

# **Economic Analysis Of Land Consolidation Projects: A Case Study In Üçhüyük Neighborhood, Çumra-Konya-Turkey**

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**Key words:** Land Consolidation, Economic Analysis, Benefits Of Land Consolidation, Improve Agriculture

## **SUMMARY**

The land is basic place of human activities. Therefore the humankind begins have always been in relationship with land until today. This relationship most important part is agriculture. In the first years of human history the agriculture was seen a food source. But today agriculture the most important sector of growing population. The agricultural sector has an important place in the country's economies. But divisions in agricultural land, changing climatic conditions due to misuse of agricultural land and decreasing, inefficient agriculture land increases transportation and transport losses in enterprises, and therefore costs. This situation affect firstly agriculture sector later country's economy.

Obtained economic gains after land consolidation projects are quite important both agriculture economy and nation economy. In terms of increasing land consolidation projects and ensuring widespread use throughout the country is quite important that are assimilated the economic benefits of land consolidation projects.

For this purpose, land consolidation was examined that work done in Konya province Çumra district in Üçhüyük neighborhood, and was done economic analysis. Benefits of land consolidation with analysis made, is highlighted once again.

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## 1. INTRODUCTION

Although world population is increase to 1 billion in leads hundreds of years, world population has increased 7 times to 7 billion in last 200 years (UNFPA 2017). In our country population of approximately 27 million in the 1960s, today 79 million have passed (WorldBank 2017). The world's and Turkey's population will continue to grow over the next decades. The land which is one of the basic inputs of the agricultural sector, no doubt indispensable natural resource that in terms of human beings can continue their lives and ensuring development and prosperity of the countries (Sönmez 2012).

This status increases the economic value of agriculture. Consequently land consolidation studies are arised out economic analysis. Therefore especially in our country and in the world firstly increase economic efficiency by making economic analysis of land consolidation project and when doing so is important to do without compromising the sustainability of natural life. Natural resources such as soil, water, forests and air are existed under threat for reasons like faulty and unplanned land use, high population growth, versatile requests for these scarce resources, corporate support and inadequacy of directions (Salvati ve ark 2016). Therefore the position of some soil species important for land consolidation, agricultural areas or clean water regimes in natural habitats must are protected and are strengthen (Moravcová ve ark 2017).

After analysis is done remarkable first subject is economy that can be expressed by numbers in after consolidation (Van Huylenbroeck ve ark 1996). While the return of agricultural studies to the national economy was 9%, when the costs are taken into consideration, this figure stands at 8% (Van den Noort 1987). Depending on the increase in the number of parts in consolidation area cost is increasing (Sklenicka ve ark 2009). Main goal of land consolidation improve the ownership structure and reduce the production costs of the farms. In practice, profitability measured by comparing the total project cost with the total benefit generated by the Project (Hiironen ve Riekkinen 2016). A major contribution to the investment of the land consolidation project on the regional economy easily detectable the regional GDP increased by 16.05% during the implementation phase and by 10.16% during the benefit phase (Jin ve ark 2016). Further According to (TÜİK 2014) data between growth rate and growth rate of agriculture seems to be the right proportion excluding 2007 and 2009 in Turkey.

Therefore increased economic productivity of projects by making economic analysis of land consolidation projects while doing this, the sustainability of natural life must be done without deterioration especially in our country and in the world.

## 2. MATERIAL AND METHOD

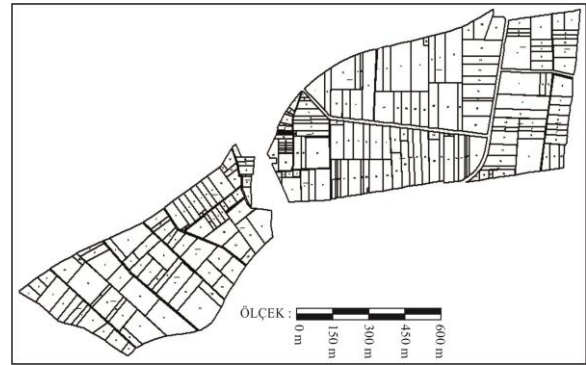
As the project area, Üçhüyük neighborhood in Konya province where land consolidation studies have already been made is selected. During the analyzing, the project area was visited and studies about the project area were made and the opinions of the farmers were applied. In this way some of the information found in theory was seen practical responses and results.

