Land Consolidation Practices in Turkey and Some Results

Gürsel KÜSEK, Turkey

According to 2012 statistical data, the total population of Turkey is about 75.6 million, of which 49.8 percent are women. The total surface area of Turkey is 778,997 km² consisting of 767,415 km² (98.5%) of continental land (excluding water surface 11,582 km² as lakes, rivers, etc.), of which 34.13 percent is agricultural land. Of the 24 million ha of agricultural land, 8.5 million ha are irrigable.

In particular, agriculture is crucial for the national economy due to its prominent role in foreign trade and due to the fact that a large portion of the population is employed in the agricultural sector.

The Ministry of Food, Agriculture and Livestock, through the General Directorate of Agrarian Reform (GDAR), is implementing a programme of land consolidation to address the problems of small and fragmented holdings, poorly shaped land parcels, and lack of access to roads. Projects can also include the provision or rehabilitation of infrastructure (e.g. water canals, pipelines, roads, drainage, etc) and to improve environmental sustainability and agriculture.

Land consolidation was introduced in Turkey in 1961. During the period 1960 – 2002, in total 450,000 ha was consolidation through the national land consolidation programme. Work has been scaled up significantly from 2009. In total during 2009 - 2013, 196 projects have been launched including 4.1 million ha.

This paper presents the importance, overall strategy and current operations of land consolidation in Turkey. Meanwhile, the developing history of land consolidation and stresses the significance of promoting land consolidation in Turkey. The significant results obtained are also emphasized in this paper.

Key words: land consolidation, GIS techniques, block design, irrigation and transportation
1. INTRODUCTION

According to 2012 statistical data, the total population of Turkey is about 75.6 million, of which 49.8 percent are women. The total surface area of Turkey is 778,997 km² consisting of 767,415 km² (98.5%) of continental land (excluding water surface 11,582 km² as lakes, rivers, etc.), of which 34.13 percent is agricultural land. Of the 24 million ha of agricultural land, 8.5 million ha are irrigable. Turkey’s fertile soil and the variety of different climates throughout the country permits raising a broad range of crops. These opportunities make Turkey one of the few countries in the world that is self-sufficient in terms of food and providing self-subsistence particularly in rural areas.

In the arable crops sector, Turkey is a major producer. In 2009 the production of cereals in Turkey was 33.6 million tones, which represents 11.4% of the EU-27. Turkey is one of the world's biggest wheat and barley producers. Country is also a major producer and net exporter of fruit and vegetables. Its level of production is around 60% of EU-27 production of fruit and vegetables. As regards nuts, in particular for hazelnuts Turkey is the largest world exporter. Besides cotton and tobacco, sugar beet is another important industrial crop. In addition to the importance of agriculture; stability of existing agricultural land, and furthermore the continuous decrease in total area due to use of land for non-agricultural purposes or misuse, increased the importance of existing agricultural land registry.

Although the share of agriculture in the Gross Domestic Product (GDP) has been decreasing for years, agriculture is still an important economic activity for Turkey representing 8 percent in GDP in 2010.

In particular, agriculture is crucial for the national economy due to its prominent role in foreign trade and due to the fact that a large portion of the population is employed in the agricultural sector.

In terms of farm structures, most of the farms in Turkey are family organizations which are employing family labour. Subsistence and semi-subsistence farming is an important characteristic of Turkish agriculture. These farms are typically characterized by low productivity and only a small part of production is marketed.

2. LAND USE CATEGORIES AND GENERAL VIEW OF AGRICULTURAL AREAS IN TURKEY

Areas in different land use categories and general view of agricultural areas in Turkey are shown respectively in Table 1 and Table 2.
### Table-1: Land use categories

<table>
<thead>
<tr>
<th>Land use categories</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural lands</td>
<td>34</td>
</tr>
<tr>
<td>Meadows and pastures</td>
<td>16</td>
</tr>
<tr>
<td>Forests and woodland</td>
<td>26</td>
</tr>
<tr>
<td>Non-agricultural use</td>
<td>10.6</td>
</tr>
</tbody>
</table>

### Table-2: General view of agricultural areas

<table>
<thead>
<tr>
<th>General view of agricultural areas</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good conditions</td>
<td>17</td>
</tr>
<tr>
<td>Erosion</td>
<td>59</td>
</tr>
<tr>
<td>Drainage</td>
<td>4</td>
</tr>
<tr>
<td>Non suitable</td>
<td>20</td>
</tr>
</tbody>
</table>

3. **SECTORAL CONTEXT**

There are 3.1 million agricultural holdings and their average size is smaller than the European Union’s average. The average area of land per holding is only 6 ha. Some 65 percent of holdings have less than five ha. In addition, the holdings are very fragmented, often into 6-10 parcels, and fragmentation continues because of inheritance. Land parcels are often poorly shaped for modern agriculture and sometimes do not have direct access to roads and water. These conditions are not conducive to agriculture and sometimes result in farmers abandoning their land.

