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A COMPARATIVE ANALYSIS OF LAND FRAGMENTATION, CONSOLIDATION PRACTICES AND POLICY RESPONSES IN TÜRKİYE AND KYRGYZSTAN

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Highlights

- The fragmentation holds significance from both policy-making and social perspectives
- Land consolidation is key to preventing fragmentation.
- Türkiye and Kyrgyzstan can solve fragmentation problems

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ABSTRACT: Understanding agricultural land dynamics is imperative for sustainable development. This research presents a comparative analysis of land fragmentation and consolidation practices in Türkiye and Kyrgyzstan. Land fragmentation, a global issue, hinders agricultural modernization due to small, scattered parcels. Factors such as inheritance laws, population pressure, and economic shifts contribute to fragmentation. Land consolidation, a solution advocated by FAO and FIG, aims to redistribute land, enhance productivity, and achieve public objectives. While Türkiye demonstrates successful land consolidation efforts, Kyrgyzstan lacks legislation and institutional capacity, impeding progress. Recommendations include tailored legislation, institutional strengthening, and international collaboration. Türkiye's experience shows significant reductions in parcel numbers and increased access to resources. Addressing fragmentation requires simultaneous consolidation and land banking initiatives. By implementing these recommendations, both countries can overcome fragmentation challenges and foster sustainable agricultural development.

Keywords: *Agricultural Dynamics, Comparative Study, Land Consolidation Practices, Land Fragmentation Analysis, Policy Responses*

1. INTRODUCTION

Farm or parcel size is generally considered as the size of land within an operation. One of the barriers to agricultural development and modernization is land fragmentation. Land fragmentation refers to the situation where numerous parcels owned by an individual are small, spatially distant, and scattered in a way that hinders rational cultivation [1]. Land fragmentation is typically expressed in terms of the size of agricultural land, the number and size of parcels owned by an individual, the spatial distribution of parcels, and the shape of parcels [2, 3]. The primary issues associated with land fragmentation include the small size, irregular shape, and spatial distribution of parcels. Ownership of land or parcel size, and the effects of this size on land fragmentation and/or agricultural productivity, are common issues globally [4, 5].

The reasons for changes in land use and fragmentation of agricultural lands vary across countries. Generally, these reasons include factors such as inheritance laws and regulations, population pressure on agricultural lands, socio-economic factors like non-agricultural use, rapid urbanization, industrialization, and rural-to-urban migration, as well as environmental characteristics such as climate, soil, and topography. Additionally, agricultural activities such as crop patterns, types of crops, and alternative crops, along with increasing land prices, contribute to these changes[1, 3-8].

Land fragmentation can be categorized into two types: physical fragmentation (parcel sizes) and fragmentation of ownership (legal) [1, 5]. Within this framework, land fragmentation includes fragmentation of ownership due to legal reasons such as inheritance, fragmentation of land use by tenants and landowners, fragmentation of ownership and use, and internal fragmentation, which considers parcel shape, size, and distance between parcels [5, 9].

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As a result of the fragmentation of agricultural lands, numerous fragmented properties, irregularly shaped agricultural lands, and small, spatially distant parcels emerge. Fragmentation leads to high production costs, lack of access to fields due to inadequate or absent roads, limited access to water, and an agricultural infrastructure distant from agricultural technology, resulting in only subsistence-level production by low-capital farmers.

Although land fragmentation is often associated with Europe, it is documented as a worldwide issue. Countries such as Taiwan, Malaysia, Japan, the United States, Kenya, Uganda, Peru, and Mexico are recognized as experiencing fragmentation [10].

In former Soviet Union countries, agricultural land ownership is moderately to highly fragmented in all countries except for Belarus, Ukraine, and Russia, due to land reforms. Meanwhile, in countries such as Serbia, Bosnia and Herzegovina, North Macedonia, Croatia, Slovenia, Montenegro, Kosovo, and Poland, ownership of agricultural land is highly fragmented due to over 75% of agricultural land being privately and state-owned during the socialist era. Land reforms in Albania, Romania, Bulgaria, and Moldova resulted in fragmented land use due to the distribution of physical blocks/parcels. The average size of agricultural land in these countries is approximately 0,3 hectares, with agricultural enterprises typically ranging from 1 to 3 hectares in size [2]. In contrast, Western Europe generally grapples with land use and internal fragmentation issues [9].

In the 2000 World Census of Agriculture (WCA) report, the Asia-Pacific region is identified as having the highest degree of land fragmentation. The average size of farms in the region is one hectare, significantly below the average farm size of 5,5 hectares for FAO member countries. Agricultural land sizes in the Pacific Islands range from 0,6 to 3,6 hectares. In some Asian countries, the proportion of small farms, defined as those less than two hectares, can reach up to 90% of the country's agricultural land assets. Land fragmentation is also a concern for countries such as Bangladesh, Vietnam, China, Taiwan, Turkey, the United States, Nepal, India, Ethiopia, Ghana, Rwanda, Israel, South Asian countries, Jordan, Peru, and Syria [10]. In Ethiopia, approximately 92,26% of rural households operate on an average of 1,4 hectares of agricultural land, which constitutes 72% of the country's total agricultural land. The country's average agricultural land size is approximately 0,8 hectares [4].

In Central Asian countries like Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan, the fragmentation of agricultural lands has largely occurred with the transition from a planned economy to a market-oriented one. Since the 1990s, many large farms (sovkhozes and kolkhozes) have been disbanded and transformed into small plots [11]. In some transition countries, the privatization of agriculture is cited as a cause of land fragmentation and irregularities in the supply chain.

In the mid-1990s, the extensive land reforms implemented in Kyrgyzstan initiated the privatization of agriculture, making the Kyrgyz experience relatively different from other Central Asian countries. Through the land reform in Kyrgyzstan, approximately 2 million individuals, including owners of small-scale farms responsible for agricultural production and larger agricultural enterprises, were distributed 75% of agricultural land. While individual, privatized ownership was welcomed positively, the expected positive development in agricultural production could not be achieved due to the poor condition of irrigation channels and unequal distribution of irrigation water in the small plots resulting from land fragmentation, leading farmers to revert to subsistence farming.

Land consolidation (LC) has been defined by the Veršinskas, et al. [12] as a legally regulated procedure directed by public authorities, used to regulate property structures in rural areas, aiming to reduce land fragmentation through comprehensive redistribution of land, expand farms, and/or achieve other public objectives such as nature restoration and infrastructure. Similarly positioned as a land policy tool by Lisec, et al. [13], LC has been emphasized as a tool for implementing government policies related to agriculture, rural development, nature conservation, and the environment. It has been noted that the traditional goal of facilitating agricultural development by reducing land fragmentation has evolved into a multipurpose approach in modern times, becoming increasingly globally implemented.

Throughout history, LC has stood out as the most effective method of land management for addressing the challenge of land fragmentation and enhancing land use efficiency [14]. Increasing

agricultural productivity through the development of LC tools; improving the incomes of small-scale food producers; and legally establishing rights, responsibilities, and limitations related to land as a result of rural LC projects contribute to SDG 1.4. Additionally, LC contributes to SDG 5 by promoting gender equality, SDG 11 regarding sustainable cities and communities, SDG 13 addressing climate action and global warming, and SDG 15 in terms of determining, monitoring, and managing land use changes, LC, and rural land management.

One of the most important outcomes to be achieved through LC is a high rate of LC. With the expansion of LC programs in 2008, LC has become a significant tool for agricultural development in Turkey. The main objectives of LC projects include reducing land fragmentation, improving in field road infrastructure, mitigating irrigation and drainage issues, and providing land development services such as leveling and stone collection. Additionally, the implementation of LC in highways, motorways, intersections, airports, and organized industrial zones has increased, and environmental solutions such as the creation of ecological corridors and the registration of protected areas have accelerated. The significance of LC was further enhanced by a legal regulation in 2014 that prevents the fragmentation of agricultural lands through inheritance. With this legal regulation, the planning of land acquisition and LC projects together has been introduced. During this period, while LC efforts gained momentum, the number of stakeholders continued to increase due to inheritance division.

This research delves into the global causes and solutions of agricultural land fragmentation, with a comparative analysis between Turkey and Kyrgyzstan. It presents findings, conclusions, and recommendations for both countries. While emphasizing the need to prevent land fragmentation in Kyrgyzstan and improve practices in Turkey, it's evident that the persistence of land fragmentation in Turkey adversely affects project success and duration. Recommendations for Kyrgyzstan include prioritizing measures to prevent land fragmentation and integrating LC into the country's agricultural development strategies. Addressing these issues requires simultaneous implementation of LC and land banking practices, which can significantly contribute not only to LC but also to transitioning agriculture towards more organized enterprises.

