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Araştırma Makalesi (Research Article)

Evaluation of the Utilization of Mechanization in the Agricultural Enterprises in Terms of Productivity

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Abstract: Productivity in agricultural enterprises is mainly achieved by increasing the productivity of seed, fertilizer, pesticide, labor and mechanization inputs. The aim of this study was to determine the productivity of the use of mechanization which has a significant share and limitation in production costs. For this purpose, in Karapınar, Çumra and Altınekin districts, which have 24% of the mechanization equipment used in the province of Konya, work was carried out. According to stratified random sampling method, 107 agricultural enterprises were interviewed. As a result of the surveys conducted with these enterprises, demographic and capital structures of the enterprises were examined, and annual activity results were calculated. According to the results of the annual activities, the land, labor and capital efficiency of the enterprises were calculated and the productivity of all three production factors increased in parallel with the growth of the enterprise scale. In order to determine the mechanization utilization productivity, which is the main purpose of the study, tractor draw force, working hours, age and usage costs were calculated. As a result of the analysis, it was determined that the mechanization productivity increased as the scale of the enterprise grew and the use of mechanization of the enterprises having land of 200 decares and above was in European standards. According to this result, it has been determined that the choice of tractor suitable for land and enterprise scale should be made. For this reason, a machine park model has been proposed to facilitate the utilization of new technologies.

Tarım İşletmelerinde Mekanizasyon Kullanımının Verimlilik Açısından Değerlendirilmesi

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Anahtar kelimeler

Mekanizasyon,
Traktör,
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Özet: Tarım işletmelerinde verimlilik başta tohum, gübre, ilaç, işgücü ve mekanizasyon girdilerinin verimliliklerinin artırılmasıyla sağlanmaktadır. Bu girdiler arasında üretim maliyetleri içerisinde önemli paya ve sınırlılığa sahip olan mekanizasyon kullanımının verimliliğinin belirlenmesi çalışmanın temel amacıdır. Bu amaca yönelik olarak Konya ilinde kullanılan mekanizasyon ekipmanlarının %24'üne sahip olan Karapınar, Çumra ve Altınekin ilçelerinde tabakalı tesadüfi örnekleme yöntemine göre belirlenen 107 tarım işletmesiyle görüşülmüştür. Bu işletmelerle yapılan anketler sonucunda işletmelerin demografik ve sermaye yapıları incelenmiş olup, yıllık faaliyet sonuçları hesaplanmıştır. Buna göre elde edilen yıllık faaliyet sonuçlarına göre işletmelerin arazi, işgücü ve sermaye verimlilikleri hesaplanmış olup, işletme ölçeğinin büyümesine paralel olarak her üç üretim faktörünün verimliliğinin arttığı

belirlenmiştir. Çalışmanın temel amacı olan mekanizasyon kullanım verimliliğini belirlemek için de traktör çeki gücü, traktör çalışma saati, traktör yaşı ve traktör kullanım maliyetleri hesaplanmıştır. Yapılan analiz sonucunda işletme ölçeğinin büyüdükçe mekanizasyon verimliliğinin arttığı belirlenmiş olup, 200 dekar ve üzeri araziye sahip işletmelerin mekanizasyon kullanımının Avrupa standartlarında oldukları belirlenmiştir. Bu sonuca göre arazi ve işletme ölçeğine uygun traktör seçiminin yapılması gerektiği ortaya konulmuş olup, bu noktada yeni teknolojilerden yararlanmayı kolaylık sağlayacak olan makine parkı model önerisi sunulmuştur.

Etik Kurul İzin Belgesi verilerin 2015 yılına ait olması nedeniyle bulunmamaktadır.

1. Introduction

The agricultural sector has a significant role in terms of meeting the food needs of the population and its contribution to national income, employment and foreign trade. Therefore, increasing the productivity in the sector is critical. In 2017, the world population is 7.5 billion. It is estimated to increase to 8.5 billion in 2030 and to 9.7 billion in 2050 (FAO, 2017). Meeting the nutritional needs of the increasing world population is greatly associated with increasing the productivity together with expanding arable lands. In recent years, arable land shows a tendency to decrease. In developed countries, the amount of agricultural land per capita in the last 50 years has declined from 0.70 hectares (ha) to 0.46 hectares. It is foreseen that it will decrease to 0.4 ha area by 2050 (Tarmakbir, 2018). For this reason, the meeting the food requirement of population depend greatly on the increase of productivity per unit area, which needs high capacity production material, skilled workforce, chemical input, mechanization usage etc. The use of mechanization does not directly affect the increase in productivity, like other inputs such as soil, water, seeds, fertilizer, and agricultural chemicals.