The Ministry of Food, Agriculture and Livestock, through the General Directorate of Agrarian Reform (GDAR), is implementing a programme of land consolidation to address the problems of small and fragmented holdings, poorly shaped land parcels, and lack of access to roads. Projects can also include the provision or rehabilitation of infrastructure (e.g. water canals, pipelines, roads, drainage, etc). The Ministry of Forestry and Water Affairs, through the General Directorate of State Hydraulic Works, is the overall responsible state agency for water resources management and works closely together with GDAR on the implementation of land consolidation projects in irrigation areas.

The General Directorate of Agrarian Reform (GDAR) implements land consolidation work covering more than one million hectare each year.

The Land Consolidation project is closely related to Millennium Development Goals - MDG 1 (on poverty and hunger) and MDG 7 (on environment) as it addresses both issues of food security and environmental sustainability.

4. **LAND TENURE STRUCTURE**
Land tenure structure in Turkey can be summarized as follows;

- Farms comprise a number of parcels. About 6-10 parcels in a holding is common and some farmers have even more.
- The average area of land per holding is only 6 ha.
- The great majority of farms are less than 5 ha.
- Fragmentation continues because of inheritance.
- Parcels are often some distance apart, sometimes up to 20 km.
- Land parcels are often poorly shaped for modern agriculture and sometimes do not have direct access to roads and water.
- Farms are often owned by the elderly.
- Farms are often jointly owned by a number of people.
- Farm owners are often absent, with many living in urban areas.
- Owners sometimes do not have legal titles.

5. SECTORAL POLICY AND LEGISLATION

Legal provisions for land consolidation are in Law No. 5488 (Agricultural Law), Law No. 5403 (Soil Conservation and Land Use Law), and Law No. 3083 (Agrarian Reform Law about Land Arrangement on Irrigation Areas).

6. WHAT IS LAND CONSOLIDATION?

6.1 Scope of land consolidation

Land consolidation can be used improving environmental sustainability and agriculture.

The scope of land consolidation projects was consolidate agricultural parcels and enlarge holdings and included provisions such as irrigation and drainage infrastructure to improve water management, construction of rural roads, land levelling, soil improvement measures and changes to land use such as converting agriculturally inferior land into forest land or wetlands.

The emphasis of land consolidation projects has shifted from a focus on restructuring agriculture to one of achieving more efficient multiple use of rural space by balancing the interests of agriculture, landscape, nature conservation, recreation and transportation, especially when land is required for the construction of major roads.

Environmental conditions are being given increasing priority. Roads are being constructed to suit the landscape. Water bodies are being restored, often with buffer zones. Land consolidation projects are also used for the protection of wetlands and to change land use patterns especially in areas endangered by frequent floods or soil erosion.
Land consolidation projects have also served to renovate and modernize exist land registry and cadastre information.

6.2 Steps of land consolidation

Implementation procedures of land consolidation projects involve;

1. Request for initiation of project  
2. Getting a resolution of Cabinet to be published in the Official Gazette  
3. Providing cadastral maps and ownership information of project area  
4. Soil investigation  
5. Design, preparation of approximate cost and table of quantities  
6. RFP, selection of consultant and contract signing  
7. Digitization of cadastral map sheets  
8. Surveying of project area  
9. Soil graduation
   - Formation of graduation committee  
   - Determination the value of parcels  
   - Determination of equivalence of classes to each other  
   - Promulgation of graduation and approval  
10. Establishment of Property Data Base  
11. Transportation System Planning  
12. Creation of Blocks  
13. Calculation of development readjustment share preparation of drafts consolidation plans with an alternatives showing the new parcel layout, location of new roads and other public facilities, and identifying those roads and facilities which will be removed.  
14. Interviews with participants  
15. Handling of first objections related to boundaries, ownership, valuation  
16. Monumentation, measurement and computation of ground control points  
17. Construction of public works (agricultural improvements, leveling, drainage, new roads with bridges and culverts etc.)  
18. Review of the options for new consolidation plan by participants  
19. Handling of objections  
20. Final detailed consolidation plan to accommodate comments of participants  
21. Control and approval  
22. Implementation of the detailed consolidation plan  
23. Survey of new boundaries on the ground  
24. Final updating of the cadastral maps  
25. Issuing and registration of new title deeds

7. LATEST IMPROVEMENTS IN LAND CONSOLIDATION

Until today, Land Consolidation projects in Turkey have been carried out using CAD-based software. This software consist of various modules and each of the modules produce a solution in itself so the lack of software which will manage projects from start to finish, has been felt.
In recent years, a new tool has been developed in order to resolve this lack by analyzing each process, from project management to project delivery and project planning. In this way improving of projects quality is also ensured as well as accelerating of project process.

