

TRENDS OF THE TRANSFORMATION OF ESTONIAN TRACTOR PARK

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ABSTRACT: This article analyses the current situation of the Estonian Tractor Park and the trends of its transformation. The examination focuses on the brands and age of the Tractor Park tractors at the moment and in the recent past. It is tried to predict the composition of Estonian Tractor Park and the main tendencies of tractor procurement in the near future. It became evident that 90 % of the tractors used in Estonian agriculture at the moment are of Russian origin, although during the last 10 years the purchase of Russian tractors has decreased substantially. At the same time the purchase of convenient, well-designed, highly efficient, but expensive Western tractors has increased rapidly. It is a clear sign of the growing prosperity of Estonian farmer.

1. Introduction

It seems that during the last years the analyses of Estonian Tractor Park has been not sufficient. The material presented in this work should not only be of interest to tractor sellers, but also to a large number of tractor users and their technical services. In our discussion the technical service involves all the actors who deal with maintenance of tractors (diagnosticians of tractor's technical condition, the suppliers of spare parts, repair materials, fuel, lubricants). The infrastructure created by them is an integral part to the self-regulating system of tractor and its user.

Present work focuses on the change of the composition of wheeled tractors in brands, countries and release dates during the last 12 years. This is the period ranging from the demolition of collective farming until today. By the end of the examined period the agricultural production in Estonia has probably reached stability. The period, during the dismantling of the property of collective farms when the tractors were distributed to people who were not connected with agricultural production, is over. By now such tractors have changed their owners once or twice and have found their true owners – the active users of tractor. It also can be stated that during such a long time agricultural machinery and technology system has been formed for existing tractors. The main development directions in agricultural technology have fixed.

2. The reliability of data and the description of methodology

The original data for current analyses comes from the Estonian Motor Vehicle Registration Centre and can be considered reliable.

The work of Estonian Motor Vehicle Registration Centre is completely computerized and all the databases situated in the branches of Estonian Motor Vehicle Registration Centre in counties are centralized to Tallinn. Therefore the duplication and entanglement of data is excluded. As Estonian Motor Vehicle Registration Centre is the only institution which gives out documents proving and verifying the ownership of tractors, then all the data concerning the concrete tractor is checked by their representative directly on the tractor. Without the certificate given out by Estonian Motor Vehicle Registration Centre it is neither possible to sell

nor by a tractor. In addition Estonian Motor Vehicle Registration Centre has no need or motivation to change or mutilate the presented data.

As all the wheeled tractors are included in the Estonian Motor Vehicle Registration Centre databases, then it can be said without exaggeration that all the actively used tractors are under our observation. Therefore all the results of our work are representative and valid to all our agricultural production.

The only possible inexactness may arise out of “dead souls”, which means that the tractor does not exist any more or it has completely lost its working capacity and is scrap iron, but is still listed in Estonian Motor Vehicle Registration Centre as being in working condition. This situation was commented by former Estonian Motor Vehicle Registration Centre employees that two years ago as the changing of tractor’s technical passports was conducted, they carried through a thorough inspection with the aim to exclude all the “dead souls” from their databases. For that reason an inner order was established that all the tractors manufactured before 1992, for which no new technical passports are applied for, are erased from the registry. It was assumed that as there was no need for new passport, then the tractor would not exist any more.

At the same time we admit that there exists quite a big number of tractors, which are not registered in Estonian Motor Vehicle Registration Centre and have not state registration certificate. Most of them date back to Soviet era and are of Russian origin. Most of them are in county border areas and in distant farms where traffic is thinner. On the other hand these tractors compensate the shortage arisen from “dead souls”. According to different experts the amount of unregistered tractors is 15-20 % of all tractors. It is not possible to leave Western tractors unregistered, as it is not possible to bring tractors without the proper documentation over the Estonian border. Through customs taxes and other taxes the movement of tractors is very precisely traceable.

3. The data of wheeled tractors up to 1. July 2003

A separate problem is how big is the number of tractors used in agriculture of all wheeled tractors. Considering the main direction and objective of our work, we were mainly interested in the tractors used in agricultural farming. Unfortunately Estonian Motor Vehicle Registration Centre does not hold information about how the tractors are used. Therefore we took under investigation tractors registered in Tallinn and Tartu and saw how they influence the overall composition of tractors. We assumed that the tractors registered in Tartu and Tallinn are not used in agriculture but on city objects (canalisation, waterworks, communal objects etc.). Certain inexactness in analysing the Tractor Park arises from the fact that new tractors are often bought with leasing. The leasing company – the juridical owner of the tractor – is registered in Tallinn. According to our methodology such tractor is not of agricultural usage. If the buyer of the tractor on leasing is farmer, then the tractor should be considered of agricultural usage.

