most serious problems are with hazelnut and tobacco.
C	Cooperatives and Unions	Includes the structural reform of the agricultural sales cooperatives and unions.
D	Support Services	Includes public information campaign to provide accurate and timely information about the reforms, advisory services and project coordination connected with the project.

2.2.2 Structure and Procedure of NRF and DIS Applications

In Turkey, the NRF and DIS applications are basically based on declarations of farmers and some control processes. These applications do not have a permanent legal basis. On the contrary, the implementation of the applications has been sustained with yearly bulletins by the Ministry of Agricultural and Rural Affairs (MARA). The declaration process has some basic rules to prove that the farmer effectively use an agricultural field. These rules and some other procedures are defined in yearly bulletins. After the declaration procedures ends and the NRF of the year is obtained, the DIS application process starts. In this process, farmers are paid for their agricultural activity proportional to area of the land and the type of their agricultural activities (Inan, 2004; Anonymous, 2002).

The NRF operates in a central computer system under the control of Information Management Department of MARA. The system serves on the WEB. The remote authorized users in provinces enter the collected data to the system by following predefined procedures (Kutlu, 2002). This online system has some auto control mechanisms to prevent data entrance errors of the users. However, the system collects and manages only alphanumeric data. Any graphical or spatial data is not included within the system. The MARA data having spatial meaning is address information of farmers as well as the special location codes (ProvinceNo+CountyNo+Village/DistrictNo) of farms (Inan, 2004).

In these serious of applications and procedures, the most particular work is made or expected to make by the MARA staff in provinces and counties. The central MARA staff makes only some administrative work. Indeed, they determines basic procedures, releases a yearly bulletin and even more interestingly requires province or county staff to control farmer declarations using sophisticated techniques and tools (e.g. Remote Sensing, Photogrammetry, and GIS). However, the central staff does not have any technical work in order to determine some standards in using these kind of high-tech tools to assist or ease control processes. So, control processes in provinces and counties have been made by using conventional techniques which causes severe problems in control works. In these conditions, NRF and DIS projects have been continuing since June 2001 (Inan, 2004).

2.2.3 NRF and DIS Applications in Figures

In Turkey, it is estimated that there are approximately four million farmers cultivating their land and make their living by this way. And, it is a reality that any legal record of these predicted farmers was not available before NRF project. Therefore, by promoting DIS project among farmers, the primary aim was the provision of NRF. This aim has been partially reached by registering 80% of the farmers in Turkey in three project years (URL-2, 2005). Some statistical annual data concerning performed registration over the years is presented in Table 2. According to the statistics, beginning from the year 2001 through 2003, in each project year, 55%, 75%, 80% of the farmers are registered respectively. In 2004 and 2005, 95% of the farmers are expected to be registered within the NRF project (URL-2, 2005).

Table 2. Yearly registered farmer and land information (URL-5, 2003).

Year	2001	2002	2003 (Approx.)
Number of Registered Farmers	2.182.767	2.582.883	2.761.000
Area of Land (da)	117.573.902	162.639.367	-
Total Amount of Pay. (USD*)	784 Million	1,463 Billion	1,887 Billion
Land per Farm (da)	53.9	65	-
DIS per Farm (USD*)	360	570	680

* Yearly average exchange rates of Turkish Lira (TL) to USD: 1USD=1.500.000TL for 2001-2002 and 1.400.000TL for 2003

2.2.4 Issues in Applying the Projects

The control stage of NRF needs a fully spatial concern because the controllers have to acquire the exact information concerning whereabouts of declared farmer land parcels and control agricultural activities on them to make a final decision. In current NRF system, this need is the main source of problem. In the areas where cadastral registration works were completed, the farmers use their deeds to declare their land. In other areas, a special commission defines land usage information. Because of this complexity and confusion, most crucial problems have been encountered in the control stage of declarations. Reasons of difficulties encountered in control processes can be classified as follows,

- Using non up-to-date deed information in the areas where cadastral registration was completed
- Using very rough visually observed land cover data in the areas where cadastral registration has not been completed yet
- The fact that there is no other spatial reference in the areas where cadastral registration has not been completed yet
- Intentional exaggeration of the area of declared land
- Different geo-coordinate systems used to produce spatial cadastral data
- Unavailability of digital and updated cadastral data
- The difficulty in accessing current spatial cadastral information in Cadastre Offices
- Inadequacy or lack of technical assistance to the MARA staff in provinces and counties

Because of the listed main reasons, adequate control works on declarations have not been able to perform in NRF. Therefore, in some regions where total agricultural area information is available, plain total area control and adjustment works have been performed. Otherwise, declarations of farmers have been approved to be true. And thus, this situation causes unjust application of DIS and distribution of payments.

