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ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

Evaluating the Impacts of the Land Consolidation Project Implemented in Tekirdağ Province on Agricultural Enterprises

Tekirdağ İlinde Uygulanan Arazi Toplulaştırma Projesinin Tarımsal İşletmeler Üzerindeki Etkilerinin Değerlendirilmesi

Derya İlkay YILMAZ[1*], Fuat YILMAZ[2]

Abstract

This study aims to evaluate the structural, economic, and social impacts of the land consolidation project implemented in Tekirdağ province on agricultural enterprises. The research utilizes data from surveys conducted with farmers in villages designated as consolidation areas, along with records from the General Directorate of State Hydraulic Works. To determine the impacts of land consolidation, descriptive statistics, the Januszewski Index (JI), the Simmons Index (SI), and other consolidation indicators were employed. Following land consolidation, the average parcel size of enterprises increased by 30.54%, reaching an average of 34.79 decares, while the number of parcels decreased by 42.37%, resulting in an average of 9.29 parcels. The increase in the JI value from 0.344 to 0.419 and the SI value from 0.197 to 0.254 suggests that land fragmentation has decreased. However, these values also indicate that it could be further reduced with improved planning. From an economic perspective, fuel consumption decreased by 11.96%, averaging 4.71 liters, and travel time loss reduced by 12.50%, averaging 0.77 hours, indicating that land consolidation has enhanced the efficiency of enterprises. The social impacts of the project were less positive than anticipated, with many farmers expressing dissatisfaction due to insufficient information during the planning phase, delays in project completion, and perceived discrepancies between promised and actual outcomes. Regarding social impacts, the percentage of farmers who believed that land consolidation would be beneficial was 93.07% before the process, which fell to 41.58% afterward. Additionally, 84.16% of farmers raised objections about the process. This suggests that the land consolidation project may not have achieved the expected positive impacts. To improve the effectiveness of land consolidation projects and increase farmer satisfaction, several key enhancements are needed. Project planning should be more comprehensive and grounded in up-to-date data, with a commitment to transparency throughout all stages. Encouraging farmer participation in the consolidation process and increasing their awareness and understanding are essential. It is also important to create avenues for farmers to voice their concerns and actively contribute to the process. Furthermore, accelerating project timelines and ensuring the complete delivery of promised services would help build farmers' trust. Implementing these strategies could lead to more positive social and economic outcomes for land consolidation projects.

Keywords: Consolidation indicators, Economic impacts, Farmer satisfaction, Rural development, Land arrangement

[1]***Sorumlu Yazar/Corresponding Author:** Derya İlkay Yılmaz, Tekirdağ Namık Kemal University, Faculty of Agriculture, Department of Agricultural Economics, Tekirdağ, Türkiye E-mail: deryailkay@nku.edu.tr OrcID: 0000-0003-0273-3323
[2]Fuat Yılmaz, Tekirdağ Namık Kemal University, Faculty of Agriculture, Department of Agricultural Economics, Tekirdağ, Türkiye. E-mail: fuatyilmaz@nku.edu.tr OrcID: 0000-0001-6454-7150
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Öz