Afore given shows, that the separation of tractors into agricultural and not agricultural tractors is very stipulated. On the other hand the statutes of different firms are worded very differently, and the sphere of action is substantiated as broadly as possible including almost all the everyday activities (except licensed activities) classical axis buying – selling – mediation – transport.

According to Estonian Motor Vehicle Registration Centre data there are all together 2569 tractors registered in Tallinn and Tartu firms. It is interesting to add that 23.1% of all Western tractors and 6.3% of all Russian tractors are registered in these cities. The concentration of Western tractors in Tartu and Tallinn is explicable with the fact that most of the leasing companies are situated in these cities and also there are many well-off firms in these cities

who can afford buying expensive Western tractors. Consequently 8% of tractors are outside of agricultural usage. According to expert judgements about 3-4% of tractors are in non-agricultural usage.

$$\begin{pmatrix} 8894 & 551 & 600 & 652 & 263 & 370 & 137 & 100 & 238 & 459 & 200 & 150 & 173 & 348 & 33 \\ 3529 & 633 & 483 & 406 & 335 & 505 & 252 & 3 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 2 & 3 & 46 & 9 & 0 & 5 & 0 & 9 & 0 & 1 & 4 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 10 & 8 & 21 & 15 & 0 \\ 3540 & 349 & 471 & 138 & 28 & 2 & 0 & 0 & 4 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 3 & 3 & 10 & 29 & 3 & 3 & 0 & 0 & 7 & 31 & 12 & 26 & 18 & 0 \\ 1721 & 171 & 117 & 6 & 0 & 3 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 \\ 2690 & 122 & 134 & 41 & 9 & 5 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1175 & 69 & 41 & 8 & 10 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 521 & 56 & 17 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Figure 1. Data matrix composed upon Estonian Motor Vehicle Registration Centre data of Russian origin tractors. The columns consist of tractor numbers by years: 1. – before 1990, 2. – 1990, 3. – 1991,..., 14. – 2002, 15. – 2003 first half. In the rows the numbers of tractors are presented according to their brands: 1. – MTZ, 2. – T- 25, 3. – T-30, 4. – VTZ , 5. – T-40, 6. – LTZ, 7. – T-150K, 8. – T-16, 9. – JUMZ, 10. K 700/701.

The matrixes in Fig. 1, 2 contains the data, used in statistical treatment

$$\begin{pmatrix} 25 & 0 & 1 & 2 & 1 & 0 & 1 & 1 & 2 & 4 & 3 & 1 & 27 & 30 & 17 \\ 51 & 2 & 2 & 8 & 14 & 3 & 14 & 23 & 16 & 18 & 21 & 17 & 25 & 33 & 39 \\ 51 & 7 & 2 & 0 & 0 & 2 & 1 & 11 & 10 & 5 & 0 & 4 & 1 & 3 & 6 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 5 & 10 & 8 & 2 & 6 & 17 & 20 & 0 \\ 13 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 1 & 0 & 0 & 1 & 17 & 8 \\ 20 & 2 & 0 & 0 & 2 & 2 & 2 & 14 & 10 & 13 & 2 & 1 & 5 & 1 & 0 \\ 12 & 2 & 1 & 2 & 0 & 0 & 0 & 5 & 8 & 11 & 1 & 0 & 0 & 0 & 0 \\ 26 & 1 & 0 & 4 & 2 & 1 & 1 & 0 & 3 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 14 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 4 & 5 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 4 & 8 & 4 & 2 & 0 & 1 & 0 \\ 1745 & 25 & 28 & 17 & 17 & 7 & 17 & 15 & 20 & 6 & 13 & 5 & 4 & 8 & 9 \end{pmatrix}$$

Figure 2. Data matrix composed upon Estonian Motor Vehicle Registration Centre data of Western origin tractors. The columns consist of numbers of tractors bought by years: 1. – before 1990, 2. – 1990, 3. – 1991,..., 14. – 2002., 15. – 2003 first half year. In the rows the numbers of tractors are presented according to their brands: 1. – JOHN DEERE, 2. – VALMET, 3. – MF, 4. – NEW-HOLLAND, 5. DEUTZ FAHR, 6. – CASE, 7. – ZETOR, 8. – FORD, 9. – CNH-INTERNATIONAL, 10. – SAME, 11. –LAMBORGHINI, 12. – other tractor brands.