The technology used in the agricultural sector consists of two components. These components are biological and mechanical technologies. Biological technology includes all kinds of breeding activities such as seeds, fertilizers and drugs. Especially with this technology, it is possible to improve the products which are healthier and more durable besides high-productivity products. Mechanical technology usually consists of mechanization. In the presence of mechanization, there are tractors, tractor-used tools-machines, irrigation equipment and livestock equipment. With mechanization applications, labor, time and production costs are saved in agricultural enterprises. In addition, these applications can minimize negative climate conditions. It provides environmentally friendly and less resource production. For example, in the Çukurova region, the harvesting of 150 decares of width and 5 rows of cotton fields lasts an average working day with mechanization, while the number of labor needed to do the same job in a day is 450 people (Tarmakbir, 2018). In addition, the share of mechanization practices within the costs varies from region to region but it is between 25-40% (Oğuz et al., 2017; Olçay et al., 2016; Özgüven et al., 2010; Tarmakbir, 2018). Considering the ratio of the use of mechanization in production and enterprise costs, it is necessary to determine the productivity in the use of mechanization.

Productivity is one of the important performance measurement dimensions for the solution of the macroeconomic problems of the countries and the realization of the social development goals. Productivity is the ratio of the output obtained at the end of a given production process to the sum of the inputs or inputs used to obtain this output. Overall, productivity, which is a measure of how productively inputs are transformed into outputs, measures how well resources are used (Alrwis et al., 2015; Deng et al., 2018; Oguz & Yener, 2018; Singh et al., 2015).

There is no study on mechanization productivity when the studies on productivity have been examined (Alrwis et al., 2015; Canan & Ceyhan, 2016; Deng et al., 2018; Oguz & Yener, 2018; Özden & Armağan, 2005; Parlakay et al., 2015; Singh et al., 2015). Since mechanization fuel, repair maintenance, fixed capital interest and depreciation costs in agricultural enterprises have a high share in production costs. Productivity of mechanization in agricultural enterprises needs to be studied. In the study, the utilization levels of the agricultural production factors were determined, and the mechanization utilization productivities of the enterprises were compared and analyzed according to different enterprise width groups. Within the scope of the study, the measurement part of labor, capital, land, and mechanization productivity has been defined as productivity and as a result of the productivity

analyzes, a machine park development model for mechanization applications in rural areas has been proposed.

2. Materials and Methods

Primary and secondary data were used as part of the study. Secondary data were obtained by taking into consideration all kinds of printed publications and institutions' reports about mechanization. The primary data were obtained by survey and belong to 2015 year of manufacture. In the research, the surveyed area was determined as purposive sampling method. Altınekin, Karapınar and Çumra districts, which are the research area, constitute 24.73% of the total mechanization used in Konya. Therefore, the survey was conducted in three districts. The stratified random sampling method was used to determine the sample number of the enterprises to be surveyed, and the sample number was calculated with the formula below (Oğuz & Karakayacı, 2017). This method was used because the coefficient of variation was over 70%. In order to ensure homogeneity between the layers, the enterprises were examined in four groups. In determining the sample size, 95% confidence limits and 5% margin of error were studied and a total of 107 agricultural enterprises were surveyed (Table 1).

$$n = \frac{(\sum Nh.Sh)^2}{N^2.D^2 + \sum (Nh.Sh^2)} \quad D^2 = d^2 / z^2 \quad (1)$$

In the formula; "n" is the number of samples, "N" number of enterprises in population, "Nh" number of enterprises in the h'th layer, "Sh" is the variance of the h th layer, "d" represents the allowable margin of error from the population mean, "z" refers to the z value in the standard normal distribution table according to the error rate.

