Available online at http://www.ijabbr.com

International journal of Advanced Biological and Biomedical Research

Volume 2, Issue 2, 2014: 545-552

Codifying a proper mathematical model for predicting the replace age of the tractors used in Shahid Beheshti Cultivation Firm of Dezfoul

Rahim Amoozadeh[1], Mohammad Javad Sheykh Davoudi[2], Heidar Ali Ghasemnejad[3]

[1]MA., Department of Agriculture, Islamic Azad University, Shooshtar Branch, Shooshtar, Iran
[2]Associate Professor, Department of Agriculture, Shahid Chamran University of Ahvaz, Ahvaz, Iran
[3]Department of Agriculture, Islamic Azad University, Shooshtar Branch, Shooshtar, Iran

Abstract

Predicting the maintenance and management costs and replacement age of tractors in agricultural mechanized units, is important from several points. So, doing a timely agricultural operations, more accurate measure of the amount of income including the cost of these items , determining the useful life of old tractors , replacement age, cost of the process changes and the possibility of examining the undesirable causes of increase in costs are considered. The main data collected for this study include: the amount of the annual maintenance costs which are obtained of three major maintenance costs (spare parts, maintenance fee, and lubricants). The amount of annual work of tractors is obtained, too. Separating the cost items shows that the cost of spare parts is highest among the total maintenance costs. The final model obtained in this study compared with some other sources indicates that the cumulative amount of these expenses as a percentage of the original price of the model resource estimate is lower than other models. The main reason which has been reported is the difference of maintenance costs (especially in the early years of the operation of tractors) with an initial price of tractors in comparison with other sources. Finally, the economic life of the machines (the optimal replacement age) was estimated for each model of tractor. Results indicate that among the three models, estimated useful life of the John Deere 3140 Tractor and TM155-Newhland has been minimum and maximum, respectively.

Key words: Harvester, Replacement age, Mathematical model, Neural network

Introduction

Since repair and maintenance costs of agricultural machinery and hours of application and using it is directly related to the life of agricultural machines, so the optimal timing of replacement plays a key role (Derakhshan, 1386). So, Shahid Beheshti cultivation firm in 15 kilometers of Andimeshk-Ahvaz road of Dezfoul Was selected as the oldest company in the production of improved seed multiplication and ancillary industries which uses the tractor since 1358 and has accurate information about tractors. 61 tractors in three types of Newhland- TM155, Jundeer-4955 and -3140 are used in this company.

Hypotheses

1. Major maintenance costs of tractors are devoted to the parts and labor associated with repairs.
2. Developing a reliable mathematical model to predict maintenance costs of tractor is now possible in the company.

Literature

Bowers and Hunt in their study of tractors concluded that tractors have generally two types of costs including: ownership fees and user fees. Maintenance costs are typically 10 to 15 percent of the total cost of the machine. Dalsted and Gatierz in 1996 concluded that the overall costs of agricultural machinery including tractors are divided to fixed costs and variable costs. In the meantime, there are a bunch of other costs or expenses related to the timing of farm operations or not carrying out on time. Ward et al in 1985 have obtained functions about maintenance costs in Ireland Forest tractors which showed that the tractors were in high repair costs. According to them, the diversity maintenance costs of the tractor were so great that prevents the use of general function for estimated maintenance for them. They attributed these differences to how to operate the machine, how to care, how to use the machine and its quality. Zaidi and colleagues in 1992 at the National Centre for Energy Conservation in Pakistan presented a mathematical model for estimating the maintenance costs of 93 tractors. Whereby information about repair costs, function, model, year, price tractors were collected using algebraic methods and regression and the models were determined. In 1989, a study was conducted by Glaym et al., and the number of Ohio farmers was studied to collect data about repair. Comparing the results of this study indicated that the coefficient of the ASAE data is large for some tractors. In 1988, Morris made similar studies in the UK and by collecting data about repair and maintenance costs of 50 tractors and fitted data, the best mathematical function that describes this relationship is revealed.

Findings

Investigating the maintenance costs for Harvester

Assessing the cost of repair and maintenance work of Harvester, three major costs include the costs of spare parts, repair labor and materials (including oil, grease and filters are consumed) were calculated. Table 1 shows the average annual maintenance costs of Harvester and their average annual function. This table has been determined to separate the contribution of each cost item. Table 1shows the average annual operating of Harvester s according to the study period (1379-1390) equal to 66/1189 hours and the average amount of time equal to the average cost of 119/423 million rials has been estimated. Thus, the average repair cost per hour to operate Harvester 384/352 thousand Rials.