Bu çalışma, Tekirdağ ilinde uygulanan arazi toplulaştırma projesinin tarımsal işletmeler üzerindeki yapısal, ekonomik ve sosyal etkilerini değerlendirmeyi amaçlamaktadır. Araştırma kapsamında toplulaştırma ilan edilen köylerdeki çiftçilerden anket yoluyla elde edilen veriler ve Devlet Su İşleri Genel Müdürlüğü'nün kayıtları kullanılmıştır. Arazi toplulaştırmanın etkilerini belirlemek için betimleyici istatistikler, Januszewski İndeksi (JI), Simmons İndeksi (SI) ve diğer toplulaştırma göstergeleri kullanılmıştır. Arazi toplulaştırma sonrasında işletmelerin ortalama parsel büyüklüğü %30.54 artarak ortalama 34.79 dekara çıkarken, parsel sayısı %42,37 azalarak ortalama 9.29 parsel olmuştur. Arazi parçalılığı göstergelerinden olan JI değerinin 0,344'ten 0,419'a ve SI değerinin 0.197'den 0,254'e yükselmesi, arazi parçalanmasının azaldığını ancak daha iyi planlamayla daha da azaltılabileceğini ortaya koymaktadır. Ekonomik açıdan, yakıt tüketiminin %11.96 azalarak ortalama 4.71 l ve yol zaman kaybının %12.50 oranında azalarak ortalama 0.77 saat olduğu belirlenmiştir. Bu durum arazi toplulaştırmanın işletmelerin verimliliğini artırdığını göstermektedir. Projenin sosyal etkilerinin beklenenden daha olumsuz olduğu belirlenmiştir. Pek çok çiftçi, planlama aşamasında yetersiz bilgi verilmesi, projenin tamamlanmasındaki gecikmeler ve vaat edilen ile gerçekleşen sonuçlar arasındaki tutarsızlıklar nedeniyle memnuniyetsizliklerini dile getirmişlerdir. Sosyal etkiler incelendiğinde, arazi toplulaştırmanın faydalı olacağını düşünen çiftçilerin oranı %93.07 iken arazi toplulaştırma sonrası bu oran %41.58'e düşmüştür. Ayrıca çiftçilerin %84.16'sının süreçle ilgili itirazlarda bulunduğu belirlenmiştir. Bu durum, arazi toplulaştırma projesinin beklenen pozitif etkileri tam olarak sağlamamış olabileceğini göstermektedir. Arazi toplulaştırma projelerinin etkinliğini artırmak ve çiftçi memnuniyetini sağlamak için çeşitli iyileştirmeler gerekmektedir. Proje planlaması daha kapsamlı ve güncel verilere dayanmalı, tüm aşamalarda şeffaflık sağlanmalıdır. Çiftçilerin toplulaştırma sürecine katılımını teşvik etmek ve farkındalıklarını artırmak esastır. Ayrıca, çiftçilerin endişelerini dile getirebilecekleri ve sürece aktif olarak katkıda bulunabilecekleri mekanizmalar oluşturulmalıdır. Bunun yanı sıra, projelerin sürelerini hızlandırmak ve vaat edilen hizmetlerin eksiksiz olarak yerine getirilmesi, çiftçilerin güvenini artıracaktır. Bu stratejilerin uygulanması, arazi toplulaştırma projelerinin daha olumlu sosyal ve ekonomik sonuçlara ulaşmasına katkıda bulunabilir.

Anahtar Kelimeler: Toplulaştırma göstergeleri, Ekonomik Etkiler, Çiftçi memnuniyeti, Kırsal kalkınma, Arazi düzenlemesi

1. Introduction

The majority of agricultural enterprises in Türkiye are small in area and consist of many separate and distant parts (Sağlam, 2022). This situation leads to deterioration in the agricultural structure, makes it difficult to take measures to increase productivity, and increases production costs (Ekinci and Sayılı, 2010; Küsek, 2014). Land consolidation is an important tool to increase agricultural productivity by merging scattered and small parcels into sufficient size and regulating their shapes (Aktaş et al., 2006; Takka, 1993). Land consolidation is defined as the merging of scattered and small parcels into sufficient size and the regulation of their shapes (Takka, 1993). These efforts not only unite parcels but also contribute to saving labor and fuel, and increasing the income of agricultural enterprises by providing agricultural infrastructure systems (roads, irrigation and drainage) (Akçay and Angın, 1989; Kuzu and Değirmenci, 2020).

Land consolidation projects start with the identification of the area to be consolidated and end with the distribution of new title deeds. These processes include the determination of the request for consolidation, information meetings, notation in the land registry, grading and preparation of new parceling plans (Official Gazette, 2019). Land consolidation is considered an important solution in cases where fragmented and scattered land ownership reduces agricultural productivity and makes mechanization difficult (Kumbasaroğlu and Dağdemir, 2007; Kır, 2012). Reducing the number of parcels, increasing their size, and improving their shape enhances agricultural efficiency and reduces costs (Polat and Manavbaşı, 2012; Arslan and Tunca, 2013). Land consolidation also contributes to environmental quality by reducing fuel consumption and CO2 emissions (Ayten and Çay, 2017; Kirmikil and Aydus, 2018). Studies conducted in the Trakya Region show that land consolidation has positive results in terms of agricultural productivity, irrigation, road access, and agricultural tool use (Bilgin, 2014; Gözener et al., 2016). Land consolidation projects have a positive impact on the economic and social status of farmers (İkikat Tümer et al., 2016).