2. THE REASONS FOR LAND FRAGMENTATION AND LAND CONSOLIDATION IN TÜRKİYE

2.1 Land Use Categories and Agricultural Population

Urban settlements, constituting 1,6% of Türkiye's surface area, accommodate 67,9% of the population. While in regions classified as rural, 17,3% of the population resides. In settlements classified as urban-rural, comprising 4,9% of the total, 14,8% of the population lives [6, 15]. According to the 2022 Turkstat data, 4,866 million people are employed in the agricultural sector.

Out of Türkiye's total approximate 78 million hectares of land area, 23,864 million hectares are agricultural land, 23,11 million hectares are forests, and 14,617 million hectares consist of pastures and meadows (Table 1). The fact that approximately one-third of the country's surface area is agricultural land reflects its status as an agricultural country.

Table 1. Land use categories and amounts in Türkiye

Class	Area (thousand hectares)
Total utilized agricultural land	38,482
Total arable land and land under permanent crops	23,864
Total arable land	20,194
Sown area	16,510
Fallow area	2,960
Areas of vegetables and gardens	718
Areas of fruits, beverages and spices crops, vineyards and olive trees	3,671
Land under permanent meadows and pastures	14,617
Forest area	23,110

Source: Turkstat 2016

2.2 Legal Framework

Article 44 of the Constitution of the Republic of Türkiye and Article 755 of the Turkish Civil Code provide for LC. Within this framework, it is stated that "Improvement works such as straightening waterways, irrigation, draining marshy areas, road construction, afforestation, and land LC can only be carried out with the joint initiatives of the relevant landowners, provided that more than half of the land is owned, and two-thirds of the owners decide in this way. Other owners must also comply with this decision. The decision taken is recorded in the declarations column of the land registry. Special legal provisions regarding these matters are reserved." Optional LC is defined in the LC regulation as "LC carried out by obtaining the signed consent of fifty-one percent of the landowners in terms of number and fifty-one percent of the area they own in the project area.

LC in Türkiye is regulated by Law No. 5403 on Soil Conservation and Land Use, Law No. 3083 on Land Arrangement in Irrigation Areas, and Law No. 7139. With a law amendment in 2018, the General Directorate of State Hydraulic Works (DSİ) was authorized as the implementing agency for LC and in-field development services. Other institutions and organizations, subject to DSİ's permission, are authorized to carry out LC and in-field development services as project administrators. Therefore, municipalities, institutions responsible for railway or highway construction, or other organizations can conduct LC activities. Most LC projects are requested by public authorities.

According to Law No. 5403 on Soil Conservation and Land Use and the Regulation on Conservation, Use, and Consolidation of Agricultural Lands, LC is defined as "preventing the degradation and fragmentation of agricultural lands due to natural and artificial factors, and in fragmented lands, combining multiple land parcels while considering their natural characteristics, usage integrity, and property rights to create economic, ecological, and more functional new parcels, determining the usage methods based on land characteristics and area, and providing land development services.

LC works are conducted in two separate forms: voluntary and compulsory, with the implementation principles being the same. While voluntary LC is generally prioritized in practice, compulsory LC is often carried out as well. In consolidation areas, participation fees of up to 10% are deducted from the lands belonging to individuals and public or private legal entities, depending on the nature of the project, for shared public areas such as roads and canals. Landowners are not required to pay additional taxes due to LC projects. Additionally, parcels newly formed according to block design are exempt from land registry fees and cadastre charges. All project-related costs are covered by the state budget.

LC projects are carried out in collaboration with other relevant institutions such as the General Directorate of Agricultural Reform (TRGM), the General Directorate of Highways and Railways (TCK and DDY), and the General Directorate of Land Registry and Cadastre (TKGM). Projects are implemented by private companies determined through open tender.

2.3 Land Fragmentation

In Türkiye, reasons for the fragmentation of agricultural enterprises include inheritance law, inheritance transmissions; fragmented cadastral parcels, scattered small lands (inheritance, commerce, public investment, spatial reasons); fragmented use (trade among farmers, leasing); sharecropping; lack of sufficient agricultural mechanization; rapid population growth, industrialization, and rapid urbanization; land markets, historical/cultural perspectives [16, 17], Additionally, the absence of agricultural land use planning, even at the macro level, is also a significant factor.

In the country, there are 32,5 million agricultural parcels, more than 40 million shareholders [18-20], and 3,1 million agricultural enterprises. Regarding parcel numbers, a significant portion of the enterprises (98,2%) consist of lands ranging from 5 to 499 hectares, with 77,5% of these parcels being between 20 and 499 hectares in size. On average, each agricultural enterprise comprises 11 parcels, with an average parcel size of 5,9 decares for agricultural lands [6, 21]. Additionally, on average, a parcel is jointly owned by 13 individuals, contributing to a fragmented ownership structure and a complex land use system. Consequently, agricultural lands are often small, scattered, and divided into numerous parcels that do not generate sufficient income. More than 50% of the existing parcels lack access roads to the fields, and for those that do, the quality of the in-field roads is low. Furthermore, 50% of the parcels are distant from irrigation channels [18]. For these reasons, the country's agricultural sector faces issues related to fragmentation, scale, inheritance, accessibility to parcels, and access to water in its land-related infrastructure [18-20].

As Küsek, et al. [22] have also pointed out, out of the 40 million shareholders, 37 million are not engaged in agriculture and reside in urban areas. This situation has two types of disadvantages:

a) Shareholders engaged in agriculture in rural areas do not invest in agriculture or agricultural land because they do not own all of the land they use. They do not engage in agricultural development because they cannot obtain loans from banks or grants from the ministry for the agricultural land they use.
b) The 37 million landowners who have shares in these parcels, usually residing in cities, cannot use, sell, or lease their agricultural land, even though they are shareholders.

In Türkiye, due to inheritance and other factors, land holdings are decreasing day by day. The amount of abandoned and unused land is approximately 2 million hectares [6, 19].

To prevent these disadvantages, in 2014, the inheritance law was revised to introduce rules for the buying and selling of agricultural lands and to establish the legal framework for land banking systems. Today, the failure to integrate land banking practices with LC practices reduces the success of the applications and increases objections. Field observations indicate that land banking practices need to be integrated with LC practices to enhance the effectiveness of LC efforts [17, 22].

2.4 Land Consolidation

The preparation phase of LC projects consists of determining the project area, conducting preliminary discussions with landowners, obtaining data from land registry and cadastre directorates, obtaining project data from public institutions, preparing a feasibility report for the LC project, obtaining the Presidential decree, the tender process, and handing over the site to the contractor firm (Figure 1).

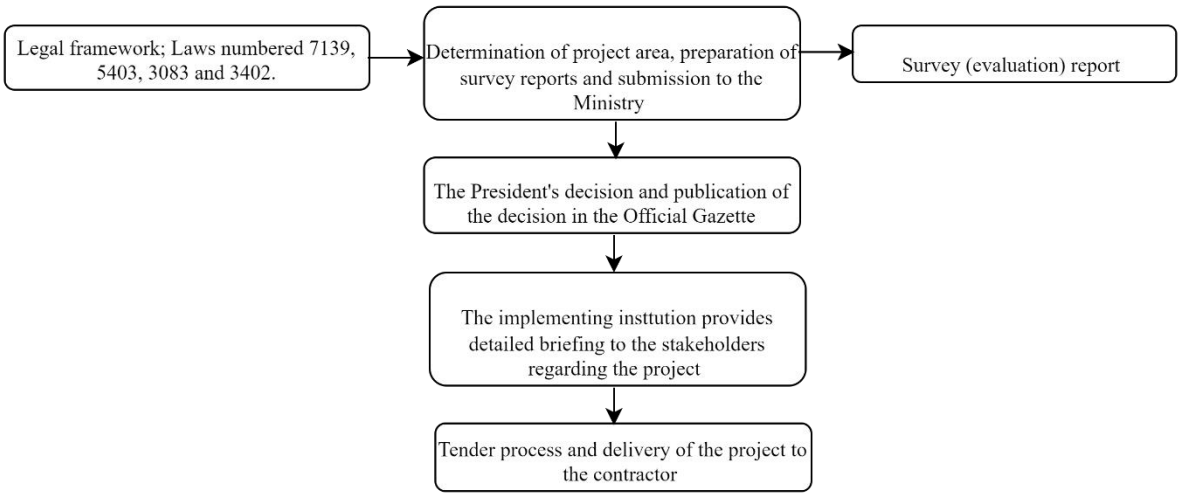

Figure 1. LC preparation works

During the project implementation phase, there are four main steps: creation of a project database using obtained land registry and cadastre data and orthophoto maps of the project area, conducting soil survey and land grading studies, preparing re-allotment planning, and conducting interviews with farmers.

