



AN INVESTIGATION OF CURRENT STATUS OF AGRICULTURAL MECHANIZATION SERVICES IN IRAQ AND FUTURE SUGGESTIONS

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ABSTRACT

The use of mechanization in different agricultural production processes lead to occurrence of latent changes in agriculture like quantity increase and quality of farm products, decrease of production costs and increase of cultivated areas. The agricultural mechanization services in Iraq have notably improved since the 1960s, and this can mainly account for the rise in agricultural production and productivity nationwide. However, the investment of Iraqi government in aspect of agricultural mechanization did not play its role required in increasing the farming areas and development the production and productivity levels of different agricultural crops. This investigation tries to identify the current status of agricultural mechanization services and view the important obstacles that led to non-expand the agricultural mechanization services in Iraq. The economic analysis based on descriptive statistics (frequency and percentage) and measure of annual growth rates by estimating the half-logarithmic regression equation. Results indicated that the agricultural mechanization for cereal crops production has been the most impressive to use in Iraq. Northern provinces of the country are the highest mechanized region during 2015 year. The largest percentage of tractors, irrigation sprayers and water pumps services was concentrated in Salahaddin province by 14.71%, 44.47% and 19% respectively, while the biggest percentage of harvester's services was focused in Nineveh province by 31.63%. Usage rates of agricultural tractors and harvesters of cereal crops areas have increased during the study period compared with standard needs; on an average there are 52 hectares per one tractor and 601 hectares per one harvester. Out of four main agricultural mechanization services in Iraq, the agricultural water pumps service occupies the first rank with ratio 91% to be provided by local markets followed by agricultural tractors service (86%), agricultural harvesters service (82%), and agricultural irrigation sprayers service (46%). Currently there are two types of utilizing agricultural machinery: as an owner (30%) or through custom hiring service (70%). Results also indicated that there is decreasing in agricultural mechanization services (tractors and harvesters) in Iraq. Annual growth rate of tractors services is negative and it becomes 0.7% for period (2000-2017). Similarly, the annual growth rate of harvester's services is negative and it becomes 0.1% for the same period. The failure in managing the agricultural machineries and lack of scientific studies related to the agricultural mechanization in Iraq are considered the more important reasons of this result. Lack of labor and necessity to lower cost of production in Iraqi agriculture make agricultural mechanization services a predictable solution in the present agricultural countryside. In light of this result, some future suggestions are formulated to develop the current status of the agricultural mechanization in Iraq. It is expected that the use of agricultural machinery services will increase in coming years if the Iraqi government takes the greater responsibility to achieve these suggestions.

Keywords: agricultural mechanization, current status, annual growth rates, future suggestions, Iraq.

INTRODUCTION

Agriculture in Iraq is one of the main sectors of the national economy, primarily because of its leading role as a major contributor to the GNP of Iraq. It also employs a significant segment of whole labour force of the Iraqi economy at about 28%. Agriculture is also a source of income for a large segment of Iraqi society; with many people involved in agriculture living in the countryside and making up more than 35% of the Iraqi population [16].

Following the events of 2003, the agricultural sector in Iraq has suffered from low government funding due to security conditions in the country, and this has negatively affected even the basic activities of the agricultural sector. The sector faced several other drawbacks, including the Iraqi economy heavy reliance on the oil sector as a unique source of wealth. However, many have failed to realize that agriculture is still an essential source of living for a large segment of the Iraqi population, many of whom are rural residents [9]. One of

the principal causes of poverty is the shortage of farm power (labour-saving tools and equipment and mechanized power). Such a situation faced by Iraqi farmers may lead to a significant decline in farm production [7].

Farm mechanization is a wide term, and it involves the use of small or big machineries, that may be moveable or fixed. Mechanization is often perceived as an activity run by power, such as those used for plowing jobs, harvesting and whipping processes. In addition, farm mechanization comprises power tractors for irrigation, lorries for hauling the crops of farm, handling machines, dairy machines for balm splitting, butter making, cotton ginning, rice hulling and even different electrical home machines (i.e., citing G. D. Aggarwal's words). The benefits of mechanization in agriculture can be summarized from the works of Wander [22], Asoegwu [6] and Al-Tahan [2]:



- a) The possibility of bringing a fresh product shape, that could not have been produced through the customary methods,
- b) Decreased unit production cost of work,
- c) Expansion of cultivated areas,
- d) Increased efficiency and decreased farm loss,
- e) Improved quality of farm products,
- f) Increased unit production (i.e., higher land-income ratio),
- g) Efficient use of areas for fodder production,
- h) Efficient use of other yield-improving inputs,
- i) Rapid completion of agricultural operations to save time and effort, and
- j) Notable change in the social structure in rural regions