7.1 Hydrological assessments

Until today no hydrological assessments have been made by project developers and this causes floods to be a major problem on previously consolidated lands. By the help of new technologies watersheds and streams affecting the project site can be derived from digital elevation models (DEM). By doing so it is possible to determine the capacities of drainage channels and water passages and act on them on the site. This is essential for a complete land consolidation project. This also affects how the blocks planned. Block plans used to be done discarding the realities of the real world. With the help of new hydrological tools plans become more effective. Today, firms realize the importance of the hydrological planning and during the planning process each block is calculated in terms of hydrological capacities.

Figure - 1: Sample Hydrological Analysis, Watershed and Streams.

Figure- 2: Hydrology and Block Planning
7.2 Road Planning

Other problem in block planning was planning the road structures on the project site. For newly constructed roads, planning blocks accurately makes all the difference. One should go from settlement center to the by with a shortest possible road. But while providing this there shouldn’t be any unnecessary roads (by grid shaped road or block plans).

Figure - 4: Roads in Block Planning

7.3 Geometric and Topological Errors

Faulty geometries which can be defined as erroneous objects in a map usually caused by not using GIS based applications. There are numerous faulty geometries on delivered projects causing errors in maps such as cadastral map, grading map, block plan maps etc. Besides topological errors causes the same problems. These errors make it impossible to derive correct projects. Especially errors in gradation maps cause uneven distributions among land owners. The only solution is using a GIS based application which doesn’t permit these kinds of errors and have the ability to inspect these errors and reports to the administration.
7.4 Soil Grading

GIS applications provide the ability to derive grading layers from soil groups, settlements, roads and points given by the grading commissions. This process is done by using advanced proximity and overlay analysis.

7.5 Complicated Work Processes

Too many approaches about how to perform a consolidation projects creates conflict between administration and firms. To avoid this, a thorough overview of the process has been made and every step has been determined. For each step report templates published in order for the firms to prepare their reports according to these templates. Defined work processes make it easier for both parties; firms and administration in terms of sharing know-how, ease in supervision of the projects and better project management.

7.6 Parcel/Block Design Errors
Design of the new parcels is maybe the most important phase of land consolidation. One of the main aims of land consolidation is to provide transportation and irrigation opportunities to each new parcel. If one new parcel has not linked to a road or a water channel this means a very big mistake for any project. To avoid this appropriate control tools should be used by administration and every project must be checked regarding these issues.

Figure- 7: Parcel Control Tools

### 7.7 Unawares error corrections

With lack of knowledge or as an intentional act firms can change some verbal entities in the projects in order to correct the previous mistakes made by the users during data entry or collection processes. Projects made on excel tables allow this kind of errors and to find a single faulty correction among others is nearly impossible to detect for the controller. Capable software should have a very district environment allowing no mistakes during data entry or collection and also not allowing deliberately faulty corrections. Automated processes suppress the need for these kinds of approaches and tend to prevent them by providing fast and easy solutions for the user.

### 7.8 Statistics

Without using software technologies it was very difficult to obtain good statistics for the projects. By the help of GIS environments now it is possible to manage and control the projects and collect statistical data such as road areas, irrigation areas, block width/length ratios, block slopes, parcel road averages, share ratio status etc.
8. CONCLUSION

Land consolidation was introduced in Turkey in 1961. During the period 1960 – 2002, in total 450,000 ha was consolidation through the national land consolidation programme. Work has been scaled up significantly from 2009. In total during 2009 - 2014, 225 projects have been launched including 4.44 million ha and of these 95 completed including 4 million ha. 3205 villages have been included in projects. The annual budget for land consolidation works has increased from 90 million USD in 2009 to 192 million USD in 2013.

For expropriation projects, land consolidation is quite important. Expropriation problem of Istanbul – Izmir Highway project which is one of Turkey's major projects was resolved by Land consolidation after minimizing. Thus the state was saving millions of dollars

Through land consolidation project, total 1067348 km stabilized road in field and 144623 km drainage and irrigation canal were built.

2009-2014 years results are given in Table-3 as a summary.

<table>
<thead>
<tr>
<th>Number of Project</th>
<th>225</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of village</td>
<td>3205</td>
</tr>
<tr>
<td>Number of parcel</td>
<td>2,257,245</td>
</tr>
<tr>
<td>Number of registered title deeds</td>
<td>578,296</td>
</tr>
<tr>
<td>Total Project area</td>
<td>4,440,705 Ha</td>
</tr>
<tr>
<td>Constructed new roads (km)</td>
<td>1,067,348</td>
</tr>
<tr>
<td>Constructed irrigation and drainage canals (km)</td>
<td>144,623</td>
</tr>
</tbody>
</table>

Table-3: Land consolidation projects and its results during the period 2009-2014.
BIOGRAPHICAL NOTES

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He was born in Adana at 1960. He had Agriculture Engineering BSc degree at 1985 and MSc Degree in Land Consolidation at 1988. He is acting as a Director General at the Ministry of Food, Agriculture and Livestock, through the General Directorate of Agrarian Reform (GDAR) since 2011.

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