### 2.1. Application Area Explanations

Üçhüyük neighborhood, is away from Çumra district 22 km and Konya province 66 kilometers. In addition, the height of the village is 1002 meters.



**Figure 1.** Before Land Consolidation



**Figure 2.** After Land Consolidation

Üçhüyük neighborhood's pre-consolidation ownership structure is shown Figure 1. Üçhüyük neighborhood's after consolidation ownership structure is shown Figure 2. There were 265 plots of 274 farmers before consolidation. Total areas entering into consolidation were 875.69 hectares. In the new situation after consolidation 243 new parcels belonging to 274 enterprises were formed. In the new situation after consolidation, the total area is 836.16 hectares.

And despite there is a large product range grown in the region, available fields are separated 40% for cereals, 20% for sugar beets, 25% for corn and the remaining 15% for other crops.

## 3. RESULT AND DISCUSSION

For analysis firstly was examined project area. Table 1 shows the state of ownership before and after consolidation. Project area with a total of 875.69 hectares before the consolidation fell 836.16 hectares after consolidation. The main reason for this fall can be shown as the areas reserved for irrigation canals and roads constructed. Approximately 76 hectares, the difference between them was earned by public in land consolidation.

**Table 1.** Information before and after consolidation of Üçhüyük neighborhood

	Before Land Consolidation	After Land Consolidation
Project Area(m2)	8756903	8361616.09
Number Of Parcels	265	243
Average Parcel Area(m2)	33044.92	34409.94
Number Of Ownership	274	274
Average Ownership Area(m2)	31959.50	30516.84
The average number of parcels per ownership	0.97	0.89

One of the successes of consolidation is the increase in the size of the post-consolidation parcels. Looking at Table 2, the parcel sizes before consolidation and after consolidation are visible. Before the consolidation 265 existing parcels while after the consolidation fell down 243 parcels. When you look at the parcels over 100 decares, before consolidation existing 11 parcels while after land consolidation became 12 parcels.

Generally increase of parcel numbers in large parcel groups by decreasing parcel numbers in small parcel groups is a display is indicator that the parcels size is growing.

**Table 2.** Parcel sizes before and after consolidation

Before Land Consolidation			After Land Consolidation		
Size Of Parcels (Decares)	Number Of Parcels		Size Of Parcels (Decares)	Number Of Parcels	
	(Piece)	(%)		(Piece)	(%)
0-5	32	12.08%	0-5	25	10.29%
5-10	37	13.96%	5-10	20	8.23%
10-20	42	15.85%	10-20	48	19.75%
20-30	38	14.34%	20-30	43	17.70%
30-40	44	16.60%	30-40	28	11.52%
40-50	20	7.55%	40-50	22	9.05%
50-60	16	6.04%	50-60	23	9.47%
60-80	16	6.04%	60-80	14	5.76%
80-100	9	3.40%	80-100	8	3.29%
100<	11	4.15%	100<	12	4.94%
Total	265	100.00%	Total	243	100.00%

### 3.1. Calculation Of Area Loss At Parcel Borders

Generally increase of parcel numbers in large parcel groups by decreasing parcel numbers in small parcel groups is a display indicator that the parcels size is growing. While agriculture, related to the use of the areas situated the borders of the parcel occurred that unavailable area. This is because in order for the borders of the field to be visible, borders are created between parcels. These borders due to various reasons like agriculture machines cannot reaching the sides of parcels caused to inability to can't use a depth of about 30 cm. This situation is one of the factors affecting the economic gain of the consolidation work.

For the calculation of area losses due to parcel borders were measured the perimeter of all the parcels before and after consolidation. While the total perimeter of the pre-consolidation parcels was 218574 m, total perimeter after consolidation decreased to 199137 m. If we get the difference between the two numbers, we will reach 19437,5. This number expresses difference between before consolidation perimeter of parcels and after consolidation. After, found result multiplied by the border of the field was calculated fields near the border. As a result of multiply to 19437,5 m and 0,4 m obtained 7775 m<sup>2</sup> area. Based on this result, it can be said that about 8 acres of area acquired after the consolidation.