Technological progress is one of the main indicators of commercial, community and cultural development. For many states, technological progress is an important indicator of economic progress at the forefront of agricultural development. In the agricultural sector, technological progress takes numerous forms and it can even be personalized depending on the level of work skill (i.e., combining the technical and economic requirements of using tractors, combine harvesters and other agricultural equipment). The use of machinery in different agricultural production processes has led to the occurrence of latent changes in agriculture like quantity increase and quality of farm products, decrease of farm production costs and increase of cultivated areas, and the degree of technological progress of any country usually depends on the extent of mechanization that is used in this country [8]. The agricultural mechanization services in Iraq have notably improved since the 1960s, and this can mainly account for the rise in agricultural production and productivity nationwide. In the past, Iraq depended on imported machinery from different sources and the local production of tractors for use in agricultural mechanization services. The Iraqi government has imported agricultural machinery (tractors and harvesters) mostly from Arab countries like Algeria and Egypt due to their increased production. Agricultural machines are then distributed from a warehouse network to cereal crop (wheat, barley and rice) farmers, who used to sell their crops at low prices. This approach highlights the economic importance of acquiring agricultural machinery to achieve crop cultivation and national food security on a large scale [1].

However, the machines were not imported solely on the basis of scientific fundamentals and studies; rather, they were introduced to be used in field experiments but thus sector has slowly grown to technologically dominate agricultural activities. In addition, the Iraqi government has not been successful with investments in agricultural mechanization and in supporting cereal crop farmers, particularly to increase their production and productivity levels. The past two decades were also characterized by several obstacles, which hindered the widespread use of agricultural mechanization services and the resulted in the failure to perform its role to increase the cultivated areas with cereal crops and to develop the production and productivity levels. In light of these conditions, the

commercial benefits of imported machinery have been transferred to the national administrations and organizations whereby the exclusive sector was included in the distribution process. Existing statistics indicate that 33% of ranchers have purchased equipment and machinery from the national organizations and 67% from the local markets [20].

Although agricultural mechanization services are considered to be very active and important element in agriculture, their number and use have not reached the required level in terms of increasing the production and productivity level of cereal crops, and the volume of agricultural mechanization services has decreased in recent years significantly and influential. Despite the economic role of agricultural mechanization services, existing some obstacles and problems in Iraqi agriculture lead to decrease their number and use in Iraq. The main objective of this research is to investigate the current status of agricultural mechanization services in Iraq and formulate the future suggestions that would develop the reality of the agricultural mechanization in Iraq.

LITERATURE REVIEW

Agricultural mechanization issues in Iraq have been addressed by several researchers, but few of them focused on study of the present status and future outlook. Among well-known issues are: the study entitled “agricultural mechanization economics and their role in development the agriculture in Iraq” [5], the study entitled “the reality and scope of development of agricultural mechanization in Iraq” [10], the study entitled “development of using of agricultural combine harvesters and tractors in Iraq (1990-1999)” [18], the study entitled “study of developing of using agricultural tractors in Iraq: Present and Future” [12], the study entitled “use of combine harvesters in Iraq: reality and prospects” [1], and the study entitled “an analysis of investment in main agricultural machinery and equipment in Iraq for the period (1980- 2009)” [20]. All these studies based on descriptive analysis (frequency and percentage) to describe the status of agricultural mechanization in Iraq. In addition, the results of studies indicated that in spite of agricultural mechanization services have been used in Iraq for a long time- as a main factor in increasing the agricultural production- the number of working agricultural mechanization (tractors and harvesters) is still few compared to developed countries and has not contributed in increasing the cultivated areas and the average production of unit farm.

MATERIALS AND METHODS

Status of Agricultural Mechanization Services in Iraq

The development of any country is measured by the degree of mechanization. Subsequently, agricultural operation improvements, namely, the production of a particular crop, depends on the level of agricultural mechanization used for production [21]. The following sections describe progresses made for the agricultural



mechanization services in Iraq and their role in agricultural operations.

Progress of Agricultural Machinery Services for Period (2000-2017)

The increase in the number of working machines in Iraq (Refer to Table-1 & Figure-1) has largely contributed to agricultural improvements in land

preparation and harvesting production. With increased efficiency, primitive methods of agriculture have been replaced by modern agricultural methods. The required agricultural development plans and technical know-how for agricultural production machinery have been implemented in tandem with raising the cultural, educational and professional levels of the agricultural community [12].

Table-1. Number of Tractors and Harvesters in Iraq (2000 – 2017).

