UDC 631.4

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# THE EFFECTS OF LAND CONSOLIDATION PROJECTS ON AGRICULTURAL INFRASTRUCTURE: THE CASE OF KARAMAN-SALUR PROJECT

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*Abstract*. Agricultural lands are decreasing and fragmentizing day by day owing to reasons such as migrations caused by increasing population, industrialization, faulty urbanization policies, laws concerning inheritance and commercial laws. It is a vital issue to improve agricultural infrastructure by consolidating lands especially in countries like Turkey where agricultural lands are dispersed and multi-part. In order for agricultural output to be increased, existing agricultural lands need to be reorganized so as to produce crops economically. Implementation of land consolidation projects has become a necessity to improve agricultural lands. In this study, the land consolidation project implemented in the village of Salur in the province of Karaman between the years 2009 and 2010 was investigated. The new situation that arose after the implementation of the project and the situation before the project were compared and contrasted in terms of the number of parcels, average parcel size and the parcels' accessibility to transportation routes. According to this, the results of the reorganization of the agricultural plots after the land consolidation projects were presented through numerical data.

*Key words:* Agricultural land, agricultural infrastructure, cadastre, land consolidation, land fragmentation.

## INTRODUCTION

Land is one of the most fundamental needs of people for both accommodation and nutrition. Conservation of agricultural lands where farming activities are being conducted, and obtainment of highest yield from unit area are extremely important issues because adequate food needs to be produced to meet the world's increasing population and this production needs to be conducted safely and with a view to conserving nature. To this end, besides interdisciplinary studies, agricultural activities should be planned and implemented within the framework of environmental, social and economic data [1, 2]. Maximum yield should be obtained from the existing lands in order to provide the food that the world's population needs. Providing a high-yield agricultural output, on the other hand, is possible through improvement of agricultural lands. Land consolidation projects are perfect tools for various applications aimed at rural development [3]. Agricultural lands are being increasingly depleted due to several reasons such as increasing world population, migrations and urbanization. In recent years, agricultural land per capita has fallen by 14,3 % in developed countries and 40 % in developing countries. According to FAO, the agricultural land per capita is 0,23 ha, and this amount is estimated to fall as low as 0,15 ha in 2050 [4].

Basic information about agricultural lands in Turkey and the changes in them by years are presented in Table 1. When these data are examined, it is seen that the total agricultural land in Turkey (including meadows and pastures) was 40,967 million hectares in 2001 whereas this figure fell to 38,560 hectares in 2014. The meadows and pastures were preserved at 14,617 million hectares in the same period. The lands used for cereals

and other agricultural crops, on the other hand, fell from 17,917 million hectares to 15,789 million hectares in the same period. It is seen from the figures that the total cultivated agricultural land in Turkey decreased by 2,407 million hectares in the 2001-2014 period. 88 % of this decreased area included areas where cereals and other crops were grown.

Table 1 – Agricultural lands of Turkey and changes in their use by years [5]

| Agricultural land – (Thousand Hectares) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total utilized agricultural land | Area of cereals and other crop products | | Area of vegetable gardens | Area of ornamental plants | Area of fruits, beverage and spice crops | Lands under permanent meadows and pastures |
| | | Sown area | Fallow land | | | | |
| 2001 | 40 967 | 17 917 | 4 914 | 909 | - | 2 610 | 14 617 |
| 2002 | 41 196 | 17 935 | 5 040 | 930 | - | 2 674 | 14 617 |
| 2003 | 40 644 | 17 408 | 4 991 | 911 | - | 2 717 | 14 617 |
| 2004 | 41 210 | 17 962 | 4 956 | 895 | - | 2 780 | 14 617 |
| 2005 | 41 223 | 18 005 | 4 876 | 894 | - | 2 831 | 14 617 |
| 2006 | 40 493 | 17 440 | 4 691 | 850 | - | 2 895 | 14 617 |
| 2007 | 39 505 | 16 945 | 4 219 | 815 | - | 2 909 | 14 617 |
| 2008 | 39 122 | 16 460 | 4 259 | 836 | - | 2 950 | 14 617 |
| 2009 | 38 911 | 16 217 | 4 323 | 811 | - | 2 943 | 14 617 |
| 2010 | 39 012 | 16 333 | 4 249 | 802 | - | 3 011 | 14 617 |
| 2011 | 38 231 | 15 692 | 4 017 | 810 | 4 | 3 091 | 14 617 |
| 2012 | 38 399 | 15 463 | 4 286 | 827 | 5 | 3 201 | 14 617 |
| 2013 | 38 423 | 15 613 | 4 148 | 808 | 5 | 3 232 | 14 617 |
| 2014 | 38 560 | 15 789 | 4 108 | 804 | 5 | 3 238 | 14 617 |
| Source: For land under permanent meadows and pastures 2001 General Agricultural Censuses, for other Ministry of Food, Agriculture and Livestock | | | | | | | |

*Land consolidation:*

Among the most important factors that affect the effective and sustainable use of agricultural lands are the sizes of enterprises owning those lands and land fragmentation. Fragmentation of agricultural lands can be defined as the division of the lands of an enterprise into large numbers of parcels and the location of each of those parcels being at different places [6]. On the basis of the 2001 General Agricultural Census, the average number of parcels and average parcel size according to enterprise size are given in table 2. According to this, the average number of parcels per enterprise in Turkey is 4,1 and average parcel size is 1,5 hectares. These figures reveal the fragmented state of the existing agricultural lands and the smallness of their, average size per enterprise. As agricultural lands get fragmented, it becomes more difficult to produce crops economically and efficiently. Indeed, lands fragmented into very small pieces and those that are far from settlements are not cultivated.