Land consolidation is considered as an important tool to support rural development. These initiatives aim to organize rural lands, increase productivity and ensure the sustainability of agriculture. This study, conducted in Tekirdağ province, aimed to evaluate the structural and economic impacts of the land consolidation project on agricultural enterprises. Additionally, it aims to increase the effectiveness of future projects by examining the problems encountered in the consolidation process and farmer opinions.

The hypotheses of the study are as follows:

Hypothesis 1: The land consolidation project implemented in Tekirdağ province has structurally positive impacts on enterprises.

Hypothesis 2: The land consolidation project implemented in Tekirdağ province has economically positive impacts on enterprises.

Hypothesis 3: The land consolidation project implemented in Tekirdağ province has socially positive impacts on enterprises.

2. Materials and Methods

2.1. Material

In Tekirdağ province, a total of 36 villages, including 17 in Hayrabolu, 7 in Malkara, and 12 in Süleymanpaşa districts, were declared as consolidation areas within the scope of the soil protection and land use law numbered 5403, with the decision published in the Official Gazette dated 11.03.2017 and numbered 30004 (Official Gazette, 2017).

The survey data obtained from farmers in the villages designated as consolidation areas constitute the primary data and main material of the study. The records of the State Hydraulic Works were used as secondary data. The questionnaires of the study are administered between July and October 2023.

This study was prepared within the scope of permission from the Tekirdağ Namık Kemal University Social and Human Sciences Scientific Research and Publication Ethics Committee dated 05/01/23 and numbered 254168.

2.2. Method

2.2.1. Sampling Method

The stratified random sampling formula (Equation 1) of the Neyman Method is used to determine the sample size

(Yamane, 2001). The value of D^2 in the formula is calculated using Equation 2.

$$n = \frac{(\sum N_h * S_h)^2}{N^2 * D^2 + \sum(N_h * S_h^2)} \quad \text{(Eq.1)}$$

$$D^2 = \frac{d^2}{Z^2} \quad \text{(Eq.2)}$$

$$n_i = \frac{N_h * S_h}{\sum N_h * S_h} * n \quad \text{(Eq.3)}$$

N_h : Number of enterprises in strata
S_h : Standard deviation of strata
N : Population size
d : A percentage deviation from the mean
Z : Table value according to degrees of freedom
S_h^2 : Variance of strata
n_i : Number of samples in a stratum
n : Sample size

Enterprises are divided into three strata based on their land size: 0-140 da, 141-400 da, and 401 da or more. Using a 95% confidence interval and allowing a 10% deviation from the mean, the total number of enterprises to be surveyed was determined as 101. The sample size was distributed among these strata according to the optimum distribution criterion (Equation 3), resulting in 32 enterprises in the 0-140 da range, 21 enterprises in the 141-400 da range, and 48 enterprises in the 401 da or more range. Additionally, the number of enterprises to be surveyed was set at 49 in Hayrabolu district, 12 in Malkara district, and 40 in Süleymanpaşa district.

2.2.2. Determining Structural Impacts

The structural characteristics of the enterprise (enterprise size, number and size of parcels), land fragmentation indicators (Januszewski Index [JI] and Simmons Index [SI]), distance of parcels to the enterprise and field road length values were examined for differences before and after land consolidation. Since the data were found to be non-normally distributed, the differences are analyzed using the Wilcoxon test. JI and SI indices, which are widely used globally, reveal land fragmentation by analyzing the parcels owned by the enterprise (Platonova et al., 2011; Demetriou et al., 2013; Popov, 2017).

Januszewski Index (JI): This index (Equation 4), used to define land fragmentation, is a numerical indicator of the total parcel area (TPA) and the area of each fragmented parcel (PA) (Januszewski, 1968; McGarigal and Marks, 1995).

$$JI = \frac{\sqrt{TPA}}{\sum_i^n \sqrt{PA_i}} \quad \text{(Eq.4)}$$

Simmons Index (SI): This index determines a numerical measure of land fragmentation (Equation 5). The value is equal to 1 when the enterprise has a single parcel (Simmons, 1964).

$$SI = \frac{\sum_i^n PA_i^2}{TPA^2} \quad \text{(Eq.5)}$$

JI and SI values approaching 1 indicate a decrease in fragmentation, while values approaching 0 indicate an increase.