Years	No. of Tractors	No. of Harvesters	Cultivated Areas with Cereal Crops/Hectare	Usage Rates of Tractors*	Usage Rates of Harvesters*
2000	59,512	5,775	1,737,250.00	29.19	300.82
2001	59,512	5,902	1,966,000.00	33.04	333.11
2002	63,056	6,079	2,878,500.00	45.65	473.52
2003	63,541	6,155	2,872,500.00	45.21	466.69
2004	63,717	6,155	2,795,250.00	43.87	454.14
2005	64,427	6,205	2,967,250.00	46.06	478.20
2006	64,600	6,205	2,851,500.00	44.14	459.55
2007	56,172	3,646	2,969,500.00	52.86	814.45
2008	57,918	2,373	3,022,000.00	52.18	1,273.49
2009	57,918	2,373	2,162,250.00	37.33	911.19
2010	68,777	4,966	2,595,000.00	37.73	522.55
2011	70,316	8,650	4,050,000.00	57.60	468.21
2012	70,540	8,823	4,114,250.00	58.33	466.31
2013	69,770	7,113	4,297,500.00	61.60	604.18
2014	48,344	5,300	3,582,500.00	74.10	675.94
2015	50,018	5,270	3,650,000.00	72.97	692.60
2016	54,000	5,200	3,720,000.00	68.88	715.38
2017	54,200	5,240	3,684,000.00	67.97	703.05
Average	60,908	5,635	3,106,403	52	601
Std. Deviation	6,776	1,701	735,601	14	233

* Usage rate (tractor or harvester) = Cultivated area with cereal crops (hectare) ÷ Number of tractors or harvesters.

Source: Ministry of Agriculture-Iraq, 2015

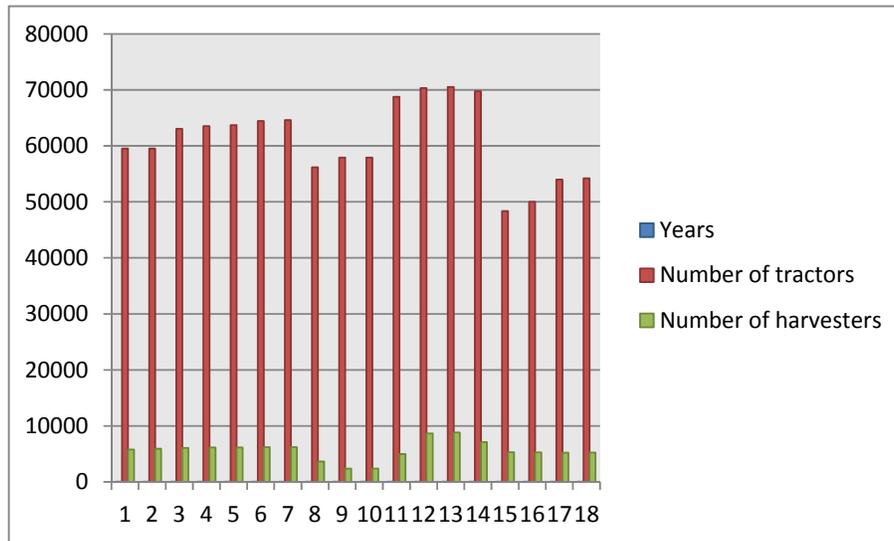


Figure-1. Number of Working Tractors and Harvesters in Iraq (2000–2017).

Despite the numerical increase in tractors and combine harvesters, Iraq still suffered from a shortage of machinery services. Current statistics indicate that the machine requirements to plant 117,254 and 19,005 grains are 55,495 tractors and 13,338 combine harvesters, respectively [4].

Agricultural Machinery Services at Level of Iraqi Provinces in 2015

Iraq includes three major parts which are northern, central and southern part, and it consists of fifteen (15) provinces. At present, machinery services for the agricultural sector can be divided into five types: tractors, combine harvesters, services of new irrigation sprayers, pumps of irrigation water and other services.

a) Tractor Services

Tractor is the basic input used to determine the impact of tractors and allied machinery and equipment on agricultural machinery services. The number of tractors has rapidly increased at the provincial level. About 80% of operating tractors are concentrated in Nineveh, Kirkuk, Salahaddin, Diyala, Anbar, Baghdad and Babil (Table-2). As of 2015, the total number of agricultural tractors among 15 Iraqi provinces was 57,087. Of this number, 88% (50,018 tractors) were operational, whereas the remaining 12% (7,069 tractors) were not working. The largest number of tractors was in Salahaddin with 8,400 tractors (14.7%), whereas Basra ranked lowest with 145 tractors (0.25%). Table-2 and Figure-2 present the percentages of tractors for each province as of 2015.

**Table-2.** Number of Tractors per Province (2015).

No.	Iraqi Province	Number of Tractors		Total Tractors	Percentage (%)
		Working	Non-Working		
1.	Nineveh	5,194	435	5,629	9.86
2.	Kirkuk	7,579	716	8,295	14.53
3.	Diyala	6,118	1,377	7,495	13.13
4.	Salahaddin	7,148	1,252	8,400	14.71
5.	Anbar	3,485	1,000	4,485	7.86
6.	Baghdad	5,119	545	5,664	9.92
7.	Wasit	2,968	200	3,168	5.55
8.	Babil	4,952	720	5,672	9.94
9.	Karbala	322	43	365	0.64
10.	Alnajaf	3,108	70	3,178	5.57
11.	Aldiwaniyah	2,073	164	2,237	3.92
12.	Almuthanna	264	59	323	0.57
13.	Dhi Qar	493	171	664	1.16
14.	Maysan	1,094	273	1,367	2.39
15.	Basra	101	44	145	0.25
Total		50,018	7,069	57,087	100%
(%)		(88%)	(12%)	(100%)	