Total winnings of 7775 m<sup>2</sup> that find out from the field use data of the consolidation area, was found to dispersion of area according to agricultural products in Table 3. After rate-ratio method according to the data obtained from farmers, calculated the amount of product obtained from the available areas. The information given by the farmers is approximately;

For cereals; 700 kg product in 1000 m<sup>2</sup>,  
 For corn; 1350 kg product in 1000 m<sup>2</sup>,  
 For sugar beet; 9000 kg product in 1000 m<sup>2</sup>,  
 For other product; 450 kg product in 1000 m<sup>2</sup>,  
 According to the values, the calculation is made according to the existing areas.

**Table 3.** Generated gain of winings from areas in parcel borders

Total Winnings= 7775 m2	Cereals	Corn	Sugar Beet	Other Product
Winnings Area(m2)	3110	1943.75	1555	1166.25
The amount of product obtained(Kg)	2177	2624	13995	525
Earnings gained (TL)	1959.3	2099.2	3148.87	866.25

The same amount of information provided by the farmers was used to calculate the amount of earnings obtained. This information is approximately as follows;

For cereals; 1 kg of product is 0, 9 TL,  
 For corn; 1 kg of product is 0, 8 TL,  
 For sugar beet; 1 kg of product is 0, 225 TL,  
 For other product; 1 kg of product is 1, 65 TL,  
 Calculated by taking.  
 Total earning value is calculated as 8073.62 TL.

### 3.2 Economical Evaluation of Path Distance Gained After Consolidation

Farmers, in order to harvest crops from the fields, many times go to their fields and come. Farmers spend diesel during their journey to and from the fields. One of the biggest expenditures of farmers in agriculture is the diesel expenses. This directly affects the economic success of the consolidation studies.

While the total distance before the consolidation was 919 km, fell to 705 km after consolidation. When Difference between these two values are taken, 214 km is obtained. This value is the change in the distance of the fields of all the farmers in the neighborhood to the village center.

Field owners cultivation operations is determined as planting, seed bed preparation, planting, fertilization and spraying, irrigation and harvesting. When looking at Table 4, the total savings that the farmers arising from their going to and from was seen in km type.

**Table 4.** The total savings distance that the farmers arising from their going to and turning

Total Saving Distance(km)	214
Going And Returning From Field(km)	428
Plowing fields(km)	428
Seed Bed Preparation(km)	428
Planting(km)	428
Fertilization And Spraying(km)	428
Irrigation(km)	428
Harvest(km)	428
Total(km)	2996

In table 4 firstly the fuel burned over the total distance of going and returning from field is calculated. Then As if the fuel that the tractor burned at 1 km was accepted as 0.8 lt, was calculated. In this calculation, The New Holland TD75D model tractor is based on the amount of fuel it burns on the straight road. When the total cost of diesel is calculated, the price of diesel accepted as 5.20. Calculated 12463TL, represents the minimum fuel savings that the Üçhüyük neighborhood farmers make annually only after their consolidation.

**Table 5.** Total saving of going and returning from field

Total Going And Returning From Field(Km)	2996
Total Diesel Consumption(lt)	2396.8
Total diesel cost(Tl)	12463.36

### 3.3. Saving From Irrigation In Project Area

The construction of irrigation channels reduces both irrigation costs and increases the efficiency of agricultural land for farmers. In Table 6, thanks to the new irrigation channels

made after the consolidation, the savings that the farmers have achieved from the irrigation have been shown. The amount of savings in the decares was determined by the opinions of the farmers. In table, the total water savings in the project area were calculated by way of the water savings on the decares. The total savings amount is about 17000TL, which is a serious amount.