3. THE NEED FOR A PARCEL-BASED INFORMATION SYSTEM

The future or, in one respect, concealed purpose of DIS and NRF projects are/should be the formation of a reliable data infrastructure for future agricultural policies (Inan, 2004). In this context, the EU's agricultural policies, beginning from the year 2000 with the new regulation (reg. EC no 1593/00), have been directed to digital graphical environments. Even more interestingly, this regulation makes compulsory the use of Geographical Information System (GIS) techniques within candidate countries (JRC, 2001). Indeed, the use of digital graphical data and GIS techniques adds invaluable capabilities to agricultural decision systems and policies. By executing graphical analysis of different types of data, it can be reached a high-tech decision-support system (Reis, 2003).

When the current situation of Turkey are considered, it is seen that even after the completion of ARIP project at the end of 2005, the collected data concerning the Turkish agricultural sector (the NRF data) will not have any meaning more than statistical data. That is to say, this data will not give any opportunity to execute some spatial analysis and manipulation for future policies and projects. At that point, when the EU case and future perspectives are considered, it is understood that the current reform applications in Turkey are insufficient in many aspects. The basic needed items can be summarized as follows;

1. The transition to a graphical digital environment rather than current alphanumerical one,
2. Choosing a concrete Land Parcel Identification System,
3. Determining other needed graphical data at least the ones which must be used to control declarations,
4. Determining data sources and standards,
5. Using GIS techniques to analyze the data.

Among these basic requirements *the second item*—Land Parcel Identification System (LPIS) —has a very crucial role because it is used to define the identity and geometry of agricultural parcels. It is the main component because the farmers perform their agricultural activities on their land parcels. However, in EU there is no standard way of forming LPIS. *Agricultural parcels, farmer's blocks, physics blocks, cadastral parcels and/or combination of these* can be used as LPIS (Relin et-al, 2003; Ozlu, 2003). On the other hand, forming a LPIS is compulsory within CAP. This situation is largely caused by the fact that land management regimes are changing over EU countries. While some countries have strong cadastral structure, some others barely manage their land. As for Turkey, it can be say that Turkey has a strong cadastral system in spite of two basic problems. These problems are analog data storage and 15% missing cadastral work. But, the cadastral system in Turkey is in a new restructuring regime with the project Turkish Land Registry and Cadastre Information

System (TAKBIS) project. This project is very promising for its digital, dynamic and also high-tech structure. The assessment and evaluation stage of the project have already completed. With its qualities, besides its main role—cadastral process management, it can readily be used for a LPIS. For this reasons, choosing cadastral data as a concrete Land Parcel Identification System (LPIS) is very wisdom. This wise selection is valid for Turkey or any other developing country having some land management related features in common with Turkey. When cadastral data is used as a LPIS, the system may be called as a Parcel-Based Information System (PBIS).

In a PBIS for the management of agricultural reforms and activities, the other stated above basic needs have to be met in one way or another. *The third item*—determining other needed graphical data to control declarations and perform needed spatial analysis—is also of great importance. This kind of graphical data may be *soil, meteorological, land cover, topography, arrival, hydrology, administrative and NRF data* and some produced data by manipulating main data (Inan, 2004). In fact, a PBIS with these kinds of data is a kind of Land Information System (LIS). An example of a conceptual PBIS/LIS for agricultural sector is presented in Figure 1.