Source: Ministry of Agriculture-Iraq, 2015

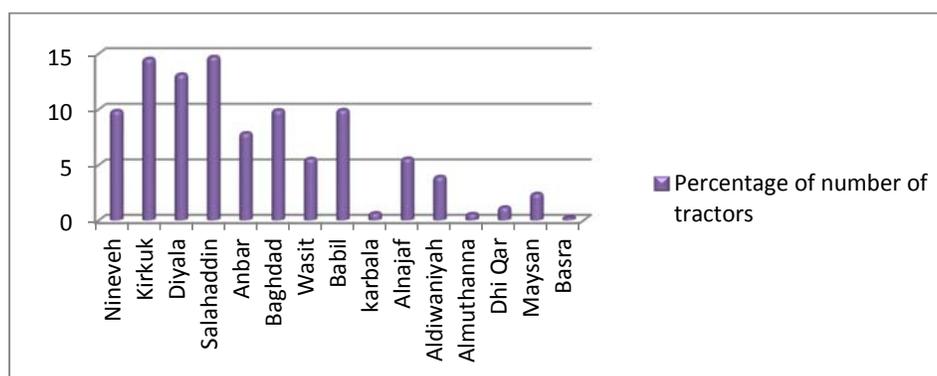
**Figure-2.** Percentage of Tractors per Province (2015).

Table-3 explains the number of agricultural tractors provided according to the provision source in the country. The total number of tractors provided by Iraqi

government is 7809 with ratio 14%, while the total number of tractors provided by local markets is 49278 with ratio 86%.

**Table-3.** Distribution of Tractors Number According To Providing Sources per Province (2015).

No.	Iraqi Province	Total Tractors	Number of Tractors Provided by Government	Number of Tractors Provided by Market
1.	Nineveh	5,629	955	4674
2.	Kirkuk	8,295	1663	6632
3.	Diyala	7,495	2026	5469
4.	Salahaddin	8,400	887	7513
5.	Anbar	4,485	198	4287
6.	Baghdad	5,664	413	5251
7.	Wasit	3,168	452	2716
8.	Babil	5,672	425	5247
9.	Karbala	365	89	276
10.	Alnajaf	3,178	331	2847
11.	Aldiwaniyah	2,237	177	2060
12.	Almuthanna	323	48	275
13.	Dhi Qar	664	60	604
14.	Maysan	1,367	56	1311
15.	Basra	145	29	116
Total		57,087	7809	49278
(%)			14%	86%

Source: Ministry of Planning and Development Cooperation -Iraq, 2016

b) Combine Harvester Services

The introduction of combine harvesters in Iraq was a technical revolution to rural respondents [18]. Combine harvesters offer significant time-saving advantages and they are less burdensome to use compared to traditional primitive methods of harvesting, threshing, winnowing and packing. In addition, combine harvesters

increase the operational efficiency of harvesting operations, as well as reduce economic losses, which are reflected positively in the increased economic returns for Iraqi farmers. The majority (84%) of the operating harvesters in Iraq were concentrated in Nineveh, Kirkuk, Salahaddin, Diyala, Wasit, Alnajaf and Aldiwaniyah (Table-4).

**Table-4.** Number of Harvesters per Province (2015).

No.	Iraqi Province	Number of Harvesters		Total Harvesters	Percentage (%)
		Working	Non-Working		
1.	Nineveh	1,691	101	1,792	31.63
2.	Kirkuk	563	49	612	10.80
3.	Diyala	433	29	462	8.15
4.	Salahaddin	587	86	673	11.88
5.	Anbar	155	18	173	3.05
6.	Baghdad	151	15	166	2.93
7.	Wasit	400	16	416	7.34
8.	Babil	215	-	215	3.79
9.	Karbala	4	2	6	0.11
10.	Alnajaf	450	20	470	8.30
11.	Aldiwaniyah	300	7	307	5.42
12.	Almuthanna	17	4	21	0.37
13.	Dhi Qar	84	12	96	1.69
14.	Maysan	212	32	244	4.31
15.	Basra	8	5	13	0.23
Total		5,270	396	5,666	100%
(%)		(93%)	(7%)	(100%)	

Source: Ministry of Agriculture-Iraq, 2015

As of 2015, the total number of harvesters in 15 Iraqi provinces was 5,666, but only 93% (5,270 harvesters) were operational, whereas the other 7% (396 harvesters) were non-operational. As shown in Table 4, as of 2015, Nineveh had the highest number of harvesters

(1,792 / 32%), whereas Karbala ranked lowest with only six harvesters (0.11%).

Figure-3 presents the percentage of combine harvesters allocated to each of the 15 provinces in Iraq as of 2015.