Table 1. Sample size distribution of the investigated farms enterprises

	Nh	Sh	Avg.	CV	Nh. Sh	Nh (Sh*Sh)	n
0-50	3 643	10.54	31.92	33.02	38 397.10	404 704.18	6.47
51-100	4 391	14.77	73.29	20.15	64 849.06	957 731.72	10.93
101-200	4 737	28.64	142.84	20.05	135 681.63	3 886 321.41	22.87
201+	3 780	105.33	320.11	32.90	398 151.67	41 937 764.44	67.11
Total	16 551				637 079.45	47 186 521.76	107.38

Prepared by the authors.

Land, labor and capital productivity were determined as follows:

- Land productivity = Production Value / Land Quantity
- Labor productivity = Production Value / Male Labor Force Unit (MLU)
- Capital productivity = Production Value / \$ 1 000

The term Production Value in the formula refers to the proceeds generated from the production activities in agricultural enterprises. Gross production value (GPV) is the most important criterion in total value of agricultural enterprises. In the scope of the study, gross production Value (GPV), net income (NI), gross margin (GM), agricultural income (AI) and net profit (NP) are calculated. The land, labor and capital productivity of all of these criteria were determined separately. In addition, while in the literature land and labor productivity is calculated over the production amount, the total gross production values are taken into consideration due to the high product variety.

The GPV is determined by the addition of the production value of plant and animal products and the increase in inventory of plant and animal productive stock value (PSV). Gross product (GP) is defined as the monetary statement of all the final goods and services produced in the enterprise a year. The gross production value of the gross product item is determined by adding housing rent and non-farm agricultural income. Another success criterion, net product, is obtained by subtracting the enterprise costs from gross product. In net product, enterprises are free of charge and without debt. Gross margin is one of the clearest success criteria used in the comparison of production activities or enterprises. As a matter of fact, gross margin is obtained by subtracting the variable costs from the GPV and the continuity of the production process in agricultural enterprises is generally interpreted by gross

margin. Net profit is defined as the profit of the entrepreneur and is obtained by deducting the production costs from the revenue generated as a result of the goods and services obtained during a production period. It demonstrates the success of the manager and is shown as the clearest benchmark (Karakayacı, 2019). Finally, agricultural income shows the income from agricultural production activities (Oğuz & Bayramoğlu, 2018). In calculation of monetary values, the exchange rate of \$ 1 to TL 2.72 were used (TCMB, 2019).

In the study, the amount of land was measured over hectare, and the capital amount shows the productivity obtained against each invested \$ 1 000, and co-productives were used in the calculation of man working day's. These co-productives are used in order to standardize the calculation of the labor force quantity of the employees who are in different ages and genders. Male and female workers in the 7-14 age group were multiplied by 0.50, male workers of 15-49 age group by 1.00 and female workers with 0.75, male workers of 50 and over were 0.75 and female workers were 0.50 male. Man Power Unit (MPU) hours was calculated by multiplying the average working day (280 days) in the agricultural enterprises by the obtained MLU (Oğuz & Mülayim, 1997).

In order to determine the mechanization productivity, the tractor value, tool machine value, tractor power, tractor age and tractor usage time (hours) were taken into consideration. The statements of the manager were considered in the calculation of these values. Mechanization productivity was determined by proportioning the product amounts obtained from agricultural enterprises with these values.

3. Results

Productivity, at the macro level, countries demonstrate the performance of enterprises at the micro level. For this reason, some productivity indicators are used in the comparison of enterprises performances. The calculation of productivity indicators in agricultural holdings is necessary in order to reveal the level of competition of the enterprises, to compare the enterprises and to develop strategies. It is possible to control and improve the performances at the level of enterprise units with the obtained productivity indicators. In addition, it allows to adjust production capacity, resource requirement and cost estimates according to budget objectives. For this purpose, in order to use the productivity indicators of agricultural holdings within the scope of the study, annual activity results and accordingly, land, labor, capital and mechanization productivity were calculated.

Labor productivity is increasing because production is continuous in non-agricultural sectors. In the agricultural sector, productivity decreases because production is interrupted. In recent years, the increase in the productivity per arable land with the developing technology leads to an increase in production quantity and total productivity. The basis of this increase in productivity is not only the marginal productivity of capital but also the increase in marginal productivity of labor and land (Karanca et al., 2014).