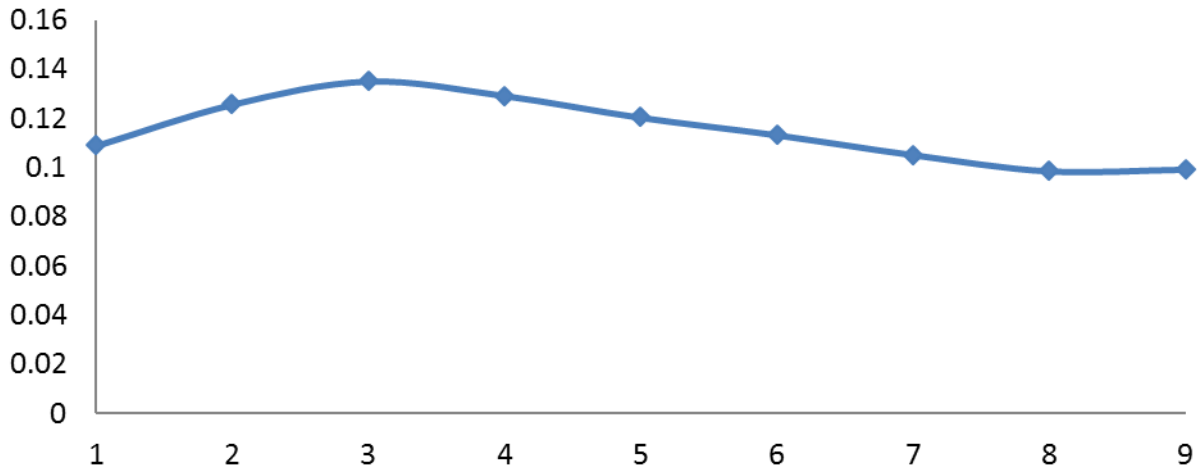
Table 1: Mean values of the average annual cost of maintenance and annual operating hours of Harvester

Repair cost per hour (Thousand)	Annual Function (H**our)(**	Average Total annual cost of The maintenance	**average cost of consumed materials**		**Average payment cost of repair and maintenance**		**Average repair costs**		**Number in group**	**Harvester age (year)**
			percent	**Value (million Rials)**	**percent**	**Value (million Rials)**	**percent**	**Value (million Rials)**		

		(Million Rials(								
156/959	1096/04	172/033	17/19	29/582	27/4	47/131	55/41	95/32	5	1
173/038	1250/12	216/318	17/48	37/811	25/69	55/581	56/83	122/926	17	2
171/922	1164/87	200/267	14/87	29/770	25/85	51/757	59/29	118/74	22	3
174/234	1240/15	216/076	17/8	38/459	25/09	54/209	57/11	123/408	23	4
206/881	1154/42	238/827	17/6	42/040	25/31	60/440	57/09	136/347	23	5
320/467	1072/42	343/675	17/75	60/990	25/27	86/864	56/98	195/821	25	6
431/171	1124/12	484/688	17/64	85/471	25/31	122/701	57/05	276/516	25	7
448/648	1214/19	544/744	17/65	96/103	25/31	137/893	57/04	310/748	25	8
483/391	1228/14	593/672	17/65	104/741	25/28	150/087	57/07	338/844	25	9
531/013	1230/18	653/241	17/72	115/754	25/43	166/113	56/85	371/374	25	10
547/384	1263/14	691/423	17/72	122/504	25/28	174/800	57	394/119	25	11
583/501	1238/16	722/468	17/5	126/360	25/35	183/188	57/15	412/92	25	12
352/384	**1189/66**	**423/119**	**17/38**	**74/132**	**25/55**	**107/563**	**57/07**	**241/423**	**Average**	