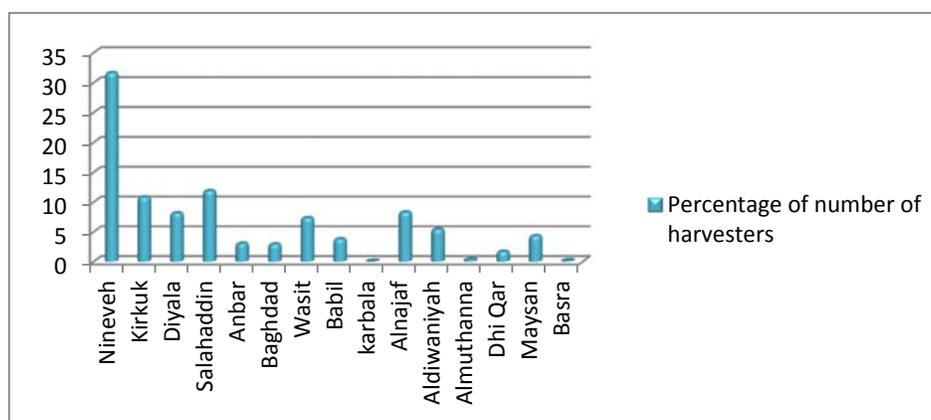
**Figure-3.** Percentage of Harvesters per Province (2015).

Table-5 explains the number of agricultural harvesters provided according to the provision source in the country. The total number of harvesters provided by

Iraqi government is 1025 with ratio 18%, while the total number of harvesters provided by local markets is 4641 with ratio 82%.

**Table-5.** Distribution of Harvesters Number According To Providing Sources per Province (2015).

No.	Iraqi Province	Total Harvesters	Number of Harvesters Provided by Government	Number of Harvesters Provided by Market
1.	Nineveh	1,792	358	1434
2.	Kirkuk	612	156	456
3.	Diyala	462	118	344
4.	Salahaddin	673	115	558
5.	Anbar	173	14	159
6.	Baghdad	166	32	134
7.	Wasit	416	58	358
8.	Babil	215	52	163
9.	Karbala	6	2	4
10.	Alnajaf	470	34	436
11.	Aldiwaniyah	307	37	270
12.	Almuthanna	21	-	21
13.	Dhi Qar	96	12	84
14.	Maysan	244	31	213
15.	Basra	13	6	7
Total		5,666	1025	4641
(%)			18%	82%

Source: Ministry of Planning and Development Cooperation -Iraq, 2016

c) Modern Irrigation System Services

As for modern irrigation sprayers, 93% were concentrated in Nineveh, Kirkuk, Salahaddin and Anbar (Table-6). The total number of modern irrigation sprayers for the 15 Iraqi provinces was 7,916, of which 92% (7,206 systems) were operational, whereas 8% (620 systems)

were non-operational. The largest number of irrigation sprayers was in Salahaddin with 3,520 systems (44.47%), whereas Dhi Qar ranked lowest with three systems (0.04%). Table-6 and Figure-4 present the percentages of modern irrigation systems in each Iraqi province as of 2015.

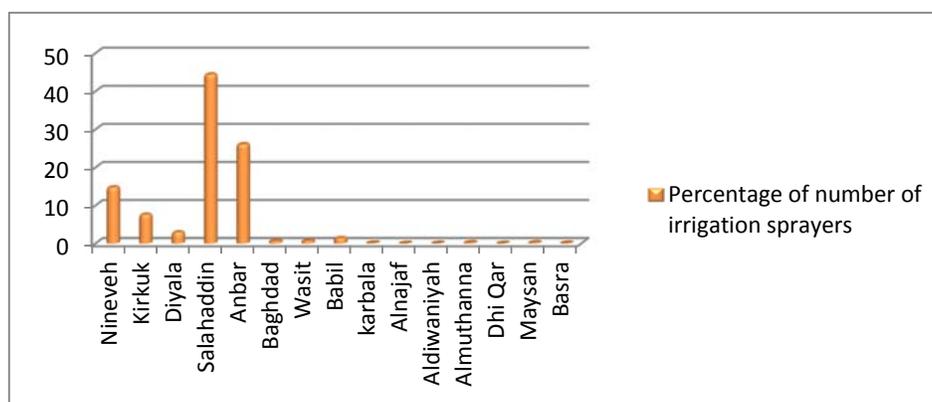
**Table-6.** Number of Modern Irrigation Sprayers per Province (2015).