Table 2 – Average number of parcels and average parcel size by enterprise size according to the 2001 GCA results [7]

| Enterprise size (Hectares) | 2001 General Census of Agriculture (GCA) | |
|---|---|---|
| | average number of parcels (numbers) | average parcel size (Hectares) |
| < 5 | 3,3 | 0,6 |
| 5,0-9,9 | 5,1 | 1,3 |
| 10,0-19,9 | 5,7 | 2,3 |
| 20,0-49,9 | 6,5 | 4,2 |
| ≥ 50 | 7,8 | 12,3 |
| Total (average) | 4,1 | 1,50 |

With land consolidation, lands that have been so fragmented as not to allow economic production and those that are widely distributed are brought together and put into an orderly shape. On the other hand, land consolidation is defined as not only unification of fragmented lands but also as land reorganization in broad terms. In reference [8], land consolidation is defined as the reorganization of the rural space in accordance with the requirements of the developing farming technology and in line with the needs of the individual, and taking all the necessary measures to ensure more efficient use of agricultural enterprises. In short, land consolidation efforts aim to take all kinds of technical, social, cultural, and economic precautions to raise the living standards of farmers.

## OBJECTS AND METHODS

Karaman (Turkey) is a city located in the southern edge of Central Anatolia. The project site, i.e. the village of Salur, is in the province of Karaman and 17 km from the city center. Information concerning the location of the project site is shown in figure 1.


Figure 1 – The location of Salur village in the province of Karaman and the project site [9-11]


Figure 2 – Overall view of the project site and the agricultural parcels before the project [9]

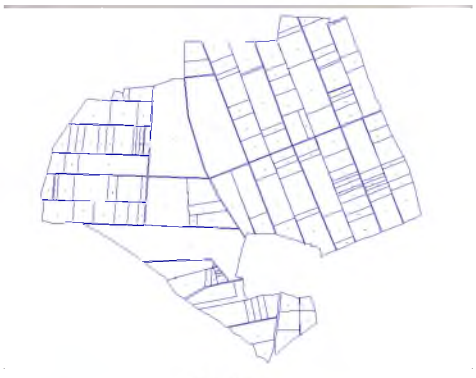
## RESULTS AND DISCUSSION

At the end of the land consolidation, the number of parcels dropped from 535 to 130. According to this, the rate of consolidation was 76 %. While average parcel size was 15,56 da before the consolidation, it rose to 62,33 na after the consolidation. According to this, average parcel size quadrupled. The length of the transportation system was 2000 m before but rose to 24000. While 20 % of the parcels did not border the road before the consolidation, all the parcels bordered the road after the consolidation and each parcel benefited from the transportation system. The total parcel area dropped from 8325735 $m^2$ to 8101930 $m^2$. The difference of 223805 $m^2$ was an area covered by roads, irrigation and drainage. This area was offered to public use by making equal deductions from the farmers in the project site depending on their respective land area. The amount of road per unit site rose from 0,24 m/ha to 2,96.

Table 3 – Information about before and after the land consolidation project

| | Units | Before | After |
|---|---|---|---|
| Number of Parcels | piece | 535 | 130 |
| Average parcel surface area | $m^2$ | 15562 | 62333 |
| Length of the transportation system | m | 2000 | 24000 |
| Road per unit area | m/ha | 0,24022 | 2,96226 |
| Number of parcels bordering the road | % | 20 | 100 |

a) Before



b) After

c) Together with before and after

Before the consolidation, respecting the distances required to reach each parcel, farmers had to travel 875 km to get to their fields. This figure was about 226 km depending on the situation and the difference between the two was 649 km. Considering that a farmer goes to their field 20 times a year, the distance covered to reach the field was 17500 km before the project but this figure dropped to 4500 km after the project. According to this, one will travel 12980 km less to reach their field each year.

## CONCLUSIONS

Land consolidation projects where agricultural lands are reorganized are meeting ever increasing interest especially in countries where agricultural infrastructure is not adequate. First generation land consolidation work has been completed in many developed countries and now second and even third generation land consolidation efforts are underway there. In those countries, land consolidation work is being conducted in terms of content and scope, too. In countries like Turkey where especially average parcel size has become extremely small, land consolidation projects have become inevitable. In addition, bringing together fragmented lands may improve the current situation. Besides land consolidation projects, measures that will prevent fragmentation and bring permanent solutions need to be taken. Division and fragmentation of agricultural lands through both inheritance laws and other regulations and practices must be prevented.