Kidsopandis Method

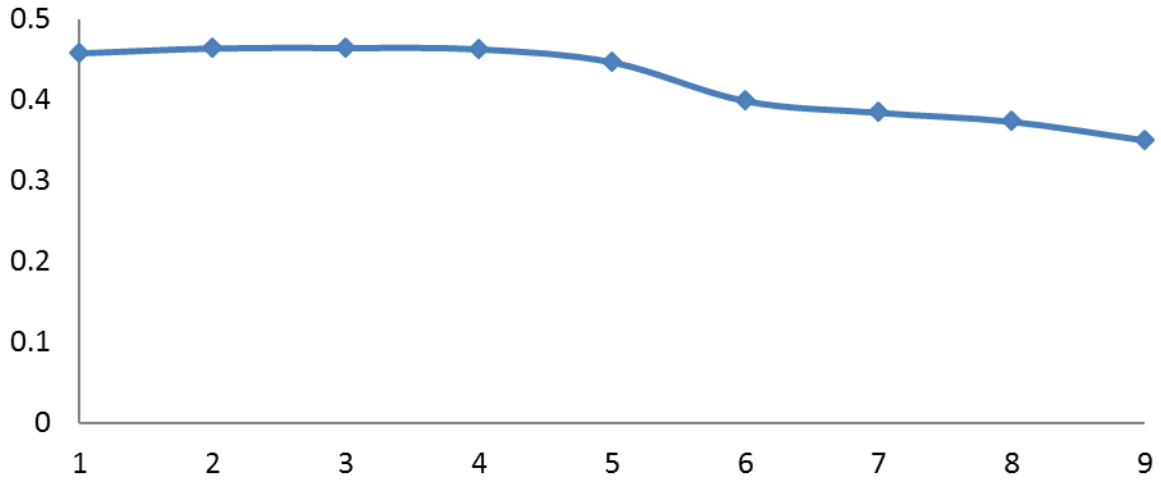
Determining the useful life and replacement of Harvester in this method the perfect time to replace in a year is the cumulative value of the annual depreciation and the cost of annual maintenance for every hour of work at least.



Cumulative amortization costs for maintenance and operating hour

The results of the determination of economic life using Kidsopandis Method.

Cost of every hour activity)Million Rials(	Cumulative cost)Million Rials(	Cumulative repair cost)Million Rials(	Cumulative depreciation cost)Million Rials(	Tractor age 3140
0/108	1700	103/640	81/584	1
0/125	3400	277/629	149/926	2
0/135	5100	482/033	207/274	3
0/129	6800	623/780	255/129	4
0/120	8500	728/436	295/300	5
0/113	10200	827/129	328/951	6
0/105	11900	895/850	357/139	7
0/098	13600	961/170	380/852	8
/099	15300	1119/533	400/531	9

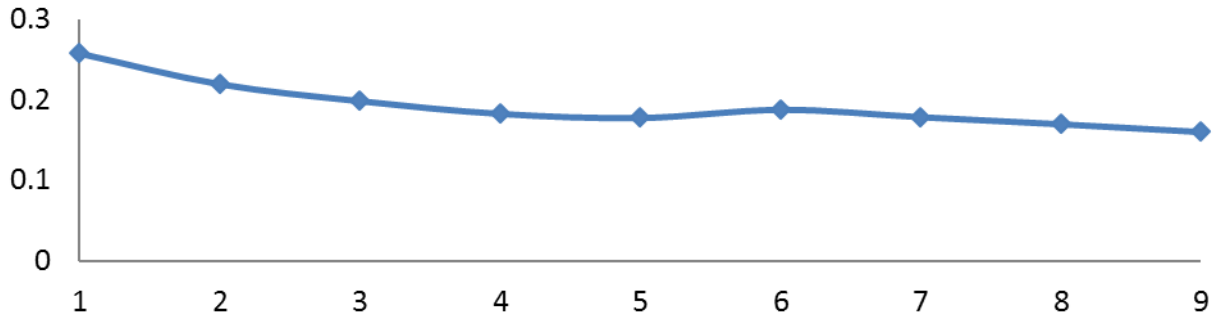


Cumulative amortization costs for maintenance and operating hour

The results of the determination of economic life using Kidsopandis Method.

Cost of every hour activity)Million Rials(	Cumulative cost)Million Rials(	Cumulative repair cost)Million Rials(	Cumulative depreciation cost)Million Rials(	Newhland Tractor age 3140
0/257	2300	252/400	339/935	1
0/219	4600	385/197	624/690	2
0/198	6900	506/775	863/223	3
0/182	9200	618/104	1063/038	4
0/177	11500	812/299	1230/417	5
0/187	13800	1221/789	1370/628	6
0/178	16100	1388/922	1488/079	7
0/169	18400	1538/993	1586/465	8