In addition, the parameters used include the consolidation rate over the number of parcels (CR, Equation 6), the total distance of parcels to the enterprise (TDP), the area-road length suitability (ARLS, Equation 7), the average number of parcels per farmer (ANPPF), and the average number of shares per farmer (ANSPF) (Akdeniz and Temizel, 2018).

$$CR = \frac{Number\ of\ old\ parcels\ (units) - Number\ of\ new\ parcels\ (units)}{Number\ of\ old\ parcels\ (units)} x100 \quad \text{(Eq.6)}$$

$$ARLS = \frac{Length\ of\ road\ between\ enterprise\ and\ parcel\ (km)}{0{,}043\ \sqrt{Parcel\ area(ha)}} \quad \text{(Eq.7)}$$

ARLS value closer to 1 indicates a better road network for the enterprise (Kuzu and Değirmenci, 2020).

2.2.3. Determining Economic Impacts

To determine the economic impacts of land consolidation, the inputs used by the enterprises before and after consolidation are analyzed. This analysis includes changes in the amount of inputs due to road and time, resulting from the change in the distances of the parcels to the enterprise. The assumption is made that farmers used an average of 0.407 liters of fuel per kilometer (Polat and Manavbaşı, 2012; Kuzu and Değirmenci, 2020; Gürgenç Irmaklı and Aydın, 2022). While calculating the time spent by the farmers to reach their parcels, it is assumed that their average speed is 15 km h^{-1} (Boztoprak et al., 2015; Kuzu and Değirmenci, 2020; Gürgenç Irmaklı and Aydın, 2022).

2.2.4. Determining Social Impacts

In order to determine the social impacts of land consolidation, farmers are asked about their level of knowledge and their opinions on the consolidation process, and the data are evaluated using frequency tables.

3. Results and Discussion

3.1. General information on farmers and enterprises

In this section, the demographic characteristics of the farmers and the characteristics of the farms are analyzed. Information about the farmers surveyed in the study is given in *Table 1*. All surveyed farmers were male. Their average age was 59.7 years. 1.98% of the farmers were younger than 35 years, 17.82% were between 35-50 years and 80.20% were older than 50 years. 63.37% of the farmers were primary school graduates, 14.85% were middle school graduates, 14.85% were high school graduates and 6.93% were university graduates. Farmers' agricultural experience ranged from 2 years to 63 years, with an average agricultural production experience of 43.44 years. 54.46% of the farmers reported earning non-agricultural income. The average family size was 3.52 persons.

Table 1. Information about farmers

		Frequency	%			Frequency	%
Age	<35	2	1.98	Family size	1 - 3	60	59.41
	35-50	18	17.82		4 - 6	34	33.66
	50 <	81	80.20		7 and above	7	6.93
Education	Primary School	64	63.37	Non-agricultural income	Pension	50	49.50
	Middle School	15	14.85		None	46	45.54
	High School	15	14.85		Trade	3	2.97
	University	7	6.93		Village headman	2	1.98

The average land size of 360.98 da before consolidation decreased by 4.35% to 345.26 da after consolidation (*Table 2*). Previous studies found that farm sizes decreased by between 2.90% and 45.84% after consolidation (Boztoprak et al., 2015; Mesci and Karlı, 2018; Kesici Bahar, 2019; Lök and Değirmenci, 2019; Durduran et al., 2018; Kirmikil and Aydus, 2018). The irrigated land size of the enterprises decreased by 8.96% and the dry land size decreased by 3.98%. The average number of parcels decreased by 42.37% from 16.12 to 9.29. The number of whole parcels decreased by 44.79% and the number of parcels with shares decreased by 43.62%. While the total size of whole parcels increased by 4.97%, the total size of shared parcels decreased by 63.54%. The average rate of decrease in the number of all parcels in studies conducted throughout Türkiye can be stated as 39.56%. The rate of decrease in the number of all parcels in Tekirdağ province was found to be close to the average for Türkiye (Eser and Uçan, 2012; Kır, 2012; Arslan and Tunca, 2013; Boztoprak et al., 2015; Şişman and Bilgin, 2016; Dağdelen et al, 2017; Akdeniz and Temizel, 2018; Akkaya Aslan, 2018; Durduran et al., 2018, Kirmikil and Aydus, 2018; Kuzu et al., 2018; Mesci and Karlı, 2018; Tunalı and Dağdelen, 2018; Kesici Bahar, 2019; Kuşlu and Ertem, 2019; Lök and Değirmenci, 2019; Kuzu and

Değirmenci, 2020; Gürgenç Irmaklı and Aydın, 2022)

While the average parcel size per enterprise was 26.65 da before the land consolidation project, this value increased to 34.79 da after the consolidation project. In previous studies, the rates of change in parcel size after consolidation vary between 27.33% and 75.23% (Eser and Uçan, 2012; Kır, 2012; Dağdelen et al., 2017; Akkaya Aslan, 2018; Durduran et al., 2018; Tunalı and Dağdelen, 2018; Kesici Bahar, 2019; Lök and Değirmenci, 2019). According to the Wilcoxon test results, the difference was significant for all structural characteristics of the enterprises before and after the consolidation project.