Re-allotment planning aims to reduce both land ownership and land use fragmentation. Its goal is to promote the growth of agricultural enterprises. At this stage, the number of parcels is optimized for agricultural efficiency. This involves minimizing the distances between the farmer's 8-10 parcel fragments and consolidating them into one or more parcels with regular geometry.

After the project, parcels will have access to roads and irrigation and/or drainage. In the final stage, the re-allotment plan is approved by DSİ or other public institution implementing the project. Necessary property checks are conducted by local cadastre and land registry offices to register the newly formed parcels. Construction works are carried out in the project area, and the project is completed (Figure 2).

The allocation of land of equal value through land grading studies, creating parcels suitable for agricultural production, displacement of parcels subject to LC, determination of farmer preferences, and participation in public services are among the key considerations in LC practices.

2.5 Land Consolidation Practices in Türkiye

The total area suitable for LC in the country is 14,3 million hectares (Table 2). As of 2022, a total of 8,78 million hectares of land have been awarded to the private sector for LC projects under 450 projects, with 6,78 million hectares of land projects completed (325 projects) and registered in the land registry. Efforts are ongoing to complete and register the remaining 2 million hectares covered by the remaining 125 projects [18]. In addition to soil classification and block design, LC projects also provide services such as reducing land fragmentation, improving agricultural road infrastructure, and addressing irrigation and drainage issues. Furthermore, they provide land development services such as removing unused channels and leveling parcels.

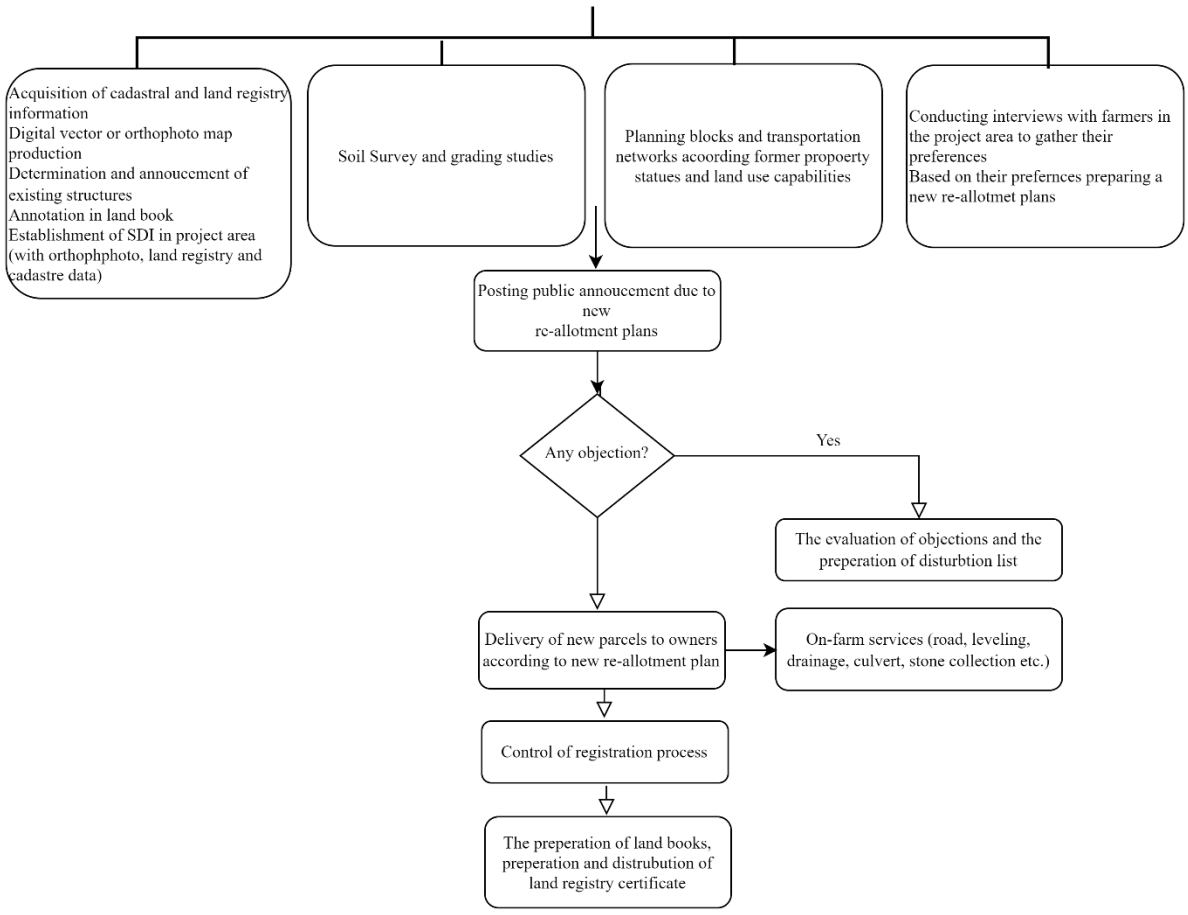

Figure 2. LC projects implementation process

Table 2. Lands suitable for LC and consolidation projects

LC and In-Farm Development	Area (ha)	Population
The area with completed projects registered	6.781.335	3.000.000
Area Under Ongoing LC Studies	1.998.900	1.150.000
Total Area Subject to LC Studies	8.780.235	4.150.000
Remaining Potential Area Suitable for LC	5.519.765	3.000.000
Total Area Suitable for LC	14.300.000	7.150.000

Source: Compiled from Demirbaş 2023

In Türkiye, LC projects typically cover an area of approximately 10.000-30.000 hectares [1, 17]. Re-allotment planning is generally integrated with public investments in agricultural infrastructure within the project area. Studies on the implementation of LC typically span 3 to 5 years [17, 18].

To assess the impact of LC on parcel numbers and sizes of newly formed parcels before and after LC across different years and geographical regions of the country, six LC projects were examined, totaling 64.998 hectares. As depicted in Table-2, there was an average decrease of 48% in parcel numbers and a remarkable increase of 136% in parcel areas. These findings underscore the pivotal role of LC not only in realizing various benefits but also in effectively mitigating land fragmentation (Table 3).

Table 3. Comparison of parcel numbers and parcel areas before and after LC

Project Name	Project Area (ha)	The Number of Parcels Before LC	New Parcel Count	Decrease in Parcel Count (%)	Average Parcel Size Before LC (m2)	New Average Parcel Size (m2)	Parcel Enlargement Rate (%)
Denizli Tavas Büyükkonak LC and In-Farm Services	1.050	11.342	2.745	76	1.000	4.000	300
Elazığ Uluova LC ve In-Farm Services	850	1.335	642	52	5.500	11.170	103
Karaman Ekinözü LC ve In-Farm Services	3.250	1.130	509	55	12.900	52.800	309
Kayseri Sarıoğlan LC and In-Farm Services	4.000	2.294	1.636	29	17.400	24.450	41
Niğde Misli 4. Kısım LC and In-Farm Services	3.500	2.591	1.863	28	13.500	19.000	41
Manyas Ovası ve Bereketli Pompaj Sulaması LC and In-Farm Services	23.348	19.097	10.120	47	12.340	14.800	20
Total	64.998	37.789	17.515	Avrg:48%	62.640	126.220	Avrg:136%

Source: Created from DSİ Projects

Between 2010 and 2012, the General Directorate of Agricultural Reform and the FAO conducted a joint pilot study to assess the impact of LC in Türkiye. The study focused on four primary objectives: reducing land fragmentation, improving access to agricultural parcels by roads, irrigation, and water, and assessing cost-effectiveness [23].