0/160	**20700**	**1646/726**	**1668/881**	**9**



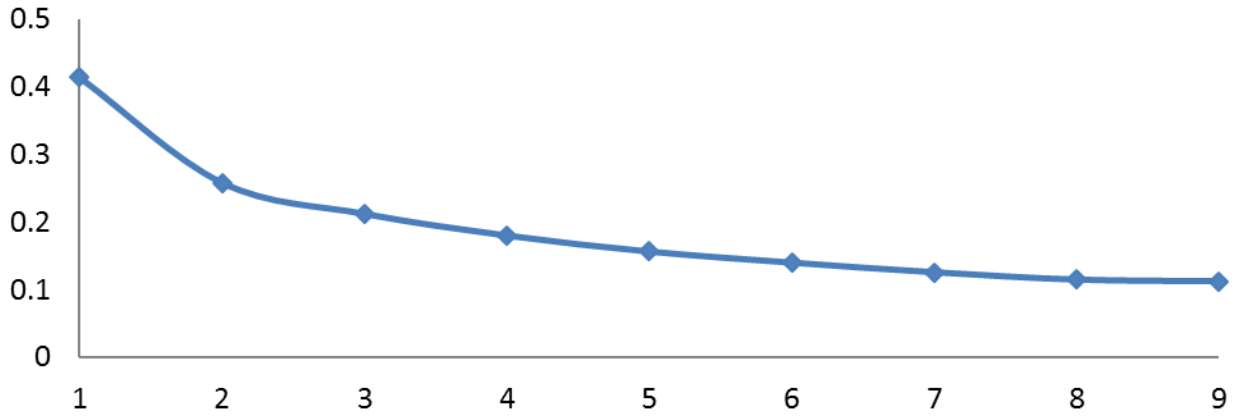
Cumulative amortization costs for maintenance and operating hour

Husti Method

In this method, the optimal time to replace the Harvester is the year in which worth buying a new car and the cumulative annual cost of maintenance for every hour of activity is minimal.

results of the determination of economic life by Husti Method

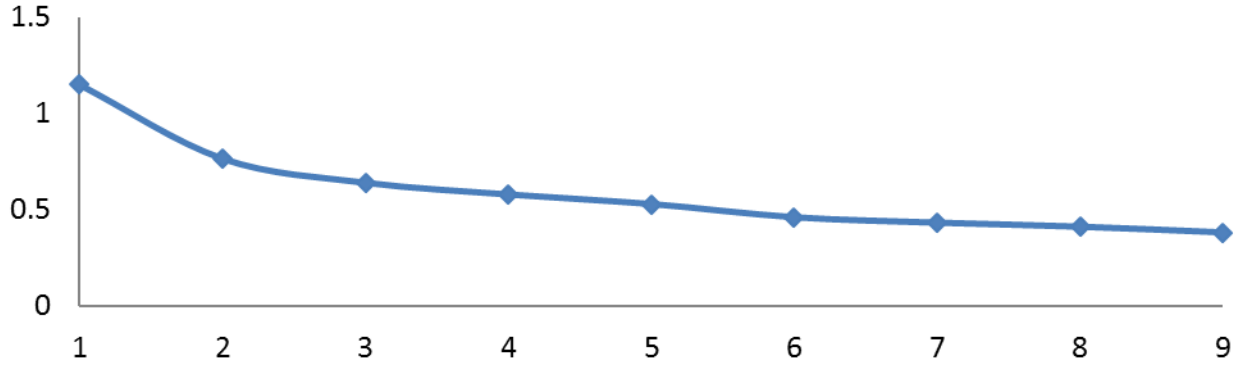
Cost of every hour activity)Million Rials(	**Cumulative cost)Million Rials(**	**Cumulative repair cost)Million Rials(**	**Cumulative depreciation cost)Million Rials (**	**Tractor age 3140**
0/413	1700	103/640	600	1
0/258	3400	277/629	600	2
0/212	5100	482/033	600	3
0/135	6800	623/780	600	4
0/125	8500	728/436	600	5
0/139	10200	827/129	600	6
0/125	11900	895/850	600	7
0/114	13600	961/170	600	8
0/112	15300	1119/533	600	9