**Table 6.** Saving from irrigation in project area

Total Area(8361,616decares)	Cereals	Corn	Sugar Beet	Other Product
Cultivate Rate(%)	40	25	20	15
Cultivate Area(decares)	3502.76	2189.23	1751.38	1313.54
Saving Irrigation In Decares (TL)	1.4	2.4	2.4	2
Total Savings(TL)	4903.86	5254.15	4203.31	2627.08
Total Project Savings(TL)	16988.4			

### 3.4. The Effects Of Consolidation Studies On Yield

After the consolidation studies in Üçhüyük neighborhood around 20 % yield increase in the agriculture areas. While before the consolidation studies the total area of the fields in the area was 8756 decares, after consolidation studies became 8361 decares. In this case people are may think that can lead to a reduction in the area of fields and a decrease in production, but lost fields have occurred facilities such as irrigation channels and roads to be efficient in project area.

In Table 7, before the consolidation and after the consolidation, the product yield account and accordingly the economic values of the products have been calculated. Despite the area before consolidation are decreased after consolidation, profit of 1,326,011 TL was obtained in general the project.

This situation shows that the increase in yields on the field after consolidation is very important. Just looking at the current analysis shows that even modern agriculture methods are very important for the country's economies and farmers.



**Table 7.** Earnings before and after consolidation

Before Consolidation				
Total Area(8756,903decares)	Cereals	Corn	Sugar Beet	Other Product
Cultivate Rate(%)	40	25	20	15
Cultivate Area(decares)	3502.76	2189.23	1751.38	1313.54
Yields In Decares (kg)	700	1350	9000	450
Total Yields(kg)	2451932	2955460.5	15762420	591093
Kilogram Unit Price(TL)	0.9	0.8	0.225	1.65
Total Profit(TL)	2206738.8	2364368.4	3546544.5	975303.45
Project Profit(TL)	9092955.15			
After Consolidation				
Total Area(8361,616dönüm)	Cereals	Corn	Sugar Beet	Other Product
Cultivate Rate(%)	40	25	20	15
Cultivate Area(decares)	3344.64	2090.4	1672.32	1254.24
Yields In Decares (kg)	840	1620	10800	540
Total Yields(kg)	2809497.6	3386448	18061056	677286.6
Kilogram Unit Price(TL)	0.9	0.8	0.225	1.65
Total Profit(TL)	2528547.84	2709158.4	4063737.6	1117522.89
Project Profit(TL)	10418966.73			
Difference Of Before Consolidation And After Consolidation(TL)		1326011.58		

In Table 8, the profit increase due to yields before and after consolidation is shown by the project value, then the average profit over the 29,862 decares, the average business size of the project area, was calculated. According to this result, about 30 decares of an enterprise increases the product gain by 4500 TL according to the before consolidation. This increase is important for farmers. This value can be further increased by increasing the consolidation ratio.

**Table 8.** Average farmer profit after consolidation

	Area(Decares)	Profit(TL)
Project	8756.903	1326011.58
An Average Farmer	29.862	4521.84

### 3.5. The Effects of Consolidation Studies on the Value Increases of The Agricultural Areas

The consolidation projects bring modern farming opportunities to the region, increasing farmers' incomes while reducing their costs. This ensures that the places where consolidation is made are requested more. Due to the supply-demand ratio, the economic value of the parcels has increased in the regions where the consolidation is made. Consolidation has caused significant value increase in Üçhüyük Neighborhood too. While one decares of fields in the pre-consolidation area is around 5000 TL, After consolidation, 1 decares of fields increased to around 10000 TL.

In Table 9, project values of project area were calculated after the consolidation. For this, the values of the fields in the project area before consolidation and the values of the fields after consolidation was calculated. The difference between the value of the fields after the consolidation and the values of the fields before the consolidation was obtained 39,831,645. According to this result, only the value increase in the project area can be accepted about 40 million TL after consolidation.

**Table 9.** Parcel values before and after consolidation

	Before Consolidation	After Consolidation
Project Area(Decares)	8756.903	8361.616
1 Decares Parcel Value(TL)	5000	10000
Project Area Value(TL)	43784515	83616160

### 3.6. Determination of Public Income With Consolidation

With the project, the village roads necessary for reaching the villages' fields easily have been appropriated by land consolidation project without expropriation. This area is 394060,64 m<sup>2</sup>. We will reach 394060x10 = 3940600 if we will by supposing the unit value of each m<sup>2</sup> area in

the project area as 10 TL. The state's gain from expropriation can be considered as roughly 4,000,000 TL.