Key Findings:

- Parcel Reduction and Size Increase: The number of parcels in the project decreased from 2.531 to 1.559, representing a 38% reduction. Meanwhile, the average parcel size increased from 2,38 hectares to 3,87 hectares, reflecting a 1,5-hectare or 63% increase in size.
- Farmers' Parcel Ownership: Prior to LC, farmers owned an average of 7,1 parcels each. After LC, this decreased to an average of 2,7 parcels per farmer, indicating a 61% reduction in parcel ownership.
- Satisfaction Levels: A significant proportion of farmers, specifically 84%, expressed satisfaction with the LC process. Only 9% reported being either not satisfied at all or not very satisfied.
- Road and Irrigation Infrastructure: The total length of roads within the fields increased from 115.084 meters before LC to 193.729 meters after LC, marking a 68% increase. Similarly, the irrigation system length expanded from 111.023 meters to 152.880 meters, representing a 38% increase. Importantly, 100% of parcels within the project scope now have access to both road and irrigation infrastructure.
- These findings underscore the effectiveness of LC in achieving its objectives, particularly in reducing land fragmentation and improving agricultural infrastructure. The study provides valuable insights for policymakers and stakeholders involved in land management and rural development initiatives in Türkiye.

3. THE REASONS FOR LAND FRAGMENTATION AND LAND CONSOLIDATION INITIATIVES IN KYRGYZSTAN

3.1 Land Use Categories and Agricultural Population

Kyrgyzstan has a land area of 19.994.928 hectares, with an estimated population of 7.037.600 people as of 2023. More than 65% of Kyrgyzstan's population resides in rural areas. The number of the agricultural population amounts to 4.584.000 people.

As presented in Table 4, agricultural lands, which account for 34% of the country's total area, serve as an indicator of the country's agricultural productivity. Forested areas make up 13%, while water-covered areas constitute 4% of the country's land area.

Table 4. Land use categories and their areas

Categories of the land fund	Area, hectares	Percentage
Agricultural lands;	6.753.418	34
Settlement lands (cities, villages) lands;	277.934	1
Lands designated for industrial, transport, communication, defense, and other purposes;	230.778	1
Lands of specially protected natural areas;	1.187.277	6
Forest lands;	2.530.390	13
Water lands;	767.292	4
Reserve lands	8.247.839	41
Total:	**19.994.928**	**100**

Source: Compiled from Soil Code of Kyrgyzstan

The total area of agricultural lands is 10.461.666 hectares. Among these: the area of arable lands is 1.212.375 hectares, permanent plantations cover 37.236 hectares, fallow lands occupy 34.771 hectares, pasture areas span 169.788 hectares, and meadows encompass 9.007.496 hectares (Table 5).

Table 5. Classification and sizes of agricultural lands

Names of agricultural lands:	Area, hectares	Percentage
Arable lands	1.212.375	11,5
Perennial plantations	37.236	0,4
Fallow lands	34.771	0,4
Highlands	169.788	1,6
Pastures	9.007.496	86,1
Total	**10.461.666**	**100**

According to the Constitution of Kyrgyzstan and land laws, lands can be classified as state-owned, municipal-owned, privately owned, and other forms of ownership. Agriculture is predominantly carried out on privately owned lands. Lands under state ownership mostly consist of pastures and highlands.

Table 6. Ownership types and distribution to agricultural areas

Forms of Ownership	Total Area, thousand ha	Of which, agricultural lands, thousand ha				
		Arable lands	Perennial plantation	Highlands	Pastures	Fallow lands
State	18.653,4	246,7	14,9	83,2	9.027,8	28,6
	206,1	135,6	14,4	7,1	28,5	1,5
Municipal	57,3	0,9	0,8	0,04	3,6	0,02
	6,5	0,8	0,9	0,02	0,03	0
Private	1.203,6	955,9	21,2	86,3	1,6	9,2
	811,1	658,1	21,1	1,5	0,3	0,6
Nationwide	19.994,9	1.203,5	36,9	169,5	9.033	37,8
	1.023,7	794,5	36,3	8,7	28,8	2,1

In Kyrgyzstan, the agricultural sector is an important part of the economy. The agricultural sector accounts for 14,7% of the country's gross domestic product (GDP), with approximately 417.195 people employed in this sector (Ministry of Agriculture, 2022). According to the International Labor Organization (ILO) data in 2019, 19,3% of the workforce is employed in the agricultural sector. There are 360 existing agricultural cooperatives in Kyrgyzstan. Of these, 91% are private peasant farms, 3% are collective peasant farms, 5% are agricultural cooperatives, and 1% are joint-stock companies (Figure 3).

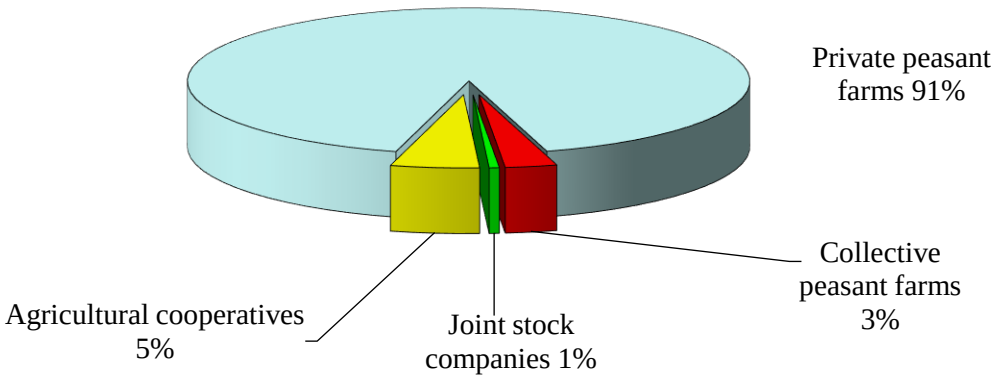

Figure 3. Usage structure of private agricultural land by farm types in Kyrgyzstan

Cooperatives and other agricultural organizations account for only 4,5% of the total agricultural production volume in the country. 75% of plant products are produced by farms and individual farm enterprises. Small-scale farmers are not integrated into modern supply chains. Low investment, limited mechanization, and land fragmentation in the agricultural sector pose a growth-inhibiting challenge for all stakeholders in the supply chain.

Within the framework of the Directive on Leasing State-Owned Agricultural Land, the Agricultural Land State Fund offers economically attractive agricultural lands for lease to farmers, local individuals, or institutions through auction.

3.2 Legal Framework

Previously, all lands in Kyrgyzstan were owned by the state and were dominated by large-scale socialist farms managing thousands of hectares of agricultural land and employing hundreds of workers. The transformation of the agricultural sector began in the early 1990s, initially focusing on the liberalization of agricultural markets and prices. Due to the absence of private ownership, land use certificates were issued to peasants using the land. These certificates provided five legal rights to individual farmers, including transferring, exchanging, selling, leasing, and using the land as collateral

for credit [24]. Land reforms were implemented in two phases between 1991 and 1996. The first phase, initiated between 1991 and 1993, led to the enactment of agricultural and land reform in the Kyrgyz Republic between 1994 and 1996, with the issuance of the Presidential Decree in 1994, and continues to this day. The first phase of the reforms was characterized by leasing of lands from collective farms (kolkhozes) and Soviet state farms (sovkhozes) for up to 49 years. During this period, farm enterprises based on state ownership and leased collective farms emerged. This phase marked the emergence and development of the land market through leasing and led to the formation of new management practices.

In 1998, with the new Constitution providing a legal basis, the transition of land ownership to private ownership before the second phase of the reform laid the groundwork for market circulation. In 1999, with the adoption of the New Land Law in Kyrgyzstan, regulations were introduced to contribute to the development of the land market through buying and selling [25]. Another significant change was the establishment of collective action institutions such as water user associations responsible for operating, maintaining, and regulating water allocation for farm irrigation facilities.

In 2013, within the framework of international cooperation, action plans were developed for 21 sectors to support long-term and sustainable initiatives and to lay the groundwork for political and economic reforms [26]. Within this framework, sub-sectors such as water management and LC were also addressed.

The National Development Program of Kyrgyzstan until 2026 includes actions aimed at developing the agricultural sector. These actions encompass:

- Reconstruction of irrigation systems (2018-2022)
- Expansion of irrigation agriculture in the Issyk-Kul and Naryn Regions under common ownership (2021-2024)
- Implementation of a national traceability system for agricultural products
- Establishment of a single value chain
- Creation of agricultural marketing and e-commerce centers
- Establishment of an agro-smart database [27].

Regarding LC, while the Kyrgyzstan Constitution doesn't contain specific provisions, the Civil Code Articles 41, 42, and 43 regulate conditions for land division and management of lands not subject to common ownership. The country's Land Law addresses issues related to cadastre and LC. Despite no separate law specifically covering LC, aspects of it are addressed within land use, protection, and management regulations.