Sum up the numbers in the rows from left to the right of matrixes in Figs. 1 and 2. The outcome is given as matrix in the next figure.

$$\begin{pmatrix} 22070 & 1954 & 1867 & 1263 & 678 & 934 & 401 & 103 & 250 & 468 & 250 & 170 & 221 & 387 & 33 \\ 1944 & 39 & 35 & 33 & 37 & 16 & 37 & 78 & 84 & 74 & 46 & 40 & 85 & 117 & 93 \end{pmatrix}$$

Figure 3. Matrix composed of Western and Russian origin tractor numbers summarily by years. The first row shows the Russian and the second row shows the Western origin tractors. The columns present the number of tractors bought by years: 1. – before 1990, 2. – 1990, 3. – 1991.,..., 14. – 2002, 15. – 2003. First half year.

Sum up the numbers in matrix columns from top to the bottom given on figures 1 and 2. The outcome is given on figure 4 as a vector.

$$(13168 \ 6147 \ 80 \ 55 \ 4533 \ 145 \ 2020 \ 3002 \ 1304 \ 595 \ 115 \ 286 \ 103 \ 71 \ 42 \ 74 \ 42 \ 38 \ 15 \ 17 \ 19 \ 1936)$$

Figure 4. Vector composed of summary numbers of tractor brands by years. The vector number accords to brands accordingly: 1. – MTZ, 2. – T- 25, 3. – T-30, 4. – VTZ, 5. – T-40, 6. – LTZ, 7. – T-150K, 8. – T-16, 9. – JUMZ, 10. K 700/701, 11. – JOHN DEERE, 12. – VALMET, 13. – MF, 14. – NEW-HOLLAND , 15. DEUTZ FAHR, 16. – CASE, 17. – ZETOR, 18. – FORD, 19. – CNH-INTERNATIONAL, 20. – SAME, 21. – LAMBORGHINI, 22. – Other Western tractor brands

In spite of inevitable mistakes the majority of tractors are employed in agriculture and the obtained results are practicable.

3. Results of the analyses

3.1. Consumption of tractors in Estonia

As known there is no tractor production in Estonia. All the tractors have to be bought from the former cheap Russian market or from the expensive Western market. Lets see how big is the number of imported tractors during the last 12 years by year. At this place it should be mentioned that in addition to new tractors there are also imported old tractors to Estonia. During late years the import of new tractors has increased which demonstrates the growth of farmers' prosperity. The bigger tractor manufacturers have their branches in Estonia. Tables 1 and 2 shows the number of newly registered wheeled tractors during the last 3.5 years. We see that the number of new tractors is rising year by year.

Table 1. Newly registered tractors numbers

Indicator	2000	2001	2002	2003 6 months
Newly registered tractors in all	223	317	402	272
The percentage of newly registered tractors	0,65 %	0,94 %	1,2 %	0,8 %
Western tractors	41 18,4 %	86. 27,1 %	115. 28,6 %	96. 35,3 %
Russian tractors	182 tk. 81,6 %	231 tk. 72,9 %	287 tk. 71,4 %	176 tk. 64,7 %

Table 2. Ranking list of purchases

Western companies	No	No	No	No
1.Valmet	18	31	33	37
2.John Deere	2	23	31	19
3.New Holland	6	14	24	6
Russian companies				
1. MTZ	151	186	255	159
2. LTZ	18	26	15	7
3.VTZ	9	18	14	5

The second column of tables 1 and 2, which shows the percentage of registered tractors of all tractors, summons a number of different thoughts.

1. Firstly the share of new tractors of all 33807 tractors is very small. The percentage of new tractors of all tractors is only 0.65 % to 1.2 %.

2. Secondly we are interested how big is the optimal number of tractors in Estonia. The Tractor Park in agriculture has to reproduce itself. After a certain time, certain elaboration, the resource of tractor is considered exhausted and its further exploitation is unreasonable. The tractor is removed from exploitation. This means that a new tractor has to be bought for the necessary work. Therefore after certain time the whole amortized Tractor Park has to be exchanged.