No.	Iraqi Province	Number of Irrigation Sprayers		Total Irrigation Sprayers	Percentage (%)
		Working	Non-Working		
1.	Nineveh	960.00	214.00	1,174.00	14.83
2.	Kirkuk	601.00	3.00	604.00	7.63
3.	Diyala	196.00	40.00	236.00	2.98
4.	Salahaddin	3,480.00	40.00	3,520.00	44.47
5.	Anbar	1,866.00	205.00	2,071.00	26.16
6.	Baghdad	19.00	33.00	52.00	0.66
7.	Wasit	19.00	38.00	57.00	0.72
8.	Babil	107.00	8.00	115.00	1.45
9.	Karbala	14.00	1.00	15.00	0.19
10.	Alnajaf	3.00	1.00	4.00	0.05
11.	Aldiwaniyah	5.00	2.00	7.00	0.09
12.	Almuthanna	20.00	3.00	23.00	0.29
13.	Dhi Qar	2.00	1.00	3.00	0.04
14.	Maysan	0.00	24.00	24.00	0.30
15.	Basra	4.00	7.00	11.00	0.14
Total		7,296	620	7,916	100%
(%)		(92%)	(8%)	(100%)	

Source: Ministry of Agriculture-Iraq, 2015

Table-7 explains the number of agricultural irrigation sprayers provided according to the provision source in the country. The total number of irrigation

sprayers provided by Iraqi government is 4292 with ratio 54%, while the total number of irrigation sprayers provided by local markets is 3624 with ratio 46%.

**Figure-4.** Percentage of Modern Irrigation Sprayers per Province (2015).

**Table-7.** Distribution of Modern Irrigation Sprayers Number According To Providing Sources per Province (2015)

No.	Iraqi Province	Total Irrigation Sprayers	Number of Irrigation Sprayers Provided by Government	Number of Irrigation Sprayers Provided by Market
1.	Nineveh	1,174.00	867.00	307.00
2.	Kirkuk	604.00	450.00	154.00
3.	Diyala	236.00	225.00	11.00
4.	Salahaddin	3,520.00	1251.00	2269.00
5.	Anbar	2,071.00	1240.00	831.00
6.	Baghdad	52.00	46.00	6.00
7.	Wasit	57.00	57.00	0.00
8.	Babil	115.00	76.00	39.00
9.	Karbala	15.00	14.00	1.00
10.	Alnajaf	4.00	4.00	0.00
11.	Aldiwaniyah	7.00	6.00	1.00
12.	Almuthanna	23.00	23.00	0.00
13.	Dhi Qar	3.00	3.00	0.00
14.	Maysan	24.00	24.00	0.00
15.	Basra	11.00	6.00	5.00
Total		7,916	4292	3624
(%)			54%	46%

Source: Ministry of Planning and Development Cooperation -Iraq, 2016

d) Irrigation Water Pumps Services

With respect to the irrigation water pumps services, more half of service (68%) was focused in Kirkuk, Salahaddin, Anbar, Babil, Alnajaf and Basra (Table-8). The total number of irrigation water pumps for the 15 Iraqi provinces was 179,788, of which 942%

(168,681) were operational, whereas 6% (11, 107) were non-operational. The largest number of irrigation water pumps was in Salahaddin with 34, 145 pumps (19%), whereas Almuthanna lowest with 2, 356 pumps (1.3%). Table-8 and Figure-5 present the percentages of irrigation water pumps in each Iraqi province as of 2015.

**Table-8.** Number of Irrigation Water Pumps per Province (2015).

No.	Iraqi Province	Number of Water Pumps		Total Water Pumps	Percentage (%)
		Working	Non-Working		
1.	Nineveh	8,842	864	9,706	5.4
2.	Kirkuk	11,265	1,580	12,845	7.1
3.	Diyala	7,635	348	7,983	4.4
4.	Salahaddin	33,298	847	34,145	19
5.	Anbar	13,981	905	14,886	8.3
6.	Baghdad	6,292	766	7,058	3.9
7.	Wasit	5,734	695	6,429	3.6
8.	Babil	22,558	1,385	23,943	13.3
9.	Karbala	3,041	31	3,072	1.7
10.	Alnajaf	21,242	965	22,207	12.4
11.	Aldiwaniyah	6,090	25	6,115	3.4
12.	Almuthanna	2,271	85	2,356	1.3
13.	Dhi Qar	7,513	941	8,454	4.7
14.	Maysan	6,490	131	6,621	3.7
15.	Basra	12,429	1,539	13,968	7.8
Total		168,681	11,107	179,788	100%
(%)		(94%)	(6%)	(100%)	

Source: Ministry of Agriculture-Iraq, 2015

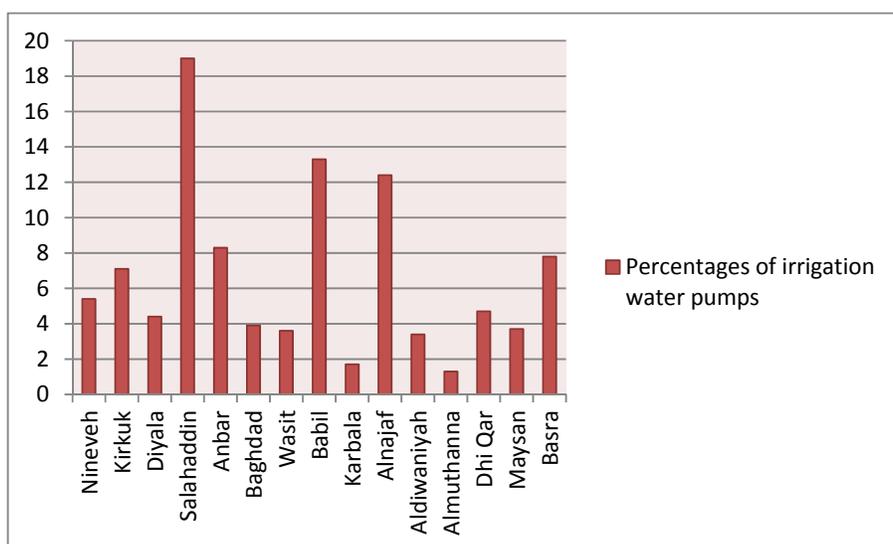
**Figure-5.** Percentage of Irrigation Water Pumps per Province (2015).