In March 2022, the "Regulation of Land Law of the Kyrgyz Republic" was enacted, which also regulates land relations in the country. Issues concerning land are managed by a Land Resources Service within the Cabinet of Ministers of the Kyrgyz Republic.

In Kyrgyzstan, discussions and planning are underway regarding LC, which involves combining fragmented parcels of land for better management and utilization. Among the methods being considered are simple LC, where smaller plots are merged, comprehensive consolidation, which involves larger-scale integration, and multipurpose consolidation, which aims to address various needs simultaneously.

It's recognized that establishing a robust legal framework at the national level is essential to facilitate effective LC programs. This framework would provide clarity on property rights, streamline administrative processes, and ensure fair treatment of all stakeholders involved. Such clarity is crucial for guiding the implementation of LC projects and resolving any disputes that may arise.

3.3 Land Fragmantation

In Kyrgyzstan, farms are classified into three main organizational categories according to official classification: household plots, peasant farms, and state & collective farms. State & cooperative farms are generally referred to as "agricultural enterprises" and encompass both state-owned and cooperative farms. Household plots and peasant farms vary significantly in their commercial tendencies, sizes, and legal statuses. Household plots are typically smaller and subsistence-oriented. Legally, household plots are considered as physical assets, while peasant farms are registered as legal entities. Household plots consist of primary agricultural land, often a small parcel of land associated with rural residences. Peasant farms

typically operate on family-owned land but may also utilize additional leased land from other farms (Table 7).

Table 7. Main characteristics of the farm types in Kyrgyzstan, 2007

	Household plots	Peasant farms	State & collective farms
Number, thousand	924,1	323,6	1,3
Average size of arable land holdings, hectares	0,11	2,9	58,9
Total sown area, thousand Hectares	101,2	951,5	76,1
Share in total sown area, %	9	84,3	6,7

Source: NSC of the Kyrgyz Republic 2008

The land use patterns of state and cooperative farms in Kyrgyzstan have undergone significant changes as part of the land reform process. Initially, there was a reduction in the amount of agricultural land allocated to these farms, which began with the transition period and was further accelerated by government directives issued after 1995.

During this process, there was a notable shift in land ownership from corporate farms to peasant farms. These peasant farms, numbering over 300.000 across the country, typically manage smaller plots of land, averaging about 2,9 hectares each. Despite their smaller size, they collectively control around 90% of the total cultivable land in the country.

On the other hand, traditional household plots, which are even smaller in size, averaging about 0,11 hectares each, control the remaining 10% of cultivable land. This fragmentation of land ownership is a significant characteristic of the land reform process in Kyrgyzstan.

To illustrate, imagine a scenario where a corporate farm that previously controlled a large tract of land has now been divided into numerous smaller plots managed by individual peasant farmers. This redistribution of land has led to a more decentralized ownership structure, with a larger number of smaller-scale farmers actively participating in agricultural production.

Table 7 also indicates a significant decrease of approximately 165.000 hectares in total cultivated agricultural land between 1991 and 2007. This decline is noteworthy as it signifies that over 13% of the land used for agricultural purposes in 1991 was either converted to non-agricultural use or left unused. It's important to note that one negative consequence of land reform in Kyrgyzstan was its contribution to the fragmentation of land use and its impact on collective action in the rural economy [24].

Land reforms, coupled with unsustainable land use practices and a lack of capacity and finance, have led to increased land fragmentation. These issues pose significant barriers to long-term investment and the efficient utilization of agricultural land. LC, by preventing land fragmentation and allowing farmers to expand their land holdings, can help make them more competitive.

These data not only reveal the presence of land fragmentation in Kyrgyzstan but also underscore the importance of distinguishing between fragmentation in land use and fragmentation in land ownership. Continued or increasing fragmentation can impede the economically efficient management of land, leading to adverse effects on agricultural productivity.

Therefore, it's crucial to address both land use and land ownership fragmentation to ensure sustainable agricultural practices and maximize productivity. By promoting initiatives that encourage LC of fragmented land parcels and streamline land management processes, policymakers can support more efficient and productive agricultural systems.

3.4 Land Consolidation

In Kyrgyzstan, LC has emerged as a crucial objective to bolster agricultural development. Typically, these LC efforts are implemented alongside the enhancement of local agricultural infrastructure, with a specific focus on areas suitable for irrigation or planned irrigation projects. The primary goals of LC

projects include reducing land fragmentation, improving local road networks, addressing irrigation and drainage challenges, and providing essential infrastructure services like land leveling and stone collection. Despite the introduction of the simple LC concept, Kyrgyzstan lacks experience in implementing such initiatives, and progress has been limited.

Pilot projects have been carried out on a voluntary basis, utilizing a model that focuses solely on combining parcels to enhance agricultural productivity. However, there's a concern that this approach may disproportionately benefit wealthier farmers or agricultural enterprises. To address this, it's essential to consider compulsory LC, led by the government, to establish necessary agricultural infrastructure and ensure equitable access to resources.

Moving forward, Kyrgyzstan could benefit from incorporating lessons learned from pilot projects and international best practices to develop effective LC strategies tailored to its specific needs. This may involve engaging with local communities, fostering partnerships between public and private stakeholders, and providing support and incentives for smallholder farmers to participate in LC efforts.

LC pilot projects were conducted with USAID support. In selecting the pilot project areas, the presence of fragmented, unused land and investor interest in the projects were considered primary factors [28]. Three investors were selected for three project areas with different characteristics:

- In Sailyk AO, an area consisting of a total of 56 parcels covering 63,8 hectares,
- In Arashan AO, an area of approximately 130 hectares consisting of 78 parcels of privately owned agricultural land, which were not irrigated,
- In Uch-Korgon AO, an area of 328,18 hectares covering a total of 867 parcels of traditional privately-owned irrigated land.

It is stated that these projects, implemented on a voluntary LC basis, have been successfully completed as a result of their implementation.

In addition to these, LC projects were carried out in the aiyl aimaks of Zhany-Nookat and Zulpui in the Nookat district of Osh region with USAID financing. A LC project covering 50 parcels on 33,5 hectares of land was implemented in the Zulpui aiyl aimak. Examples of before and after LC are shown in Figure 4.

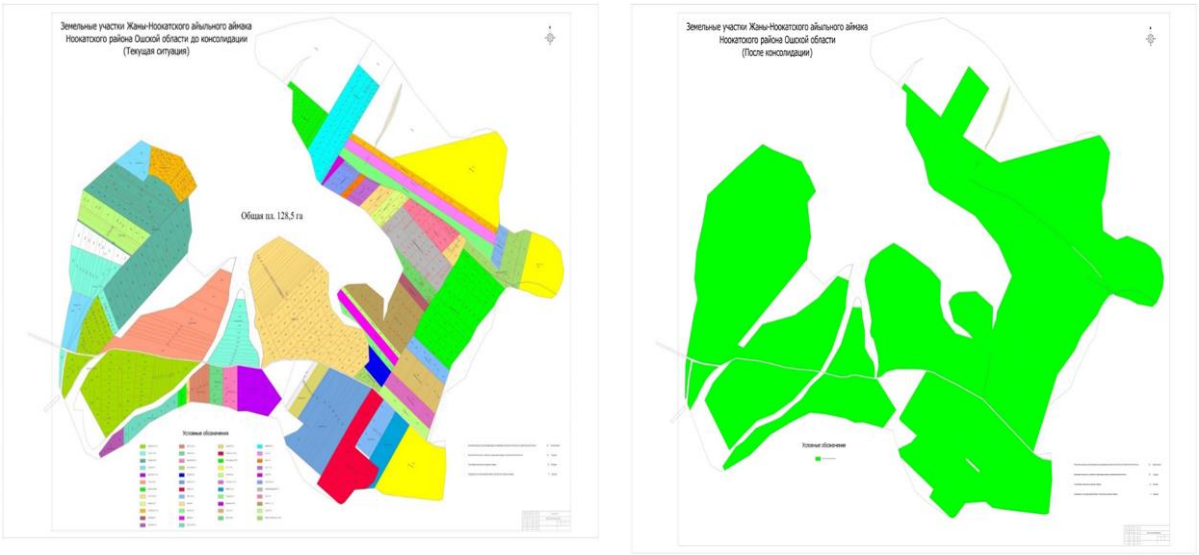

Figure 4. Zhany-Nookat aiyl aimak of the Nookat before (left) and after (right) LC