#### 4. CONCLUSION

There are 2 types of gains that the consolidation work has earned to the region. The first one is the profits that farmers get when they cultivate fields. With this gain, farmers benefit from this gain as long as they are cultivate fields. The second one is the one-time gain after the completion of the consolidation studies. This gain is a one-time example, and this gain is exemplified by the increase in value, the passage of pipelines without expropriation and the provision of other public investments.

**Table 10.** Sum of annual and fixed earnings increases after consolidation

After Consolidation Yearly (Recurring) Earnings Increase	
Gain from Border Losses(Tl)	807.62
Savings From Road Distance(Tl)	12463.36
Saving from Irrigation(Tl)	16988.4
Gain From Increase In Yield(Tl)	1326011.58
<b>Total</b>	<b>1356270.96</b>
After Consolidation Fixed(One-Timed) Earnings Increase	
Gain From Increase In Value Of Fields(Tl)	39381645
Public Gain(Tl)	3940600
<b>Total</b>	<b>43322245</b>

In Table 10, two types of value increases are also seen. The value increase in the first group is about 1,356,270 TL and farmers will benefit from this increase in each product take. The sum of the one-time gain increase in the second group is 43,322,245 TL. As a result of these conclusions, as soon as the consolidation work has been completed, the region has made great gains and as long as the owners continue to cultivate their fields, this gain will increase.

It is obvious that the consolidation studies are very useful for the country economy. The results of the analysis were shown that after the consolidation both the economic development and agricultural products increased. The fact that this situation is not considered in one dimension and that more agricultural products are exported will undoubtedly increase agricultural yields and indirectly increase the economic value of their consolidation efforts.

## ACKNOWLEDGEMENTS

This paper has been prepared by benefiting from the inventions of the project whose number is 114Y608 which supported by TÜBİTAK. We would like to thank TUBITAK for their support.

## REFERENCES

- Hiironen J, Riekkinen K, 2016. Agricultural impacts and profitability of land consolidations. *Land Use Policy*, 55, 309-17.
- Jin X, Xu X, Xiang X, Bai Q, Zhou Y, 2016. System-dynamic analysis on socio-economic impacts of land consolidation in China. *Habitat Int*, 56, 166-75.
- Moravcová J, Koupilová M, Pavlíček T, Zemek F, Kvítek T, Pečenka J, 2017. Analysis of land consolidation projects and their impact on land use change, landscape structure, and agricultural land resource protection: case studies of Pilsen-South and Pilsen-North (Czech Republic). *Landsc Ecol Eng*, 13, 1.
- Salvati L, Kosmas C, Kairis O, Karavitis C, Acikalin S, Belgacem A, Solé-Benet A, Chaker M, Fassouli V, Gokceoglu C, 2016. Assessing the effectiveness of sustainable land management policies for combating desertification: A data mining approach. *J Environ Manage*, 183, 754-62.
- Sklenicka P, Hladík J, Střeleček F, Kottová B, Lososová J, Číhal L, Šálek M, 2009. Historical, environmental and socio-economic driving forces on land ownership fragmentation, the land consolidation effect and the project costs. *Agricultural Economics*, 55, 12, 571-82.
- Sönmez B, (2012). Onuncu Kalkınma Planı (2014-2018) Tarım Arazilerinin Sürdürülebilir Kullanımı Çalışma Grubu Taslak Raporu, Ankara. 2014. Erişim. Erişim adresi.
- World population trends, 2017. UNFPA, Erişim. Erişim adresi.
- Van den Noort PC, 1987. Land consolidation in the Netherlands. *Land Use Policy*, 4, 1, 11-3.

Van Huylenbroeck G, Coelho JC, Pinto PA, 1996. Evaluation of land consolidation projects (LCPs): A multidisciplinary approach. *J Rural Stud*, 12, 3, 297-310.

Türkiye Genel Bakış, 2017. Erişim. Erişim adresi.

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