Table 2. Structural characteristics of the enterprises (before and after consolidation)

	Before consolidation			**After consolidation**		
	Min.	Max.	Average	Min.	Max.	Average
Land size (da)	23.00	2250.00	360.98	20.00	2140.00	345.26
Irrigated land size (da)	0.00	455.00	27.22	0.00	398.00	24.78
Dry land size (da)	3.00	2115.00	333.76	2.00	2021.00	320.48
Number of parcels	3.00	63.00	16.12	2.00	37.00	9.29
Number of whole parcels	0.00	56.00	13.53	2.00	36.00	7.47
Number of shared parcels	0.00	12.00	2.82	1.00	7.00	1.59
Size of whole parcels (da)	0.00	2150.00	312.38	0.00	2140.00	327.89
Size of shared parcels (da)	0.00	364.00	47.70	0.00	70.00	17.39
Average parcel size (da)	2.30	189.00	26.65	4.60	225.00	34.79

3.2. Indicators of fragmentation and consolidation of enterprises

3.2.1. Januszewski Index (JI) and Simmons Index (SI)

When JI and SI values approach 1, it indicates that fragmentation has decreased, whereas values approaching 0 indicate that fragmentation has increased. After consolidation, the JI value increased from 0.344 to 0.419, and the SI value increased from 0.197 to 0.254 (*Table 3*). The increase in these index values can be interpreted as a decrease in fragmentation. However, the current index values remain relatively low compared to the ideal value of 1, suggesting that there is significant room for improvement in reducing fragmentation. These results show that the land consolidation project successfully reduced land fragmentation. However, better planning could lead to even greater improvements.

Table 3. JI and SI values of enterprises

	Before consolidation	**After consolidation**
JI	0.344	0.419
SI	0.197	0.254

In studies conducted in Niğde and Denizli provinces, JI and SI values increased after consolidation (Akkaya Aslan, 2018; Lök and Değirmenci, 2019).

According to the Wilcoxon test results, the difference between the JI values ($\bar{x}$=0.344, SD:0.143) and SI values ($\bar{x}$=0.197, SD:0.16678) before consolidation and JI values ($\bar{x}$=0.419, SD:0.145) and SI values ($\bar{x}$=0.254, SD:0.17088) after consolidation are significant (Z=-5.539 for JI; p=0.000<0.05, Z=-5.067 for SI; p=0.000<0.05). According to these results, the consolidation project reduced land fragmentation.

3.2.2. Consolidation Indicators

The consolidation rate (CR) of the enterprises based on the number of parcels was calculated as 35.40%. In studies conducted on land consolidation in Türkiye, the consolidation rate was observed to vary between 27.11% and 77%, with an average consolidation rate of 43.91% (Kır, 2012; Arslan and Tunca, 2013; Boztoprak et al., 2015; Şişman and Bilgin, 2016; Dağdelen et al., 2017; Kuzu et al., 2018; Tunalı and Dağdelen, 2018; Lök and Değirmenci, 2019). The consolidation rate in Tekirdağ province was found to be lower than the average.

In the study, the total distance of the parcels to the enterprise (TDP) was 13.145 km on average before consolidation, while it became 11.584 km as a result of consolidation. An average decrease of 11.88% in the total distance of the parcels to the enterprise was observed after consolidation. The decrease rate is similar to previous studies (Kuzu et al.,

2018; Kuşlu and Ertem, 2019). While the area-road length suitability (ARLS) was 70.326 on average before consolidation, it decreased by 8.71% as a result of consolidation and became 64.199 (*Table 4*). The Average Number of Parcels Per Farmer (ANPPF) decreased by 44.57% before consolidation and became 9.06. The Average Number of Shares Per Farmer (ANSPF) decreased by 36.08% after consolidation and became 2.02.