In Figure 5, LC is seen in Zulpuev Municipality, Osh Oblast. Original, fragmented parcels (left); LC after months later (right)

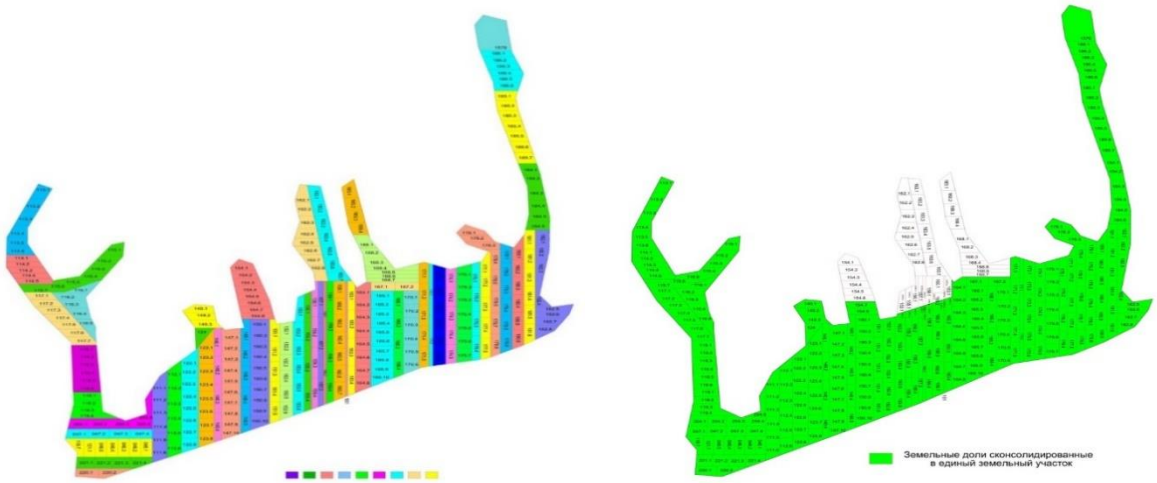

Figure 5. Zulpui aiyl aimak before (left) and after (right)LC

4. DISCUSSION AND RESULTS

4.1 Discussion

LC is a planning and management process that affects agricultural lands. It draws attention due to its various aspects such as improving productivity and sustainability, managing land use, planning infrastructure and services, protecting the environment, utilizing natural resources, and evaluating social and economic impacts.

Having knowledge of agricultural population data is crucial as it helps in making agriculture more attractive and enhancing the sustainability of agricultural enterprises through LC. Furthermore, considering that large and fertile agricultural lands generally provide more job opportunities and increase income prospects in the agricultural sector, they have the potential to offer better living conditions and job opportunities for rural populations.

Although Türkiye's land area is approximately four times larger than that of Kyrgyzstan, its population is approximately twelve times larger. 93,5% of the country consists of rural areas, with agricultural land accounting for 48,9% of the total. This includes 63% of total arable land and land under permanent crops. 17,3% of the population resides in rural areas, while urban-rural mixed settlements constitute 4.9% of the country's land area, accommodating 14,8% of the population. In Kyrgyzstan, 65% of the population resides in rural areas, with cultivated agricultural land covering 18% of the country's land area.

In Türkiye, 18% of the population is engaged in agriculture, with an employment rate of 5,66% and the agricultural sector's share in GDP being 5,4%. In Kyrgyzstan, 19,3% of the population is employed in the agricultural sector, with the GDP rate approximately at 14,7%.

Comparison of agricultural population, share in GDP, and employment in the agricultural sector between Türkiye and Kyrgyzstan reveals that Kyrgyzstan is indeed primarily an agricultural country (Table 8).

Table 8. Comparing the agricultural land use categories, population and economic indicators

TÜRKİYE	KYRGYZSTAN
The countries' Area and population?	
Area:780.000 km2 Population: 86.011.789	Area: 199.949 km2 Population: 7.037.600
Rural Area and Rural Population (rural/urban-rural)?	
17,3% of the population resides in rural areas, which cover 93,5% of the country. In urban-rural mixed settlements, constituting 4,9% of the total, 14,8% of the population lives.	More than 65% of the population resides in rural areas, which account for 34% of the country's land area.
Agricultural land amounts?	
Total utilized agricultural land is 38.000.482 ha, out of which total arable land covers 23.864.000 ha. This means that 63% of the total agricultural land used is arable land.	Total utilized agricultural land is 6.753.418 hectares, with total arable land covering 1.212.375 ha. This indicates that 18% of the total agricultural land used is arable land.
The countries' agricultural population?	
14.705.000 (18%)	4.584.000 (65%)
Agricultural parcel numbers?	
32.500.000	N/A
The share of the agricultural sector in the country's gross domestic product (GDP)?	
5,4%	14,7%
Employment in the agricultural sector?	
4.866.000 (5,66%)	417.195 (19,3%)

Türkiye is a highly experienced country in the field of LC. In this regard, LC is addressed in the Constitution and the Civil Code. There are laws and regulations concerning the subject and its implementation. Cadastre studies, which constitute the technical and legal infrastructure of LC, have been completed nationwide. The DSİ is authorized as the implementing agency for LC and on-farm development services. Other institutions are authorized to carry out LC and on-farm development services as project administrators subject to the approval of DSİ. Farmers are exempt from taxes, fees, and charges within the scope of LC projects. However, farmers may be required to contribute a maximum of 10% to common facilities Table 9.

In Kyrgyzstan, apart from the three articles in the Civil Code related to LC, no legal framework has been established, and therefore, there is no public institution directly responsible for LC. Consequently, it is believed that turning LC into a state policy by establishing its legal framework would contribute to the country's agriculture and economy, considering Kyrgyzstan's readiness in terms of cadastral infrastructure and its classification as an agricultural country.

Table 9. Comparing the legal framework

TÜRKIYE	KYRGYZSTAN
Are there any articles regarding LC both in the Constitution and Civil Code?	
Yes, LC is mentioned in Article 44 of the Turkish Civil Code and Article 755 of the Turkish Civil Code.	It is not included in the Constitution. Articles 41, 42, and 43 of the Civil Code are related to the conditions for the division of lands.
What are the main legal codes related with LC in the country?	
Law No. 3083 on Land Arrangement in Irrigation Areas No. 3083, Law No. 7139 on the Organization and Duties of the General Directorate of State Hydraulic Works, Law No. 5403 on Soil Conservation and Land Use, Law No. 2644 on Land Registry, Law No. 3402 on Cadastre, Law No. 6831 on Forestry, Law No. 4342 on Pastures, Law No. 3213 on Mining, Law No. 442 on Villages, Law No. 6360 on Metropolitan Municipalities, Law No. 3194 on Zoning, Law No. 2863 on the Protection of Cultural and Natural Resources, Law No. 3202 on Services for Villages, along with related Ministry Regulations.	In Kyrgyzstan, there is a Land Law that regulates issues related to land ownership, cadastre, and LC. The "Regulation on Land Law of the Kyrgyz Republic," which also regulates land relations in the country, was enacted in March 2022.
Is there a Land Policy in the country that covers topics such as property, cadastre, and LC?	
Yes, Land policy is clearly stated in the Turkish Civil Code.	Yes, issues related to land ownership, cadastre, and LC are regulated by the Land Law.
Has the cadastre been completed in your country?"	
Yes	Yes
Is there a LC Law in the country?	
Yes	There is no separate law that directly and entirely covers LC.
Is there public institution directly responsible LC?	
Yes	No
The institutions where LC is carried out collaboratively?	
DSİ is authorized as the implementing agency for LC and on-farm development services. Other institutions and organizations outside of DSİ are authorized to carry out LC and on-farm development services as project administrators subject to the approval of DSİ.	No
Are farmers required to pay taxes, fees, or similar charges for LC?	
No, Farmers are exempt from such taxation in LC.	There is no legislation or implementation regarding the matter.
Is there a deduction made from farmers as deduction for participation in common facilities in LC, and if so, what is the deduction rate?	
Max: 10%	There is no legislation. No project has been initiated yet.