The mechanization productivity of the enterprises is given at Table 2. As the enterprise scale grows, per hectares GPV, GP, NP, GM, NP and TI are increasing. This situation is seen in other studies (Ağızan & Bayramoğlu, 2019; Ağızan & Bayramoğlu, 2018; Arisoy et al., 2017; Aydın & Unakitan, 2016; Aydın & Unakitan, 2018; Erdoğan & Bayramoğlu, 2017; Karakayacı, 2020; Oğuz et al., 2017; Topcu, 2018). Increase in income with the growth of the enterprise scale in agricultural enterprises can be explained by productivity and efficiency. As the success of the production inputs used increases, there will also be an increase in total revenue. For example, it is seen that there is a positive correlation between income and the increase in the use of mechanization, which is one of the inputs of production. For this reason, the choice of mechanization should be done according to the needs of the enterprise. Otherwise, the mechanization will cause the equipment's to remain idle. Oğuz and Kaya (2016) have determined that the technical productivity of milk Enterprises is low against the proper size of their activities. The reason of low technical productivity is the lack of technical knowledge and management.

Enterprise scales do not differ much in terms of the number of tractors per hectare. However, the number of machine tools per hectare, tractor towing power and usage time are increasing with the increasing scale of the enterprise. Small-scale enterprises usually dry conditions grain crops are grown. In large-scale enterprises, generally irrigated agriculture is widespread and sugar beet, potato, silage maize, and alfalfa, perennial plants are grown. Therefore, the duration of tractor use increases according to the scale of the enterprise.

Table 2. Land productivity by enterprise' size

	0-50	51-100	101-200	201-+	Average of Enterprises	
Land Productivity	GPV per ha (\$)	3 980.05	4 854.04	5 061.92	5 293.04	5 239.86
	GP per ha (\$)	4 653.24	5 317.07	5 343.86	5 466.76	5 398.26
	NP per ha (\$)	1 086.10	2 163.15	2 555.39	2 961.01	2 827.95
	GM per ha (\$)	2 204.65	3 062.02	3 186.37	3 344.15	3 306.63
	NP per ha (\$)	-686.36	483.56	1 268.38	1 754.49	1 592.16
	TI per ha (\$)	-329.83	1 679.30	2 009.62	2 315.63	1 939.84
	Tractor Number per ha (Number)	0.83	0.81	0.69	0.83	0.80
	Number of Machine Tools per ha (Number)	6.56	5.54	5.91	7.88	7.14
	Tractor Towing Power per Ha Amount (HP)	38.87	32.10	39.57	50.67	45.71
	Tractor Usage Period per Ha (hour)	36.72	67.40	140.93	410.52	296.33

In general, there is an inverse relationship between mechanization and labor. These production factors can substitute for each other. As the technology level increases, the amount of labor required in the enterprise decreases. The increase in mechanization levels in parallel with the growth of the enterprise scale increases productivity and efficiency. Similar results were obtained in this study. In Table 3 shows the amount of production value and the productivity of mechanization per labor force. In the study, MLU was considered when calculating the labor force of the family members in agricultural holdings. According to the table, all the financial indicators per MLU increased in line with the growth of the enterprise scale. With the growth of the enterprise scale, the workforce is used more productivity and productively. In parallel with the growth of the enterprise scale, the fact that the products which are more in need of labor force are included in the production pattern accelerate this situation more. Depending on the increase in enterprise scale, the number of tractors per MLU, the number of tools, the amount of tractor draws power and the period of use of tractors have increased.