Table 4. Consolidation Indicators

	Before consolidation	After consolidation	Change (%)
TDP	13.145	11.584	11.88
ARLS	70.326	64.199	8.71
ANPPF	16.350	9.060	44.57
ANSPF	3.160	2.020	36.08

According to the Wilcoxon test results, the difference between before consolidation TDP ($\bar{x}$=13.145, SD:11.32129) and ARLS ($\bar{x}$=70.326, SD:68.54491) and the after consolidation TDP ($\bar{x}$=11.584, SD:10.44998) and ARLS ($\bar{x}$=64.199, SD:64.52481) is significant (Z=-4.587 for TDP; p=0.000<0.05; for ARLS (Z=-3.755; p=0.000<0.05). These results indicate that the consolidation project reduced the total distance of the parcels to the enterprise and the area-road length suitability values.

3.3. Change in fuel consumption and travel time loss due to shortened distance

As a result of the consolidation, the distance of parcels to the enterprise has decreased. Consequently, changes in fuel consumption and travel time loss due to the shortened total distance have been examined.

The change in fuel consumption and travel time loss due to distance was calculated after the consolidation. Farmers make an average of 12 trips to the fields for wheat production and 9 trips for sunflower production. Before consolidation, the average fuel consumption per round trip was 5.35 liters, which decreased by 11.96% to 4.71 liters after consolidation (*Table 5*). This difference was found to be statistically significant (p=0.01<0.05). These results demonstrate that the land consolidation project reduced fuel consumption and associated costs.

Before consolidation, the average travel time loss per round trip for enterprises was 0.88 hours, which decreased by 12.50% to 0.77 hours after consolidation. Considering the wheat and sunflower production processes, the travel time loss per enterprise decreased by 6.93 to 9.24 hours after consolidation. This difference was also statistically significant (p=0.01<0.05). Other studies have shown that travel time loss decreased by 50% to 82% (Ayten and Çay, 2017; Kuzu and Değirmenci, 2020; Gürgenç Irmaklı and Aydın, 2022).

Table 5. Changes in fuel consumption and travel time loss of enterprises due to distance

	Before consolidation	After consolidation	Change (%)
Average fuel consumption (l)	5.35	4.71	11.96
Average road time loss (h)	0.88	0.77	12.50

3.4. Opinions and experiences of farmers about consolidation

95.05% of the farmers reported attending the informational meetings held prior to the consolidation, and 94.79% stated that they were provided with sufficient information. The farmers who felt they were not adequately informed indicated that the implementation differed significantly from the plans presented during the informational meetings.

The rate of farmers who objected to the new parceling plans and/or ownership lists was 84.16%. The most common objection, accounting for 50.59%, was the change in parcel locations (*Table* 6). Other objections included parcel size (21.18%), the desire to remain in the same location (17.65%), the desire for consolidation (11.76%), parcel geometry (8.24%), land value (5.88%), geographical structure (5.88%), neighbor relations (3.53%), individual title deeds (1.18%), fixed facilities (1.18%), and soil structure (1.18%). These complaints suggest that the expectations set during the project planning phase were not adequately met. The research findings are similar to those of a study conducted by Sayın Kaya and Şişman (2020) in the province of Aksaray.

45.88% of the farmers stated that their objections did not yield any results, 35.29% said their objections were accepted, and 18.82% reported partial success. The proportion of farmers who indicated that the consolidation took longer than planned was 84.16%, while 24.75% reported experiencing income loss.

Table 6. Issues that farmers object to

Subject of objection	Frequency	%*
Change in parcel locations	43	50.59
Parcel size	18	21.18
Desire to remain in the same location	15	17.65
Desire for consolidation	10	11.76
Parcel geometry	7	8.24
Land value	5	5.88
Geographical structure (slope, cracks etc.)	5	5.88
Neighbor relations	3	3.53
Individual title deeds	1	1.18
Fixed facilities	1	1.18
Soil structure	1	1.18

* More than one answer is given by the farmers

Before consolidation, 93.07% of the farmers believed that the consolidation would be beneficial, but this percentage dropped to 41.58% after consolidation. Among the farmers who expressed negative views about the consolidation project, 48.08% stated that the outcomes did not match what was promised before the project, and 32.69% indicated that the implementation was flawed (*Table 7*). This shift in perception is largely attributed to the lack of transparency and communication throughout the project.