Table-9 explains the number of agricultural water pumps provided according to the provision source in the country. The total number of water pumps provided by

Iraqi government is 16524 with ratio 9%, while the total number of water pumps provided by local markets is 163264 with ratio 91%.

**Table-9.** Distribution of Irrigation Water Pumps Number According To Providing Sources per Province (2015).

No.	Iraqi Province	Total Water Pumps	Number of Water Pumps Provided by Government	Number of Water Pumps Provided by Market
1.	Nineveh	9,706	2755	6951
2.	Kirkuk	12,845	2873	9972
3.	Diyala	7,983	993	6990
4.	Salahaddin	34,145	211	33934
5.	Anbar	14,886	1743	13143
6.	Baghdad	7,058	782	6276
7.	Wasit	6,429	726	5703
8.	Babil	23,943	3146	20797
9.	Karbala	3,072	72	3000
10.	Alnajaf	22,207	-	22207
11.	Aldiwaniyah	6,115	51	6064
12.	Almuthanna	2,356	13	2343
13.	Dhi Qar	8,454	895	7559
14.	Maysan	6,621	666	5955
15.	Basra	13,968	1598	12370
Total		179,788	16524	163264
(%)			9%	91%

Source: Ministry of Planning and Development Cooperation -Iraq, 2016

e) Other Agricultural Machinery Services

In Iraq, agricultural machinery is not only limited to tractors, combine harvesters, water pumps and modern irrigation systems. Other equipment and machinery are used to prepare the land for agriculture such as ploughs, shredding machines, spades, trucks, shovels, settling machines (i.e., to loosen soil), drills for seed tillage and other equipment for seeding and planting. For crop servicing and vegetable production, the commonly used tools and equipment are air hoes, sapling machines for chemical and organic composts and mechanical farm sprayers for poisons and pest control. At present, available services are limited to national farming only, and not at the levels of provinces [4].

Custom Hiring of Agricultural Mechanization Services in Iraq

Prior to the 1950s, hiring was widely used in the real estate sector. Throughout the middles of the 20th century, many have proposed the concept of rent as a step towards possessing various types of fixed assets. Hiring or leasehold is a contract wherein a renter (lessee) delivers payment on an agreed-upon deadline to a landlord (lessor) for an asset utilized by the renter or for the services provided by the landlord over a particular period [19].

In the context of agricultural services, most small-scale farmers of cereal crops who cultivate less than three hectares of land could not use the agricultural

machinery imported by the Iraqi government for the following reasons [3]:

- a) **Small farm size:** Machines are economical and effective when used on large farms. When used in small farm plots, the cost of operating these machines is relatively high.
- b) **Lack of spare parts:** Small-sized farms in Iraq often suffer from lack of machine spare parts, face problems with machines unsuitable for agricultural work conditions and power shortages. Most agricultural machines were imported from other countries at high cost, similar to the case of spare parts.
- c) **Limited knowledge of farmers and local service providers:** Machines ultimately need to be repaired, which expectedly cannot be done by a small farmer. Operating and repairing imported agricultural machinery require specialize knowledge, which implies the farmers should be professionalized. Workshops for repair services and facility maintenance are approached to raise the knowledge of farmers.

The aforementioned limitations have led numerous cereal crop farmers, many of whom are rice farmers, to make a hiring option and seek the private sector in the country to hire agricultural machinery



services. Moreover, admission to suitable mechanization services was constrained by a particular agricultural condition faced by each province. Current estimates indicate that only 30% of the farmers operate their own equipment, whereas 70% hire contractors to undertake harvesting and seedbed preparation [20].

April 2003 marked the milestone date when the private sector began to exclusively service the farmers from southern and central Iraq on a neighbor-to-neighbor basis. However, several present-day issues have been noted, such as the informal hiring approach in the service sector, as well as the acquisition of low-quality machine spare parts. Hiring services that were mainly based on

rancher-to-rancher contracts were seldom on a personal basis [9].

Custom hire of agricultural mechanization services is an important practice in most Iraqi provinces. The option of whether to own a machine or custom hire the service depends on the costs involved, the skills needed and the amount of works to be done. For machine that will be used very little, it is often more economical to hire the work done on a custom basis. Table-10 shows various prices of custom hire for different types of agricultural field machinery of Iraqi provinces during 2015 planting season.