Table 3. Labor productivity by enterprise' size

	0-50	51-100	101-200	201-+	Average of Enterprises	
Labor Productivity	GPV per MLU (\$)	46.60	147.01	272.68	714.38	488.29
	GP per MLU (\$)	54.48	161.03	287.87	737.83	503.05
	NP per MLU (\$)	12.72	65.51	137.66	399.64	263.53
	GM per MLU (\$)	25.81	92.79	171.65	451.33	308.13
	NP per MLU (\$)	-8.04	14.64	68.33	236.80	148.37
	AI per MLU (\$)	-3.86	50.89	108.26	312.52	180.77
	Number of Tractors per MPU (Number)	0.01	0.02	0.04	0.11	0.08
	Number of Machine Tools per MLU (Number)	0.08	0.17	0.32	1.06	0.76
	Tractor Towing Power per MLU Amount (HP)	0.46	0.97	2.13	6.84	4.87
	Tractor Usage Period per MLU (hour)	0.43	2.04	7.59	55.41	36.56

The family population is of high importance in meeting the need for labor in agricultural enterprises. Because agricultural production is interrupted, the amount of labor required is not always the same. In addition, since family labor wages are treated as fixed costs and enterprisers make production by considering the changing costs, the quantity of family labor in enterprises is very important.

The most used method of determining the productivity of capital use in agricultural enterprises is of invested \$ 1 and the value obtained against the multiples. In terms of meaningful interpretation of the results, the productivity of capital in the study was determined with the production value obtained for the sum of \$ 1 000. In the scope of the study, GPV, GP, NP, GM, NP and AI, which are expressed as revenue in agricultural enterprises, were determined and the amounts of these values were calculated as per \$ 1 000 (Table 4). The amounts of these calculated values per unit capital increase due to the increase in the enterprise scales. In other words, the capital used in the enterprise is used more rationally with the growth of the enterprise scale.

Table 4. Capital productivity by enterprise' size

	0-50	51-100	101-200	201-+	Average of Enterprises
GPV per \$ 1 000 (\$)	12.27	35.08	73.09	167.99	125.19
GP per \$ 1 000 (\$)	14.35	38.43	77.16	173.50	128.98
NP per \$ 1 000 (\$)	3.35	15.63	36.90	93.97	67.57
GM per \$ 1 000 (\$)	6.80	22.14	46.01	106.13	79.00
NP per \$ 1 000 (\$)	-2.12	3.49	18.31	55.68	38.04
AI per \$ 1 000 (\$)	-1.02	12.14	29.02	73.49	46.35
Tractor Value Per \$ 1 000 (\$)	51.29	161.76	398.53	1 254.78	890.87
Machine, Tool Value Per \$ 1 000 (\$)	48.18	122.30	440.96	2 298.99	1 549.61

In terms of capital usage, the tractor and tool machine value per 1 000 \$ were determined in mechanization productivity. The share of these values in unit capital has increased depending on the enterprises scale. Arisoy et al. (2017) in their study in Konya province, they determined that enterprises are economically sustainable without public support as the land width increases. Oguz and Yener (2018), investigated the productivity of dairy cattle farms in Çumra, Karapınar and Ereğli counties. They found that productivity increased due to the increase in the number of animals in the enterprises. Canan and Ceyhan (2016) demonstrated their innovation and change in paddy-producing enterprises in Bafra district in Samsun with total factor productivity. In medium and large enterprises, total factor productivity is higher than small enterprises. The reason for this is that medium and large enterprises adapt to innovation and technology. With the increase in the amount of capital in agricultural enterprises, the productivity of capital and other production factors is increasing. As a matter of fact, technological developments provide ease of substitution between land, labor and capital. This status increases the elasticity of factor-demand (Karacan et al., 2014). The possibilities of substitution that will occur with the use of technology in agriculture are given in the figure. Accordingly, while the other production factors are fixed, the increase in the amount of capital in the land allows for the use of less labor and larger tractors. In case of decrease in the amount of capital, traditional production is made with more labor force. Substitution between capital and labor is never complete. As a matter of fact, it is not possible to produce without labor (Figure 1). Karabacak and Direk (2009) stated in their study that the developments in agricultural production technology will replace the labor force of capital and the demand for labor force will decrease. In addition, they showed that the decrease in the need for labor force would lead to an increase the optimal enterprises size within the framework of the scale economy.