Jundeer 3140 tractor repair and maintenance costs per hour

Results of the determination of economic life by Husti Method

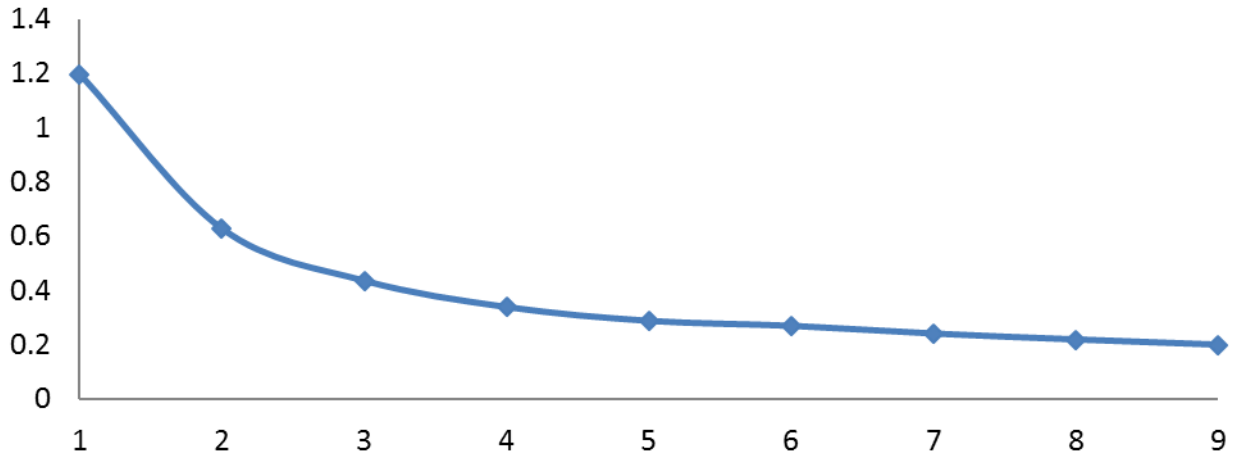
Cost of every hour activity)Million Rials(	**Cumulative cost)Million Rials(**	**Cumulative repair cost)Million Rials(**	**Cumulative depreciation cost)Million Rials (**	**Tractor age 3140**
1/149	**2000**	**698/055**	**1600**	**1**
0/763	**4000**	**1455/591**	**1600**	**2**
0/638	**6000**	**2233/732**	**1600**	**3**
0/577	**8000**	**3021/212**	**1600**	**4**
0/527	**10000**	**3679/252**	**1600**	**5**
0/459	**12000**	**3908/699**	**1600**	**6**
0/430	**14000**	**4430/193**	**1600**	**7**
0/409	**16000**	**4957/493**	**1600**	**8**
0/565	**18000**	**8573/316**	**1600**	**9**



Jundeer 4955 tractor repair and maintenance costs per hour

Results of the determination of economic life by Husti Method

Cost of every hour activity)Million Rials(	**Cumulative cost)Million Rials(**	**Cumulative repair cost)Million Rials(**	**Cumulative depreciation cost)Million Rials(**	**Newhland Tractor age 3140**
1/196	**2300**	**252/400**	**2500**	**1**
0/627	**4600**	**385/197**	**2500**	**2**
0/435	**6900**	**506/775**	**2500**	**3**
0/338	**9200**	**618/104**	**2500**	**4**
0/288	**11500**	**812/299**	**2500**	**5**
0/269	**13800**	**1221/789**	**2500**	**6**
0/241	**16100**	**1388/922**	**2500**	**7**
0/219	**18400**	**1538/993**	**2500**	**8**
0/200	**20700**	**1646/726**	**2500**	**9**



Maintenance costs and the price of a Newhland tractor per hour

Results

The results of this study are:
Share of the constituent items of repairs and maintenance costs
Based on the assessment of repair and maintenance cost of Harvester tractors, three major costs include the costs of spare parts, maintenance labor and materials (including oil, grease and filters are consumed) the calculated amount as of which are:
1. Spare parts costs (07/57%) 2. Pay Repairs costs (55/25%) 3. Consumables costs (38/17%)

Appropriate age of replacement of Harvester

Two methods were used to determine the age for replacing Harvester, the results are:

1. Kidsopandis Method

2. Husti Method

In Kidsopandis method appropriate replacing age was determined at the end of the fifth year of life by evaluating the cost of maintenance and depreciation, cumulative.
In Husti method, by examining the cumulative cost of buying a new machine and its maintenance, right age for replacement determined at the thirteenth year of the life of the machine.

Reference

1. Bowers W & Hunt D,1970.Application of mathematical formulsas to repair cost data. Transactions of ASAE 13(6):806-809.
2. Dalsted N & Gutierrrez p,(1996).The cost of owning and operating farm machinery .Agricultual and business management notes.
3. Derakhshan, M. (1386). Econometrics. SAMT Publication, 1st Volume. 3rd Edition. Tehran
4. Gleim JA ,Persinger KM,Carpenter TG,Holmes RG and Ozkan HE,(1989).A Comparison of ASAE estimated tractor and combin repair and maintenance cocts of selected farmers.ASAE Paper No.89-102.
5. Morris J,(1988).Estimation of tractor repair and maintenance cost.J Agric Engng Res 41:191-200.
6. Ward,S.M.,Mcnulty,P.B.,Cunney,M.B.(1985).Repair Costs of 2 and 4 WD Tractors,Transaction of ASAE,28,4,1074-1076.
7. Zaidi,M.A.,Zafar,A.W.,Sabir,M.S.(1992).A Mathematical model for repair and maintenance cost of agricultural machinery,AMA,23,3,70-72.