Table 3. The percentage of tractors exchanged depending on their usage.

The age of tractor in years	12 year	15 year	18 year	20 year	25 year
Percentage of exchanged tractors (% tractors per year)	8,3 %	6,6 %	5,5 %	5,0 %	4,0 %
The actual percentage of exchanged tractors (% tractors per year) 2002	1,5				
Total number of tractors All wheeled tractors – 2003	33807				
The necessity for new tractors:					
4.1. innumerably	2806	2231	1859	1690	1352
4.2. were actually bought	504	504	504	504	504
4.3. the difference of innumerable and actually bought tractors	2302	1727	1355	1186	848

We find out how big should be the exchange percentage of tractors depending upon the established amortisation norms. This norm should be established in every institution's bookkeeping. Table 3 demonstrates that on the basis of theoretical usage age (12-15-18-20-25 years) 8.3% to 4.4 % of tractors should be exchanged every year. The percentage in Estonia was in 2002 1.5 %. We see that every year one needs 2806 to 1352 new tractors. The actual purchase in 2002 was 504 new tractors.

The percentage of exchanged tractors every year is a theoretical minimum, because it is not taken into account that not every tractor is used till its exhaustion. For example traffic accidents, fires, other accidents can eliminate tractors of all ages by deleting them from the

list or leaving them out of work for a long period, also being arrested during bankruptcy disputes, which may last for years. Therefore the actual necessity for tractors is higher than the theoretical minimum.

We have data of the composition of wheeled tractors by brands and manufacture dates beginning from 1990 till 2002. (Fig. 1, 2) This data gives sufficient bases for analysing past, present and prognosticating future. To simplify let's divide all the tractors into two groups – Western tractors and Russian tractors. Russian tractors have Soviet or Russian or post-Soviet country origin (Belo-Russia, Ukraine etc.). Other tractors are considered Western tractors. We also considered tractors that are regarded as “other tractor brands” in Estonian Motor Vehicle Registration Centre files as Western tractors.

The composition of wheeled tractors by brands and manufacture dates is investigated since 1990 because the earlier period would reflect the situation when all the collective farms were not yet abolished and the tractors were registered on their names.

Let us see how the purchase of tractors has proceeded during the last 12 years in Estonia. Three phases can be distinguished.

1. period 1990-1994

This period is characterized by the decrease in the purchase of Russian tractors. In today's sense the amount of tractors bought was very large. The brands of tractors bought were very different, including large tractors K-701 and T-150 K. In three years the amount of tractors purchased decreased from 2000 to 700.

2. period 1995-1997

This period is characterized by deep crises. The influences of Russian economy crisis resulted in the further decrease in tractor sales and reached their historical minimum in 1996. In 1996 only 181 new Russian tractors were bought. It can be said that in 1996 began the invasion of Western tractors to Estonia. Their sales numbers increased from 37 to 78 in one year. Every next year the numbers increase even more.

3. period 1998 till today

This is the period of growth and stability. Every year more new tractors are being bought and the import of Western tractors increases, although in sales figures the Western tractors are, compared to Russian tractors, in a manifold minority.

Little percentage of purchased new tractors leads to following thoughts:

1. There are still too many tractors in Estonia and the aged tractors are being exchanged in inner rotation - that means with sales inside the republic. There are plenty of not used but still in working condition tractors.

2. The farmer is so poor that he/she cannot afford a new tractor. The investments' list is long and the investment into a new tractor is not most important.

3. While moving around the countryside one can notice quite many fields are uncultivated. The tractor meant for the cultivation is standing near the shed. What is not moving is not expended. If all the fields in Estonia would be cultivated, there probably would be shortage of tractors.

3.2. Wheeled tractors by age today

The age of wheeled tractors today is given in table 4.

1. The tractors working in Estonian fields are very old (table 4). The average manufacturing date of wheeled tractors is 1984, this means that the average tractor is 19 years old.

2. Tractors aging less than 10 years compose only 13.61 %. The best age for tractor use is till 10 years.

3. The number of very old tractors which age over 20 years is 11 532 and they compose 34%. Working with such tractors involves a constant risk that with poor maintenance

there might arise an unexpected disorder and during the busiest working period the work can be disrupted.

4. The age of tractors is lowered by Western tractors, because they are usually bought as new. The composition of Western tractors by age is given in table 5.