Rural land fragmentation can arise from historical, cultural, social, economic, and environmental factors. Among these factors, land fragmentation through inheritance may be one of the most significant. Globally, land is inherited and fragmented from one generation to the next. Over time, with each succession, land is divided among multiple heirs, leading to increased fragmentation and the emergence of smaller parcels of land with multiple stakeholders. However, factors such as rapid population growth, urbanization, infrastructure development, and land speculation contribute to increased pressure on land resources, necessitating the subdivision of land into even smaller parcels to support the livelihoods of the growing population. This process poses a significant challenge to one of today's most pressing issues: ensuring food security. Topics like this, as well as similar ones, are on the agenda of countries like Türkiye

and Kyrgyzstan

In Türkiye, the number of agricultural holdings is 3,1 million. Due to inheritance, there are 40 million shareholders of these holdings. As a result of this fragmentation caused by inheritance, the average number of agricultural parcels per holding is approximately 11, and the parcel size is slightly less than six hectares. Due to land fragmentation, scale issues, inheritance, parcel access, and water access deeply affect agricultural infrastructure and agricultural production. LC programs, land use planning, land ownership reform, supporting sustainable agricultural practices, community-based natural resource management initiatives, and conducting LC and land banking activities together are considered as measures that can be taken against land fragmentation.

Consequently, the privatization of large agricultural enterprises in Kyrgyzstan has led to individual ownership arising from land fragmentation, resulting in parcel sizes averaging approximately (estimated) 1.200.000 holdings, with parcel sizes in 90% of them averaging 2,9 hectares and the remaining 10% falling as low as 0,11 hectares (Table 10).

Ultimately, although the reasons may differ, it is understood that both Türkiye and Kyrgyzstan are significantly affected by land fragmentation, and LC is perceived as the solution to this issue.

Table 10. Land fragmentation: a comparison of its causes and solutions

TÜRKİYE	KYRGYZSTAN
The number of agricultural holdings?	
3.100.000	1.200.000 (The estimate; with more than 300.000 peasant farms averaging 2,9 ha of agricultural land and over 900.000 traditional household parcels averaging 0,11 ha)
The average number of parcels on a holding?	
On average, each agricultural holding consists of 11 parcels.	There is no statistical information
The average size of agricultural parcels?	
5,9 ha	More than 300.000 peasant farms averaging 2,9 ha of agricultural land and over 900.000 traditional household parcels averaging 0,11 ha
What are the primary drivers of land fragmentation in the country?	
The primary reason is inheritance. Additionally, the absence of a clear definition of a farmer, migration from rural to urban areas due to social, economic, educational reasons, and the uncertain status of siblings who remain in the village and engage in agriculture in terms of agricultural significance.	The fragmentation of agricultural lands in Kyrgyzstan largely began with the transition to a market-oriented economy, leading to the dissolution of sovkhozes and kolkhozes and the transformation of agriculture into smaller units managed by individual farmers.
What are the problems caused by fragmentation in your country?	
Scale issues, inheritance, parcel access, and access to water are deeply affecting agricultural infrastructure and agriculture.	It has a negative impact on agricultural development.
Is there an unused (abandoned) land in the country? If any, its size?	
Approximately 2.100.000 ha	In 1991, more than 13% of the total area used for agricultural purposes was converted to non-agricultural uses.
What could be the solution to land fragmentation?	
LC programs, Land use planning, Land ownership reform, Supporting sustainable agricultural practices, Community-based natural resource management initiatives, Conducting LC and land banking activities together can be included.	Preventing fragmentation through inheritance Land Law reform, LC, Improvement of cadastre records to identify and reclaim abandoned agricultural lands, Infrastructure development and farmer support.

When comparing Türkiye and Kyrgyzstan's approaches and implementations to LC projects,

Türkiye's extensive experience over the years stands out, contrasting with Kyrgyzstan's relatively nascent involvement in this field. Table 11 has examined the differences and similarities in the understanding and processes of LC in both countries. As seen, while Türkiye is highly experienced in LC practices, Kyrgyzstan is still in the early stages. However, both countries have the fundamental data for LC, including soil databases and digital land registry-cadastre data.

Table 11. Land fragmentation: a comparison of its causes and solutions

TÜRKİYE	KYRGYZSTAN
Is voluntary LC or compulsory LC being implemented?	
There are also examples of voluntary LC alongside significant compulsory LC.	In the pilot project conducted with international aid institutions, voluntary LC has been implemented.
Are land registry and cadastre data in digital format?	
Yes	Yes
Are orthophotos used as base maps in LC projects?	
Yes	There is currently no implementation of actual LC projects
Are interviews conducted to gather farmers' preferences?	
Yes	The pilot project was conducted with the participation of a few large farmers, and their opinions were taken into account.
Is there a soil database with sufficient accuracy in the country?	
Is it produced as a stage of soil classification LC projects?	
Yes. However, land classification is carried out according to the Storie index in the projects.	Yes, there is a soil database
Are pasture lands being included in LC?	
Yes	No information
Are there enough qualified experts in the country to work on LC projects?	
Yes	There is no personnel with experience in LC.
Are LC projects carried out through private sector tenders?	
Yes, all	There is no LC project.

4.2 Results

In this research, it has been observed that within the framework of land fragmentation, consolidation practices, and policy responses, there are both similarities and differences between the two countries. According to the findings obtained, the results of the research can be summarized as follows:

1) Kyrgyzstan is more agriculturally oriented compared to Türkiye.
2) Both countries have nearly identical proportions of their populations engaged in agriculture.
3) Türkiye stands as a highly experienced country in LC. As of 2023, it has undertaken LC projects covering 8,78 million hectares of land and continues to do so. Conversely, Kyrgyzstan is still in the phase of research, discussion, and strategy development.
4) Despite differing motivations, both countries suffer from land fragmentation. High parcel numbers per farm and low average parcel counts prevent households from generating sufficient income from agriculture.
5) Consequently, both countries have areas of unused, abandoned, or misused lands.
6) Turkish and Kyrgyz academics concur that LC is essential for preventing land fragmentation and enhancing agricultural productivity
7) Both countries possess soil databases and digital land registry-cadastre systems, forming the foundation of LC.

8) Both countries have responded to the needs by developing policy responses in line with the legal, social, economic, and environmental conditions of the country. Examples of policy responses can be seen in Kyrgyzstan with the law enacted in 2022, and in Türkiye with the changes in laws regarding agricultural land sales in 2014 and institutional restructuring in 2018.
9) In Kyrgyzstan,
    a) there is an understanding of the need for legislative work to reduce administrative barriers and simplify the re-registration processes of property rights within the scope of LC. This way, conducive conditions for LC can be established.
    b) The design and execution of strategies, such as land auctions and exchanges, are crucial for ensuring transparency in land transactions and facilitating the establishment of the actual market worth of land parcels. Consequently, proficient land users can competitively obtain extra land parcels to broaden their economic endeavors.
    c) Conducting training initiatives for land users covering topics such as market economics, legal intricacies of land ownership and utilization, and cutting-edge agricultural technologies is essential. By raising awareness, farmers can make informed choices regarding the LC and effective utilization of land resources.
10) In Türkiye;
    a) Türkiye has completed its legal framework and institutional development regarding LC.
    b) LC in Türkiye is conducted through tendering processes involving the private sector.
    c) LC projects are predominantly carried out by public institutions under compulsory LC regulations. Farmers are exempt from taxes, fees, and duties in LC projects.
    d) Land fragmentation poses a scalability issue in agricultural production, hindering access to water and in field roads. These factors necessitate LC in Türkiye.
    e) LC projects are executed by experienced personnel utilizing modern technology. There is a substantial number of qualified LC experts in public, academic, and private sectors.

5. CONCLUSION

This research aimed to facilitate the understanding of agricultural land dynamics in Türkiye and Kyrgyzstan through a comparative analysis of land fragmentation and consolidation practices and policy responses. The ultimate goal was to develop recommendations for enhanced practices in both countries.

The foremost conclusion of the study is the absence of legislation concerning LC in Kyrgyzstan. To address this gap, it is imperative to develop LC legislation tailored to the specific conditions of the country. This lack of legal framework poses a significant barrier to effective LC efforts and hinders progress in addressing land fragmentation issues.

Enhancing institutional structures to fulfil the responsibilities outlined in the LC legislation constitutes another significant outcome. Developing institutional capacity, incorporating modern technology, and embracing digitalization are vital areas that need to be addressed within this scope. Strengthening institutional frameworks will enable more efficient and effective implementation of LC projects and ensure their long-term sustainability.

Given that LC involves direct participation of farmers and leads to changes in property ownership, it is paramount for policymakers, public institutions, and farmers to deeply understand the content, implementation, contribution to farmer welfare, and agricultural development aspects of the project to ensure their support and success. Prioritizing public awareness on these matters stands as a crucial outcome and recommendation. Engaging stakeholders in the planning and implementation process will foster greater buy-in and ownership of LC initiatives, leading to more successful outcomes.