Table 7. Reasons for negative views after consolidation

Reasons for negative change	Frequency	%*
The outcomes did not match what was promised	25	48.08
The implementation was flawed	17	32.69
There was biased behavior	16	30.77
The personnel conducting the consolidation were inadequate	9	17.31
My new lands are less productive	7	13.46
No soil classification was conducted	4	7.69
I had to leave ancestral land	3	5.77
My lands became more dispersed (distance between parcels increased)	3	5.77

* More than one answer is given by the farmers

Tablo 8. Reasons for positive views after consolidation

Reason for positive change	Frequency	%*
Every parcel became accessible by road	32	76.19
My scattered parcels were consolidated	22	52.38
The number of shared titles decreased	14	33.33
The land was leveled, making agricultural operations easier	3	7.14
Public lands were distributed	2	4.76
Infrastructure (roads, irrigation, and drainage) facilities were established	1	2.38
Gathering the land parcels reduced my production costs	1	2.38

* More than one answer is given by the farmers

The aspects that farmers with positive views on the land consolidation project found favorable are presented in *Table 8*. 76.19% of the farmers reported that every parcel became accessible by road, 52.38% stated that their scattered parcels were consolidated, and 33.33% noted that the number of shared titles decreased, leading them to view the consolidation projects positively.

92.68% of the farmers reported incurring additional expenses due to land consolidation. Of these expenses, 62.50% were for leveling operations, 31.25% for boundary adjustment, and 6.25% for boundary delineation. The average cost per enterprise was calculated to be 34.307.89 TL.

4. Conclusions

In Tekirdağ province, the average land size of enterprises decreased by 4.35% following land consolidation. The higher reduction rate compared to the deductions recorded by the General Directorate of State Hydraulic Works (DSI) may be attributed to farmers working on lands with unclear ownership or on treasury lands.

The study found that the number of parcels per enterprise decreased by 42.37% after land consolidation. The reduction in the average number of parcels indicates that one of the objectives of the consolidation has been achieved.

After consolidation, the number of whole parcels decreased by 44.79%, and the number of shared parcels decreased by 43.62%. The decrease in whole parcels can be explained by the merging of adjacent whole parcels under a single title deed. The average parcel size per enterprise increased by 30.54%, reaching 34.79 da. The increase in average parcel sizes can be considered an indication of the effectiveness of land consolidation projects in enhancing the efficiency of tools and machinery.

The reduction in the number of parcels, coupled with the increase in the number of whole parcels and parcel area, is a structurally desirable situation for enterprises. This suggests that the land consolidation project has had a structurally positive impact on the enterprises.

According to the calculated JI and SI index values, the land consolidation reduced land fragmentation. However, the land consolidation project in Tekirdağ province has reduced land fragmentation less compared to other provinces. These results indicate that while the land consolidation project has decreased land fragmentation, better planning could further reduce fragmentation.

The consolidation rate (CR) based on the number of parcels per enterprise was calculated to be 35.40%. By consolidating the arable lands of enterprises, assessing the boundary losses due to fragmented lands, and saving time, labor, fuel, and depreciation costs associated with accessing the land. These changes are expected to contribute to increased income for enterprises, thereby benefiting the national economy.

Following the land consolidation project, the increase in average parcel size and the decrease in both the number of parcels and land fragmentation indicate that enterprises have achieved a more efficient structure. These findings support the first hypothesis of the study and demonstrate the positive structural impacts of land consolidation projects on enterprises.

The total distance of parcels from the enterprise (TDP) decreased by 11.88%, from 13.145 km to 11.584 km. The area-road length suitability (ARLS) decreased by 8.71% to 64.199. The reduction in the distance between enterprises and their parcels increases operational efficiency, which is one of the main objectives of land consolidation. The decrease in distance results in lower fuel consumption, reduced labor, and less time spent. This indicates that the land consolidation project has a positive economic impact on enterprises and support the second hypothesis.

The results of the study indicate that the land consolidation projects implemented in Tekirdağ province have failed to meet social expectations and have led to dissatisfaction among farmers. After the consolidation, the percentage of farmers who believed it was beneficial decreased from 93.07% to 41.58%, and 84.16% of the farmers raised objections regarding the process. Additionally, 48.08% of the farmers reported that the promises made were not fulfilled, and 32.69% stated that there were errors in the implementation. Based on these findings, the study's third hypothesis should be rejected.