5. Also most of the Western tractors are over 12 years old – 73.6 %.

Table 4. The age of wheeled tractors today

Age of tractor in years	All tractors	%
Till 3	1146	3,4
4 – 6	1172	3,4
7 – 10	2284	6,8
11 – 15	9213	27,3
16 – 20	8460	25,0
Over 20	11532	34,1
All	33807	100 %

Table 5. Composition of Western tractors by age

Age of tractor in years	All tractors	%
Till 3	335	12,0
4 – 6	199	7,2
7 – 10	90	3,2
11 – 12	107	3,8
Over 12	2043	73,6

All together 2774 tractors

There was a period in Estonia when many old Western tractors were imported. Unfortunately we have neither overview nor data in what kind of technical condition they are. We also do not possess thorough and reliable information how these tractors hold out in Estonia and what are their exploitation qualities.

3.3. Division of tractors by brands

The division of tractors by brands and manufacturing dates is given in table 3 and the next conclusions can be made.

1. The most popular tractor brand is wheeled tractor MTZ manufactured in Minsk, Byelorussia. The total amount is of MTZ tractors is 13168 and it makes 38.9% of all tractors. Its sales success is tremendous. According to Estonian Motor Vehicle Registration Centre's data in 2002 the sales figures of MTZ tractors was three times as big as of all Western tractors together. It is important that almost all MTZ tractors are bought as new.

2. The authors of this work are on the opinion that MTZ tractors are well designed and reliable and with good price and quality balance.

3. The next popular tractor is small intertillage tractor T-25, manufactured in Vladimir's tractor plant in Russia. The sales figure was 6147. A light class tractor T-25, which is manufactured in Lipetski tractor plant, Russia, is followed by tractor T-40. It should be mentioned here, that T-30 has been replaced by VTZ and T-40 has been replaced by LTZ.

4. Western tractor brands do not have such a leader as MTZ. Between themselves compete Valmet, John Deere and MF, whose sales figures are accordingly 172, 115 and 113. All other tractor brands fit under sales figure 100.

5. In 1 July 2003 there were 33807 wheeled tractors in Estonia. 31052 of them, that is 91.8 %, were of Russian origin and 2776, that is 8.2 %, were of Western origin.

6. Soviet period tractor K 700/701 is disappearing. This brand is not being purchased already for years. The same destiny is probably waiting other large tractor T-150 K. Although right now a considerable number of these tractors is working on Estonian fields – 2020 tractors.

Analysing the division of tractor brands it should not be forgotten from where most of our Tractor Park comes from. Before the fall of collective farming there were 360 collective farms in Estonia. Every one of them had a set of tractors for agricultural large-scale production. With the dismantling of collective farming all these sets of tractors were scattered. The big set of tractors could not be divided into smaller sets of tractors. Therefore it is no use trying to find an optimal set of tractors from today's list.

4. Prognoses till 2008

Using the data of last 12 years (Figs 1 and 2), a regression parabolas has been composed, which is extrapolated outwards the data area, with the aim to prognosticate the trends of the growth of Estonian Tractor Park in the future. Of course we assume that the evolution of the society has been: 1. stable, without great shocks or wars, 2. that we have joined the European Union and are its full and equal members, 3. we are not in the influence of Russia, 4. the Euro has not changed the principles of our economy.

In Figs 5 and 6 the dots symbolize the number Russian (Fig. 5) and Western (Fig. 6) tractors in Estonia. At that the sequence numbers symbolize years as follows 0 – 1990, 1 – 1991, ..., 13 – 2003, ...,18. 2005. Figure 5 clearly shows already earlier mentioned tendencies of decline in the purchase of Russian tractors. The extrapolation of regression parabola outside the data area indicates that the purchase of Russian tractors probably increases in the future