As can be seen in the case of Karaman-Salur land consolidation project, the number of parcels drop and average parcel size increase as a result of consolidation. When parcels are reorganized, there are no parcels left that do not border the

road and do not benefit from the irrigation and drainage systems. Therefore, in order to attain the desired goals better and use the irrigation water more efficiently in irrigated farming lands, land consolidation efforts need to be intensified in areas opened to irrigated farming and irrigation and consolidation projects need to be implemented together in areas planned to be opened to irrigated farming [12]. On the other hand, it would be unfair to evaluate the implementation of land consolidation projects in terms of technical measures only. With land consolidation, the peace and prosperity of the people living in rural areas increase, which in turn contributes to social peace and quiet.

ACKNOWLEDGMENTS

We would like to thank Agricultural Reform Konya District Directorate for their assistance in the collection of the data used in this study and for their technical support. In addition, the presentation is supported by Selcuk University Scientific Research Projects Coordination Unit, Project No 15701615.

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## ТҮЙІН

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### АУЫЛ ШАРУАШЫЛЫҒЫ ИНФРАҚҰРЫЛЫМДАРЫНА ЖЕРЛЕРДІ ШОҒЫРЛАНДЫРУ БОЙЫНША ЖОБАЛАРДЫҢ ӘСЕРІ: КАРАМАН-САЛЮР ЖОБАСЫ МЫСАЛЫНДА

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Қазіргі уақытта халық санының өсуімен туындаған миграция, индустрияландыру, урбандалу саясатының дұрыс жүргізілмеуі, заңдар, мұралық және коммерциялық заңдарға қатысты факторлардың нәтижелерінен ауыл шаруашылығы алқаптары қысқарып фрагменттелуде. Ауыл шаруашылығы алқаптары шашыраған және бөлшектенген, әсіресе Түркия сияқты елдерде, ауыл шаруашылығы инфрақұрылымдарын жерлерді шоғырландыру жолымен жақсарту өмірлік маңызды сұрақ болып табылады. Ауыл шаруашылығы өндірісін арттыру үшін экономикалық тұрғыдан бұрыннан бар ауыл шаруашылығы аумақтарын қайта ұйымдастыруды жүргізу қажет. Жерлерді шоғырландыру бойынша жобаларды іске асыру ауыл шаруашылығы жерлерін жақсарту қажеттілігінен туындады. Бұл зерттеулерде, 2009-2010 жылдары Караман ауданындағы Салюр ауылында жүргізілген жерлерді шоғырландыру бойынша жобасы тексерілді. Біз аумақ саны, аумақтардың орташа мөлшері мен олардың көлік бағыттарына жақындығы тұрғысынан, жоба іске асырқаннан кейінгі және жоба басталғанға дейінгі туындаған жағдайлармен жаңа жағдайларды салыстырдық. Осыған сәйкес, жерлерді шоғырландыру жобасынан кейін ауыл шаруашылығы аумақтарын қайта ұйымдастыру нәтижелері сандық мәліметтер көмегімен көрсетілді.

*Түйінді сөздер:* ауыл шаруашылығы жерлері, ауыл шаруашылығы инфрақұрылымы, кадастр, жерлерді шоғырландыру, жерлерді фрагменттеу.

## РЕЗЮМЕ

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### ВЛИЯНИЕ ПРОЕКТОВ ПО КОНСОЛИДАЦИИ ЗЕМЕЛЬ НА СЕЛЬСКОХОЗЯЙСТВЕННУЮ ИНФРАСТРУКТУРУ: НА ПРИМЕРЕ ПРОЕКТА КАРАМАН-САЛЮР

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Сельскохозяйственные угодья сокращаются и фрагментируются в настоящее время, в следствии таких факторов как миграция, вызванных ростом численности населения, индустриализации, неправильной политики урбанизации, законов, касающихся наследования и коммерческих законов. Жизненно важным вопросом является улучшенне сельскохозяйственной инфраструктуры путем консолидации земель, особенно в таких странах, как Турция, где сельскохозяйственные угодья разбросаны и раздроблены. Для увеличения сельскохозяйственного производства необходимо провести реорганизацию существующих сельскохозяйственных участков с экономической точки зрения. Реализация проектов по консолидации земель стала необходимостью улучшения сельскохо-

зяйственных земель. В этом исследовании, был обследован проект по консолидации земель, осуществляемый в селе Салюр в провинции Караман в 2009 и 2010 годах. Мы провели сравнение новой ситуации, возникшей после реализации проекта и ситуации до начала проекта с точки зрения количества участков, среднего размера участков и их близости к транспортным маршрутам. В соответствии с этим, результаты реорганизации сельскохозяйственных участков после проектов по консолидации земельных участков были представлены при помощи числовых данных.

*Ключевые слова:* Сельскохозяйственная земля, сельскохозяйственная инфраструктура, кадастр, консолидация земель, фрагментация земель.