While the primary goals of consolidation projects often center around economic and structural benefits, the social benefits can significantly affect the long-term success and perception of these projects. In this study, although land consolidation in Tekirdağ province resulted in tangible economic improvements such as reduced fuel consumption and enhanced operational efficiency, the social outcomes were less favorable. The significant drop in the percentage of farmers who believed that consolidation would be beneficial indicates a gap between expectations and outcomes. This dissatisfaction was largely due to the perceived shortcomings in communication and execution, with many farmers feeling that their concerns were either inadequately addressed or ignored.

Farmers' objections to the process, particularly related to the new parceling and ownership arrangements, further underscore the need for more inclusive and transparent project management. Over 84% of the farmers raised objections during the implementation phase, with many citing issues such as changes in parcel locations and dissatisfaction with parcel sizes. These objections highlight a broader issue of farmer engagement in the planning stages. For future projects,

it is crucial to establish more effective channels for farmer participation, where their input is not only solicited but genuinely integrated into the decision-making process. The success of land consolidation projects should be measured not only by economic gains but also by the level of social harmony and farmer satisfaction they achieve.

To address these social challenges, land consolidation efforts must prioritize the education and involvement of farmers from the earliest stages. Informational meetings alone are not enough; there needs to be a concerted effort to ensure that the information provided is clear, accessible, and tailored to the specific needs and concerns of the farming community. Additionally, building trust through consistent and transparent communication is essential. Farmers need to feel that they are active participants in the process and that their livelihoods and opinions are valued. By fostering a more participatory approach and addressing social concerns head-on, future land consolidation projects can not only improve economic efficiency but also contribute to stronger, more resilient agricultural communities.

Farmers in the region generally attend information meetings. However, due to insufficient understanding of the information provided at these meetings, farmers have reported that they are not adequately informed. The importance of farmers' participation in these meetings should be emphasized more. To ensure farmers are satisfied with land consolidation projects and for the projects to achieve successful outcomes, it is essential to accurately convey problems and demands during consultations and to gain farmers' trust. Farmers living outside the village have indicated that there are delays in receiving information about the meetings. To address this issue, new information dissemination methods need to be implemented. Sending information messages to farmers' registered mobile phone numbers and, if available, to their email addresses will ensure that meeting dates reach more farmers.

Farmers have reported that the lands allocated to them after the consolidation project are not suitable for cultivation (e.g., due to elevation differences, gullies, riverbeds). This issue is thought to stem from discrepancies between actual data and recorded data. The cadastral records are not up-to-date, riverbeds have shifted over time, and there are unregistered streams and small creeks that do not appear as rivers on maps, leading to inconsistencies between the mapped and actual land structures. Therefore, the database underpinning the consolidation, both spatial and non-spatial (title deeds and farmer information), must be current, complete, and accurate.

More than 90% of the farmers reported incurring additional expenses due to the land consolidation. Land improvement services within the fields are carried out after the completion of consolidation in nearby parcels. However, farmers undertake tasks such as land leveling and boundary adjustments themselves to avoid missing the planting season, as waiting for officials would cause them to miss out on the next year's crop. Therefore, such tasks should be completed before the planting preparation period to ensure farmers do not miss the cultivation season.

The primary reason for the positive perception of the land consolidation among farmers was determined to be the provision of roads to each parcel post-consolidation. The increase in the number of parcels with road access not only provides economic advantages to the enterprises but also contributes to social harmony.

In order to minimize the issues encountered in land consolidation and achieve the set goals, it is essential to prioritize educational and extension activities that foster a positive outlook among producers toward consolidation. During these activities, all details of the consolidation projects should be explained to farmers, and necessary information should be provided using data from successfully completed consolidation projects. It is believed that such information meetings can help eliminate farmers' prejudices about land consolidation.

The increase in successful consolidation projects could encourage agricultural landowners to adopt consolidation and contribute to its broader acceptance**.**

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Ethical Statement

This study was prepared under the permission numbered 254168, dated 05/01/23, from the Ethics Committee of Tekirdağ Namık Kemal University Social and Human Sciences Scientific Research and Publication.

Conflicts of Interest

We declare that there is no conflict of interest between us as the article authors.

Authorship Contribution Statement

Concept: Yılmaz, D.İ.; Design: Yılmaz, D.İ., Yılmaz, F.; Data Collection or Processing: Yılmaz, D.İ., Yılmaz, F.; Statistical Analyses: Yılmaz, D.İ., Yılmaz, F.; Literature Search: Yılmaz, D.İ., Yılmaz, F.; Writing, Review and Editing: Yılmaz, D.İ., Yılmaz, F.

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