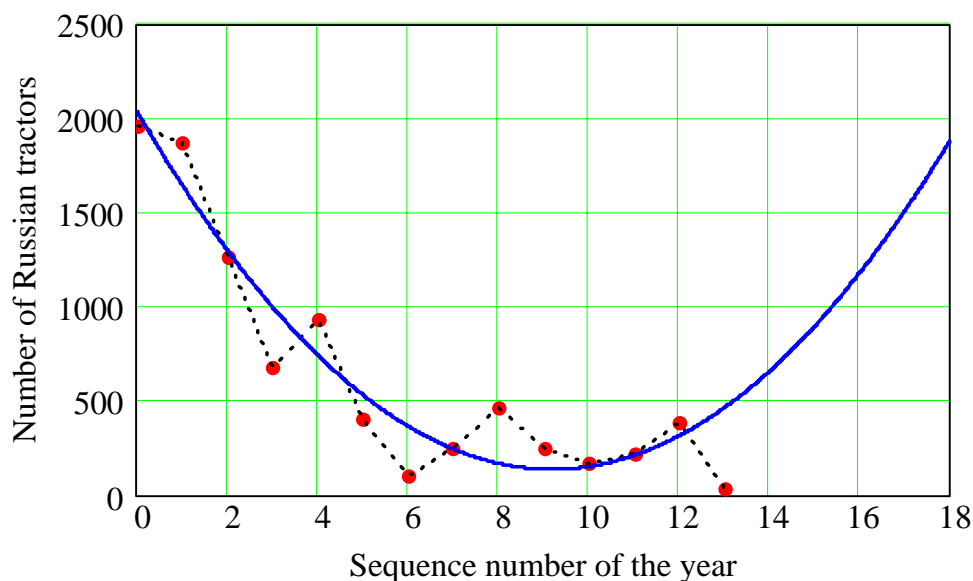


Figure 5. Russian tractors' purchase data (points) (0. – 1990, 1. – 1991, ..., 13. – 2003 (first half year) and prognoses in the near future (14 – 2004, 15 – 2005, ..., 18. – 2008)

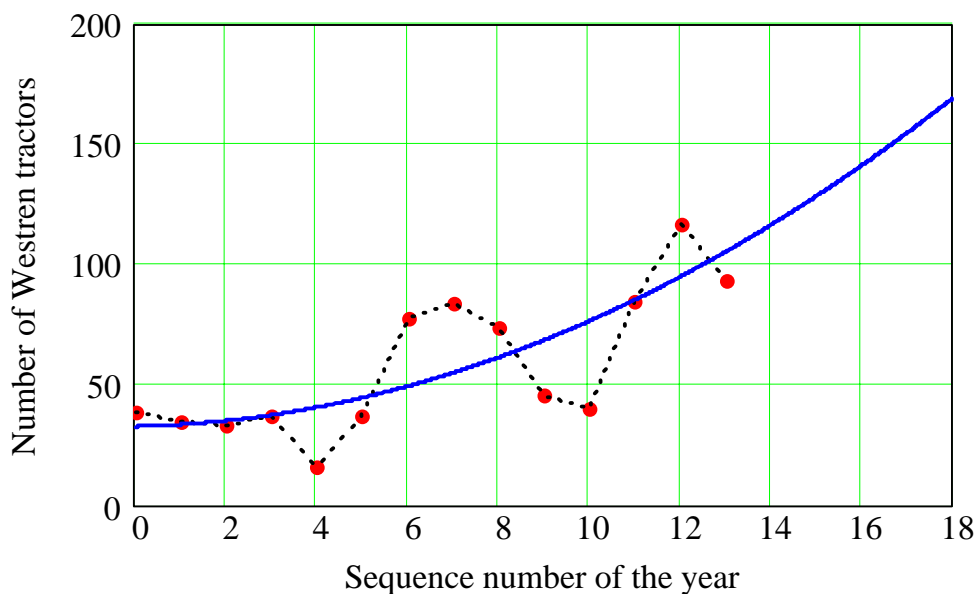


Figure 6. Data of purchase of Western tractors (points) (0. – 1990, 1. – 1991, ..., 13. – 2003 (first half year) and prognoses of near future (14 – 2004, 15 – 2005, ..., 18. – 2008)

Figure 6 confirms earlier mentioned tendencies of the increase of Western tractors. From this figure one can prognosticate important growth in the purchase of Western tractors.

Figure 7 and 8 prognosticates the purchase of tractor brands being bought until now in the near future. Figure 7 demonstrates that the next years will bring a rise in the purchase of Russian tractors MTZ, T-25, T-40 and T-150 K.