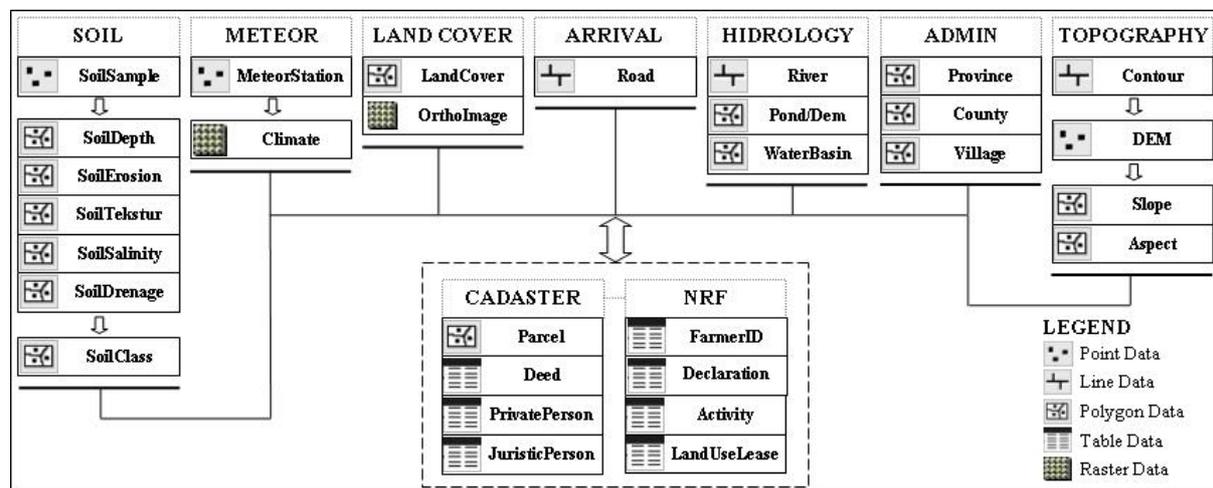


Figure 1. A sample conceptual framework of a PBIS/LIS

The design of a conceptual framework of this kind (Fig. 1) can be made with slight changes in accordance with some different or extra needs in different nations. However, at the design stage, the previously stated *fourth item*—determining data sources and standards—is also of critical importance. This requirement have been a nuisance for the control works of NRF in Turkey because of different sources, base materials, scales, production techniques of used graphical data (Inan, 2004; Reis, 2003). In this respect, *data quality, visualization, geometry, precision, classification, database structure, terminology and even data exchange format-media* standards have to be reached before the formation of a PBIS/LIS of this kind (TC Basbakanlik, 2000). In fact, some precision and raster data standards have been determined by European Commission (EC). For example, it is suggested that the precision of aerial Ortho Imagery or remotely sensed data must be proportional to the precision of 1/5.000-1/10.000

scale maps (JRC, 2001). The studies of EC on data standards can be used as guidance in forming PBIS/LIS's.

Ones the technical requirements for *items one and five* are also met and the formation of a PBIS/LIS is completed, using such a PBIS/LIS is just a matter of querying, analyzing and manipulating the data in the system.

Although some allegations have been arisen against the usage of cadastral data for this purposes because of its non-dynamic structure, the fact that the owner of a cadastral parcel is not always the user and the fact that agricultural land hiring issues are common in some countries, with the usage of up-to-date Ortho Imagery and yearly alphanumeric NRF data within a PBIS/LIS, these alleged disadvantages turn into complete advantages. Moreover, in such a system, the analysis of declared and non-declared agricultural areas can be executed and apart from analysis, the social reasons can also be examined in problematic regions. Furthermore, having these advantages a PBIS/LIS of this kind can be a model for developing countries.

4. CONCLUSIONS

Concerning previous experiences of Turkey, it is obvious that there is a need for a full-fledged PBIS/LIS in Turkey. On the other hand, forming a PBIS/LIS is a hard job. This can be accomplished in a decisive and patient manner. In Turkey, this job should be done not only to meet the requirements to join to the EU but also to boost the agricultural economy. Likewise, in other developing countries, this is the case and, for many reasons, there is a need of a PBIS/LIS—probably the best way of managing agricultural activities. By using such a system, developing countries can control their land and labor force, generate or adopt new policies, finally reach an effective agricultural production and management level. Within a PBIS/LIS, by executing graphical analysis on different types of data, it can be reached a high-tech *decision- support system*. In this information age, decision-support systems are of critical importance in all areas of management. Therefore, Turkey, along with the EU joining period, should and will form a complete PBIS/LIS for agricultural reforms and thus, forming a good example and a model for other developing countries.

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BIOGRAPHICAL NOTES

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