Table-10. Prices of Custom Hire for Different Agricultural Field Machinery.

Field Machinery	Custom Rate of Tractor Services	Custom Rate of Sprayer Services	Custom Rate of Harvester Services
Custom Rate: \$US/Hectare	112	12.80	272

Source: Ministry of planning-Iraq, 2015

Above table indicates that rates of custom hire in Iraqi provinces of each of tractor and machinery of soil preparation, farm sprayer and combine harvester services were \$US 112, 12.80, 272 per hectare respectively. The high cost of rice combine harvester services hire belongs to the high investment value of this machinery. Figure-6 explains the ratios of prices rates for hiring main agricultural field machinery in Iraqi provinces.

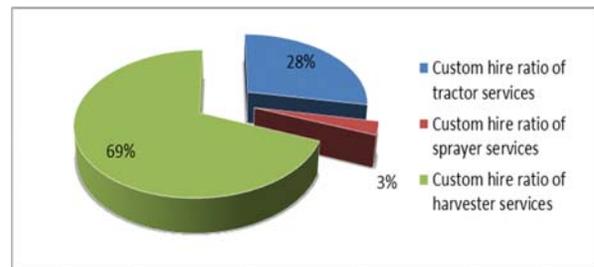


Figure-6. Ratios of Custom Hire Prices of Agricultural Machinery.

RESULTS AND DISCUSSIONS

Measure of Annual Growth Rates of Agricultural Machineries in Iraq

By using the half-logarithmic format of simple regression equation, the annual growth rates of main agricultural machineries (tractors and harvesters) were estimated and the results of analysis are shown in the following tables:

a) Annual Growth Rate of Agricultural Tractors Services in Iraq

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.076	.055		202.970	.000
	Time	-.007	.005	-.319	-1.348	.197

a. Dependent Variable: LNY (Number of Tractors).



b) Annual Growth Rate of Agricultural Harvesters Services in Iraq

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	8.591	.180		47.625	.000
	Time	-.001	.017	-.011	-.043	.966

a. Dependent Variable: LNY (Number of Harvesters).

The results as can be seen in above tables, the annual growth rate of number of agricultural tractors in Iraq is negative and it becomes 0.7% for period (2000-2017). Similarly, the annual growth rate of number of agricultural harvesters is negative and it becomes 0.1% for the same period. These results refer to the significant shortage of tractors and harvesters services in Iraq for period (2000-2017). In other words there is a low level of employment of mechanical power in planting and production of cereal crops.

Reasons of shortage of Agricultural Mechanization Services in Iraq

In spite of the available of arable areas for agriculture that are estimated by 12.905 million hectares and the fuel for operating of different agricultural mechanization services, the use of agricultural mechanization in Iraq is still low compared to other countries. This maybe belongs to the following reasons [10], [11] & [13]:

- Continuing on the methods of random and inherited cultivation which are not suitable for using mechanization to serve agricultural crops.
- Lack of expertise in the maintenance and operation of machines used in the service of agricultural crops.
- Lack of interest in the development of the machinery industry used in the service of agricultural crops.
- Lack of ability to manage the machines used in the service of agricultural crops.
- The irregular distribution of agricultural holdings, which led to the non-use of agricultural machineries economically.
- Lack of optimal utilization of the mechanization power used in the service of agricultural crops.
- Lack of scientific research and studies related to the agricultural mechanization in Iraq.

FUTURE SUGGESTIONS FOR AGRICULTURAL MECHANIZATION IN IRAQ

The lack of labor and necessity to lower cost of production in Iraqi agriculture make agricultural mechanization services a predictable solution in the present agricultural countryside. In order to increase the agricultural production and productivity of per area in the further, the following suggestions are formulated to improve the current status of the agricultural mechanization services in Iraq:

- Providing of appropriate agricultural mechanization services for farmers either by importing from branded sources or local industry,
- Supporting and expanding the local industry for various agricultural mechanization services and developing them in the same way as under developing and developed countries,
- Coordination between the public sector and private sectors in the provision of agricultural machinery used in the service of agricultural crops,
- Avoid of diversifying in the importing of agricultural machinery from different places, with the need to oblige exporting countries to open advanced workshops to maintain and repair their trading machines and develop the expertise and skills of Iraqi technicians workers,
- Contribution of universities and research departments to determine the suitability of agricultural machines imported to the factual conditions of the country,
- Distribution of operating agricultural mechanization services on the Iraqi provinces according to the actual needs,
- Opening of workshops specialized in the repair of agricultural mechanization services in each province of the country,
- In order to the economic use of agricultural machinery, the work on encourage of the cultivation of large agricultural holdings according to the annual rates of employment allocated to each machine,
- Preparing of advanced and expanded extension programs about the optimal use of agricultural mechanization services, and
- The participation of university professors, masters, bachelors, technicians and workers on agricultural machines in developing courses inside and outside the country to learn about the latest scientific developments related to agricultural mechanization services.

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