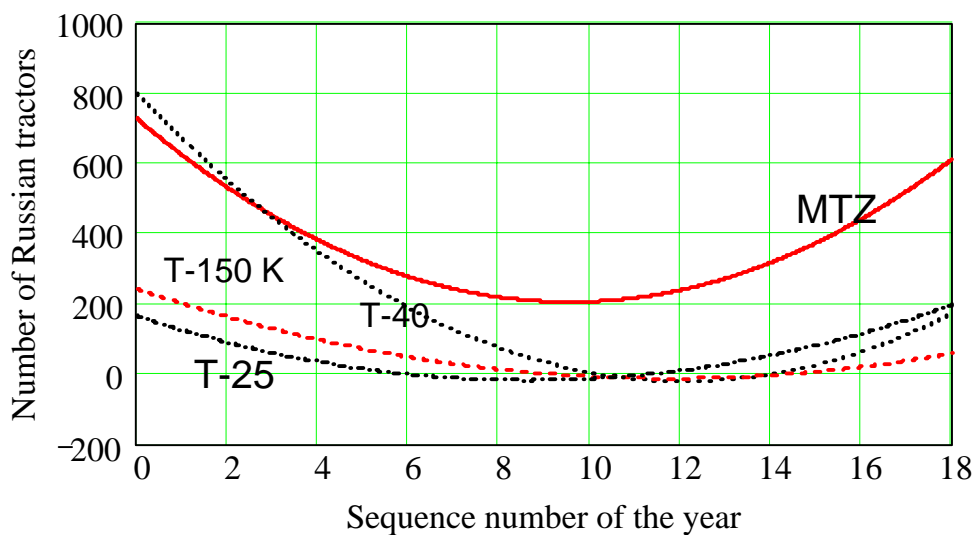


Figure 7. The most imported in Estonia (0 – 1990, 1 – 1991, ..., 13 – 2003 (first half year) Russian tractors MTZ, T-25, T-40, T-150 K and purchase prognoses in the near future (14 – 2004, 15 – 2005, ..., 18. – 2008).

Figure 8 prognosticates the growth in Western tractors JOHN DEERE and VALMET purchase and the end of purchase of MF tractors.

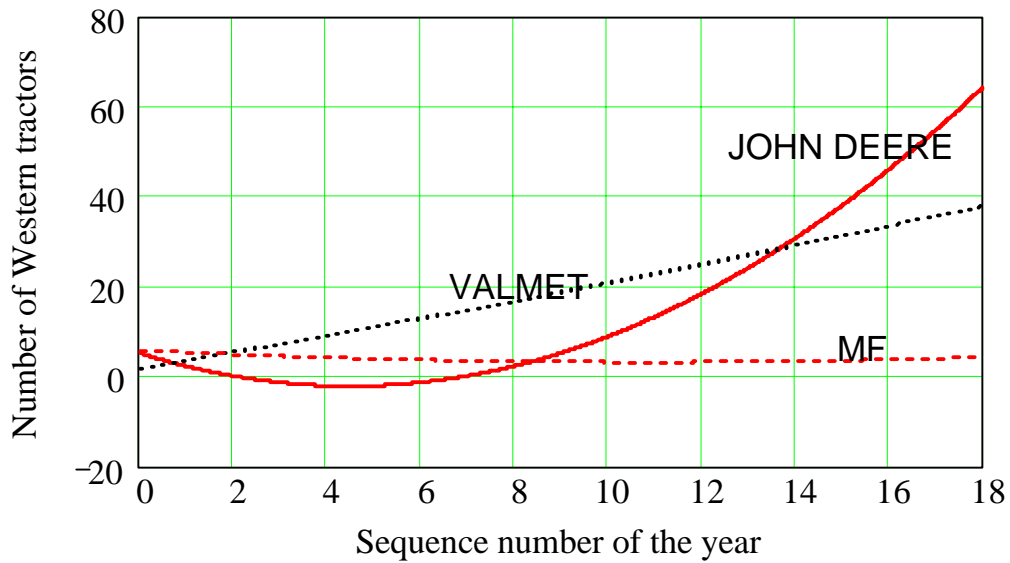


Figure 8. The most imported in Estonia (0. – 1990, 1. – 1991, ..., 13 – 2003 (first half year) Western tractors JOHN DEERE, VALMET, MF purchase prognoses in the near future (14 – 2004, 15 – 2005, ..., 18. – 2008).

5. Conclusions

1. In the near future the import of Russian and Western tractors will increase
2. Probably most of the today's 31 052 Russian tractors are in working condition also in ten years, which should be taken into consideration when educating the tractors' technical service attendants.
3. The leader of Russian tractors – MTZ – will be probably purchased also in the near future.
4. The purchase of Western tractors in the near future will increase.