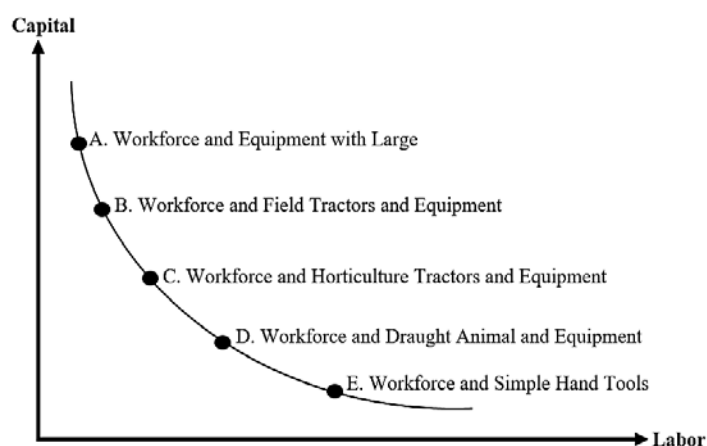


Figure 1. Technological Alternatives in Agriculture (Karacan et al., 2014).

The most important factor limiting production decisions in agricultural enterprises is capital. The inadequacy of capital structures of agricultural enterprises and the fact that production factors such as mechanization require expensive investments limit the use of these inputs. In order to obtain these inputs, the producers turn to external sources of finance and enable their enterprises to benefit from the technologies. Because technological applications are expensive investments, it is important to plan

capital use. The use of more capital than needed increases in depreciation and interest expenses in enterprises, resulting in increased enterprise costs. As a matter of fact, the success of the enterprise can be increased by making appropriate planning in agricultural enterprises.

In Table 5, mechanization productivity is given according to enterprises size groups. In order to be productive in mechanization use in agricultural enterprises, criteria used are tractor working hours, powers (HP), age and annual cost of use. Tractor power (HP) and age directly affect productivity in production. With the increase in tractor power, more work can be done per unit time and the productivity of the equipment's used can be increasing. In addition, being the high of tractor draw power in hard topographic conditions enables the production to be carried out with mechanization. For this reason, there must be a linear relationship between the towing power of the tractor to be purchased and the amount of land to be processed. The tractor can remain idle only if the tractors with higher traction are preferred without considering the land scale and topographical conditions. In this case, interest and depreciation costs of the enterprise are increasing.

Table 5. Mechanization productivity by enterprise' size

		0-50	51-100	101-200	201+	Average of Enterprises
Mechanization Productivity	Average Working Hours (hours)	51.39	120.45	240.65	528.93	398.19
	GPV/Working hours (\$)	238.80	291.24	303.72	317.60	314.40
	Agricultural Income / Working Hours (\$)	-19.79	100.82	120.58	138.94	116.39
Mechanization Productivity by Tractor Power	Average Tractor Power (HP)	54.33	57.36	61.48	67.37	64.35
	GPV / Tractor Power (\$)	225.86	611.56	1 188.87	2 493.38	1 945.64
	Agricultural Income / Tractor Power (\$)	-18.72	211.71	471.99	1 090.77	720.27
Mechanization Productivity according to tractor age	Average Tractor Age	13.33	12.45	10.91	10.09	10.69
	GPV/ Tractor Age (\$)	920.39	2 816.76	6 697.47	16 649.58	11 709.54
	Agricultural Income (AI) / Tractor Age	-76.27	975.10	2 658.94	7 283.63	4 334.87
Mechanization Productivity according to The Annual Utilization Cost	Average Annual Enterprise Cost of the Tractor Utilization	2 361.83	4 195.35	5 629.44	8 016.54	6 793.51
	Annual Costs According to Enterprise Working Hours (\$)	45.96	34.83	23.39	15.16	20.68
	Share in Enterprise Costs (%)	21.47	18.41	13.98	10.08	12.41
	According to Tractor Power / Annual Cost of Use (\$)	43.47	73.14	91.57	118.99	105.58

It was determined that the working hours of tractors increased in the investigated enterprises in parallel with the enterprise scale. As a result of this situation, an increase was observed in GPV and AI. The annual working hours of tractors in Turkey are average 500-550 hours (Tarmakbir, 2018). Therefore, it is seen that only large enterprises use their tractors rationally. In other enterprises, tractors remain idle and this raises enterprise costs.