Initiating pilot projects for LC through international collaboration at the outset, followed by their widespread dissemination across the country based on the resulting outcomes, highlights a pivotal result deserving thorough investigation. Collaborating with international partners can provide valuable expertise, resources, and support for implementing LC projects effectively.

The analysis conducted within the study has demonstrated that the number of parcels involved in LC efforts in Türkiye has decreased by approximately 50%, while parcel areas have enlarged by around 130%. Moreover, it has been observed that each parcel now benefits from access to water and field access roads. These findings are further verified by a study conducted by the FAO in collaboration with relevant Turkish government agencies. The revelation of the achievement of the technical objectives of LC projects in Türkiye represents a valuable outcome derived from this study.

In conclusion, the persistence of the problem of land fragmentation in Türkiye negatively impacts the success and duration of projects. Addressing this issue requires the simultaneous implementation of LC and land banking practices. Land banking can significantly contribute not only to LC but also to the transition of agriculture towards more organized enterprises. By implementing the recommendations outlined in this study, both Turkey and Kyrgyzstan can take significant steps towards overcoming the challenges posed by land fragmentation and promoting sustainable agricultural development.

Declaration of Ethical Standards

Authors declare that all ethical standards have been complied with.

Credit Authorship Contribution Statement

Orhan ERCAN Originated the fundamental concept, made a substantial contribution to its development, and spearheaded the manuscript drafting process.

Ainura BATYKOVA Assisted in shaping the research design, conducting analysis, and refining the manuscript, actively engaging in result discussions and contributing to the final version.

Tamchybek TULEEV Gathered and presented data on land fragmentation in Kyrgyzstan.

Ahmet Hilmi ERCİYES Compiled and structured information on land consolidation practices in Türkiye, contributing to shaping the final form of the research.

Declaration of Competing Interest

The authors declare that there are no declarations of interest.

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Data Availability

Due to the nature of this study, no statistical or formula-based data were utilized.

REFERENCES

[1] M. B. Hartvigsen, Land reform and land consolidation in Central and Eastern Europe after 1989: Experiences and perspectives. 2015.

[2] M. Hartvigsen, "Land reform and land fragmentation in Central and Eastern Europe," Land use policy, vol. 36, pp. 330-341, 2014.

[3] I. Markuszewska, "The outlook of land consolidation in Poland: Stakeholdersdilemmas and policy weaknesses," 2016.

[4] G. T. Alemu, Z. Berhanie Ayele, and A. Abelieneh Berhanu, "Effects of land fragmentation on productivity in Northwestern Ethiopia," Advances in Agriculture, vol. 2017, 2017.

[5] D. Balcı and A. S. Gün, "Toprak Yönetiminde Toprak Toplulaştırması Süreci (Land Consolidation Process in Land Management)," Turkish Journal of Agriculture-Food Science and Technology, vol. 12, no. 3, pp. 462-469, 2024.

[6] O. Ercan, " Agricultural land-based functional model for effective rural land management in Türkiye," Journal of Agricultural Sciences, n.d., doi: https://doi.org/10.15832/ankutbd.1342935.

[7] L. Luo, C. Yang, R. Chen, and W. Liu, "Comprehensive Land Consolidation Zoning Based on Minimum Cumulative Resistance Model—A Case Study of Chongqing, Southwest China," Land, vol. 12, no. 10, p. 1935, 2023.

[8] B. Paudel, J. Pandit, and B. Reed, "Fragmentation and conversion of agriculture land in Nepal and Land Use Policy 2012," 2013.

[9] K. O. Asiama, R. Bennett, and J. Zevenbergen, "Land consolidation for Sub-Saharan Africa's customary lands: The need for responsible approaches," American Journal of Rural Development, vol. 5, no. 2, pp. 39-45, 2017.

[10] R. Beltramo, A. Rostagno, and A. Bonadonna, "Land consolidation associations and the management of territories in harsh Italian environments: A review," Resources, vol. 7, no. 1, p. 19, 2018.

[11] C. Raab and M. Spies, "Characterising cropland fragmentation in post-Soviet Central Asia, using Landsat remote-sensing time series data," Applied Geography, vol. 156, p. 102968, 2023.

[12] T. Veršinskas, M. Vidar, M. Hartvigsen, K. Mitic Arsova, F. Van Holst, and M. Gorgan, Land Consolidation (Legal Brief, no. 1). Rome, Italy: FAO, 2021, p. 10.

[13] A. Lisec, M. Louwsma, and W. Krupowicz, "Public participation," in Land Consolidation – The Fundamentals to Guide Practice. Denmark: International Federation of Surveyors (FIG), 2022, ch. 3, pp. 25-33.

[14] S. Li and W. Song, "Research progress in land consolidation and rural Revitalization: Current status, characteristics, regional differences, and evolution laws," Land, vol. 12, no. 1, p. 210, 2023.

[15] TURKSTAT. [Online]. Available: https://www.tuik.gov.tr/

[16] İ. Arıcı and Ş. T. Akkaya Aslan, "Arazi Toplulaştırmada Çok Amaçlı Proje Geliştirmenin Yararları ve Zorlukları," in Biyosistem Mühendisliği III, A. Atılgan, H. Değirmenci, V. Demircan, and Ç. Tanrıverdi Eds.: Akademisyen Kitabevi, 2022, pp. 9-16.

[17] F. T. Z. Gülsever, O. Özkan, and U. Büyükhatipoğlu, "The Land Consolidation Implementation Studies In Turkey," in Symposium on Land Consolidation and Land Readjustment for Sustainable Development, Apeldoorn, 2016: FIG, in Symposium on Land Consolidation and Land Readjustment for Sustainable Development Proceedings [Online]. Available: https://fig.net/resources/proceedings/2016/Symposium_LCLR_Apeldoorn_2016_Proceedings.pdf. [Online]. Available: https://fig.net/resources/proceedings/2016/Symposium_LCLR_Apeldoorn_2016_Proceedings.pdf

[18] S. Demirbaş, "Türkiye'de Arazi Toplulaştırma Çalışmaları," in III. International Conference on Real Estate Development and Management, Ankara, 2023, Ankara: Ankara Üniversitesi Yayınevi, 2024.

[19] M. Türker, "In Turkey Land Abandonment and the Combat Activities (Land Banking Services)," Santiago, 2019.

[20] M. Türker, "Türkiye'de Tarımsal Arazi Yönetimi ve Geleceğİ (Agricultural Land Management and its Future in Türkiye)," in III. International Conference on Real Estate Development and Management, Ankara, 2023, Ankara: Ankara Üniversitesi Yayınevi, 2024.

[21] TURKSTAT. [Online]. Available: https://www.tuik.gov.tr/

[22] G. Küsek, Ş. Akdemir, and I. S. Ismailla, "Land consolidation in Turkey-a multipurpose/discipline land consolidation in Turkey with ICT support 2023," Scientific Papers Series Management, Economic Engineering in Agriculture & Rural Development, vol. 23, no. 2, 2023.

[23] M. Kvistgaard, "Pilot evaluation: Land Consolidation in Konya Region, Cumra District, villages Inli and Dinlendik (2010-2012)," Ministry of Food, Agriculture and Livestock of Turkey & FAO., 2015. [Online]. Available:

https://www.fao.org/fileadmin/user_upload/reu/europe/documents/Events2015/LN7/Konya_en.pdf

[24] K. Akramov and N. Omuraliev, "Institutional change, rural services, and agricultural performance in Kyrgyzstan," 2009.

[25] Land Code of the Kyrgyz Republic, 1999.

[26] USAID, "Kyrgyzstan Local Development Program A Task Order Under The Segır/Gbtı Iı Iqc Fınal Report," United States Agency for International Development, 2014. [Online]. Available: https://urban-links.org/wp-content/uploads/Kyrgyzstan-%E2%80%93-Local-Economic-Development-Program.pdf

[27] Kırgızistan Tarım Sektörü Ülke Yatırımcı Rehberi, 2022. Online] Available: https://www.tarimorman.gov.tr/ABDGM/Belgeler/Ulke%20Masalar%C4%B1/K%C4%B1rg%C4%B1zistan.pdf

[28] USAID, "Land Reform And Market Development Project Ii Final Report Kyrgyzstan 2008–2010," United States Agency for International Development, 2010. [Online]. Available: https://pdf.usaid.gov/pdf_docs/PDACR659.pdf