Another indicator of the mechanization productivity is the age of the tractors used. The age of the tractors is important in terms of cost and time. Although it is not possible to use the old tractor efficiently, these tractors bring additional costs to the enterprises in fuel consumption and maintenance costs are very high. As a result of the aging of a tractor, an average of 700 L of fuel and an average of 100 hours of work loss occurs. Repair and maintenance costs are approximately \$ 735.29. These factors' costs to enterprises is higher than \$ 3 676.47 (Yalçın et al., 2007). In addition, the use of elderly tractors adversely affects human health. In European countries, 69% of tractor accidents occurred with tractors older than 12 years (Tarmakbir, 2018). In Table 5, as the enterprise size increases, the tractor age decreases and in parallel with the enterprise size, young tractors are used more efficiently. The economic life of a tractor is 10 000-12 000 hours in international standards and the average annual working time in Turkey is 500-550 hours. According to these values, the maximum life of a tractor in Turkey is 24 years. This situation reveals that the tractors in the investigated enterprises are below average and that they have tractors that can be used.

The last criterion of mechanization productivity is annual cost of use, and the best criterion for productivity is this. In the sub-components of this criterion, the average tractor usage cost is included. In addition, the share of this cost in the enterprise costs was calculated according to the working hours and tractor power. According to the results obtained, the usage time of the tractor increases with the increase in the scale of the enterprise and accordingly the usage cost increases. However, it is necessary to pay attention to the cost of tractor usage per hour. According to the table, per unit hours the usage cost of the tractor decreasing while the increasing of the scale of the enterprise. This also applies to

enterprise costs. The share of the use cost of tractors in enterprises costs decreases with the increase of the enterprises scale. Because tractors are strong and new in the investigated enterprises, the costs of tractor use are inversely proportional to the working hours. As the enterprise scale increases, the cost of tractor use per unit tractor power increases as well. This allows more land to be processed depending on the tractor's towing power.

4. Conclusion

Small and fragmented agricultural lands in Turkey restricts the use of mechanization in agriculture. This complicates the choice and acquisition of mechanization. As a matter of fact, the fact that the land is small and fragmented prevents the decrease in income and the use of mechanization due to the physical properties of the land. This situation causes a decrease in productivity in agricultural production. The mechanization used to ensure productivity should increase profitability in enterprise. As a result of the study, as the size of the land increases, the productivity of the mechanization used increases and profitability increases. In addition, there is productivity in the use of labor force and capital, and it is determined that the production factors are used rationally in parallel with the growth of the enterprise scale.

In line with the results obtained, the use of high-tech mechanization tools and equipment is recommended in agriculture in Turkey. Since the cost of these equipment is high and the capital structure of agricultural enterprises of Turkey is not at the level to meet these equipment, new strategies need to be developed. This strategy is "Cooperation in Machine Use Models". With this development model, there will be no investment costs of the machines. In addition, with the renewal of mechanization tools and equipment's in a short time, the latest technologies will be used in the enterprises. With "Cooperation in Machine Use" mechanization costs will be minimized and high depreciation and interest costs in fixed capital will be reduced. Reduction of costs, technological developments will increase profitability in enterprises.

The development model, expressed as Cooperation in Machine Use, has started to be implemented in the 2000s and the first examples have failed for various reasons. However, the organization called CUMA in France increased the use of tractor 2.5 times and increased it to 1 000 hours. In recent years, necessary attention has been given to this issue in Turkey. Among the successful examples;

- "Cooperation in Machine Usage Park Project" Of Suruç District Governorship,
- Bayburt Provincial Directorate of Agriculture and Forestry for the use of common machinery Park Formation,
- The work of the Association of cattle breeding in Amasya to exploit the equipment's in the Cooperation in Machine Park at low cost to the producers is located.

Recently, applications for "Cooperation in Machine Use" are not enough against the increase. To increase the use of common machinery.

- Enterprise width, production patterns, irrigation facilities, labor supply and existing mechanization levels should be established.
- It should be explained that the product diversity and productivity increase will be provided to the producers with the use of mechanization.
- The number of institutions / organizations that can offer "Cooperation in Machine Park" to producers should be increased and these institutions / organizations should be introduced to producers.
- Producers should be given the ability to act together and cooperation should be ensured between them.

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