Farm Machinery Market in the Second Half of the XX Century

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Abstract

In the 1950's the sales of tractors and harvester threshers grew dramatically in the Federal Republic of Germany (FRG) and in France (in 1950 22,500 tractors were sold in France increasing to 110,711 in 1955). At the same time sales in Poland were still low, but with an increasing trend. In the USA a decrease in sales was already occurring. Beginning in 1970, the sales of farm machinery began to decrease in both France and in the FRG. The reasons for the decrease in sales were: (1) saturation of the farm equipment market, (2) a reduction in the number of farms and the increased use of specialization, (3) changes in technology and the way farm machinery was utilized, (4) an increase in the cost of production versus the value of the agricultural products. In Poland the dramatic drop in sales did not occur until the 1990's, resulting from the removal of price controls for farm machinery (increase in cost) coupled with a drop in the price of agricultural products.

Keywords: tractors, harvester threshers, number, sales, historical analysis

Introduction

Among the various countries and regions of the world the level of mechanization used in agriculture is vastly different. For example in Sub-Saharan Africa there are only 0.12 tractors per 100 hectares of agricultural used area (AUA) while in Japan there are 50 tractors per 100 hectares of AUA (Pawlak, Pellizzi, and Fiala, 2002). Among the industrialized countries the history of the development of farm mechanization was quite different. By 1950 a high level of mechanization was observed in USA, while in Western Europe (except the UK) and in Japan farming was still done with animal power. A dynamic growth in the number of tractors and farm implements occurred in Western Europe during the 1950's and 1960's, and the 1960's and 1970's for Japan. During this period of increasing sales of tractors in Western Europe and Japan, signs of a decrease in sales in the USA were observed.

The changes (both in time and regional aspects) on the farm machinery market were the result of a number of factors. There is a strong interdependence between the farm machinery market and the implementation of emerging agricultural engineering practices. This is very important because agricultural engineering is now "addressing great challenges facing humanity, such as ensuring adequate and safe food supply for an expanding world population and managing and protecting the world's vital water, soil, air and energy resources" (Stout 2000).

The purpose of this paper is to describe the main trends occurring in the farm machinery market during the second half of the XX century, and discuss the possible reasons for the changes. The sales of tractors and harvester threshers, as the most representative agricultural machinery, were used for this study. Statistical data from 4 countries (France, Germany, Poland and USA) was assembled and analyzed.

Materials and Methods

Data from statistical yearbooks of the particular countries, from international organizations, professional magazines like Implement & Tractors, and information courtesy of organizations such as AEM, UNACOMA, and VDOMA was used as information sources for this paper. The gathering of the yearly information for the time period between 1950-2000 proved to be a difficult task. The information was limited treating the long-period analysis of trends in the farm machinery market. Most of the comparative analyses carried out on the international level dealt with trends in changes of farm equipment (Pawlak and Esmay 1986) rather than trends in sales. Most of the published market analyses covered shorter periods e.g. 10 years.

In many cases there are significant differences in the data from similar sources. One example is the number of tractors in use in the USA published by the Yearbook of Agricultural Statistics (edited by USDA) and the FAO Production Yearbook. For this and similar situations, data from national statistical yearbooks (if available) were taken into consideration. The other problem is the decreasing amount of data relating to farm mechanization presented in the statistical yearbooks.

For this study estimates of tractor and harvester thresher levels for some years was necessary. The estimates were based on changes in the number of machines in use, on shipments and inventories, as well as replacement rates. Only the sale of newly built machines was taken into consideration.

The analysis of the farm machinery market was carried out using the background of processes observed in other aspects of agricultural reality, such as structural changes, price relations, technological advances and so on.

Results and Discussion

The situation of the farm machinery market, both as seen from qualitative and quantitative points of view, is strictly linked with a stage of development of agricultural mechanization. At the beginning of the process, starting theoretically from a moment when the first machine of a given kind was purchased and introduced into agricultural production, all purchases were considered as new investment. At the beginning the number of machines sold was rather low, and the increase of machines in use grew slowly as expressed in absolute values, but very fast in relative (%) values, because of the very low starting point. In the next (second) stage, the rate of absolute values of increase in the number of machines in use became more and more dynamic along with a gradual decrease of the relative growth. Most of purchases at this stage were still considered as new investments, but with a growing share as replacements. At this stage the sales of machines achieved the highest level.

After achievement of relative saturation, that can not be identified with the situation that all farms are equipped with a given machine, the sales of machines tended to decrease and the purchases of replacements became more and more dominating.

Qualitative changes were also observed. That was because of changes in the farm size structure, scale of agricultural production and the level of specialization. Decrease in the number of farms and specialization of production caused the number of potential buyers to drop. At the beginning of this stage the number of machines in use was still growing. However, later on the decreasing trend was observed.

The changes in number of farms were related to the growth of their average size (table 1).

In table 1, number and average size of farms in Germany refers only to the western part of the country. After unification the average size of farm has became larger. In 2000 it averaged 37 hectares of AUA for whole country, and the total number of farms amounted to 450 thousands units.

Table 1. Number and average acreage of farms in selected countries

Countries		1950	1955	1960	1965	1970	1975	1980	1985	1990	2000
France	A	2065	1990	1774	1688	1421	1209	1135	1022	928	735[1]
	B	15	16	17	19	21	24	26	29	31	39[1]
Germany[2]	A	1647	1550	1385	1206	1083	905	797	721	630	420
	B	8	8	9	11	12	14	15	17	19	27
Poland	A	2985	2895	3254	3145	3236	3068	2396	2291	2143	1892
	B	7	7	6	6	6	6	7	8	8	9
USA	A	5388	4782	3720	3158	2954	2808	2309	2240	2146	2000
	B	86	97	127	136	149	155	171	180	187	195

A – number of farms, B – average size of farm in hectares, [1] 1995, [2] without former GDR
Source: Statistical yearbooks of particular countries

In the United States the first of the above-mentioned stages of development of agricultural mechanization was already over by 1950, in France and Germany - at the beginning of the fifties whilst in Poland at the end of sixties. The Second World War in Europe hampered the development of agriculture and caused even the highly industrialized countries of Western Europe to regress, compared to USA, in the stages of the development of farm mechanization. That was especially true during early post-war period. Another factor causing the differences was the farm structure. Smaller farms in Europe were more difficult to mechanize than the much larger ones in the USA. Differences in the stages of mechanization development were reflected in changes of farm machinery sales in different countries. Over the years 1950-1955 sales of tractors in France and Federal Republic of Germany were growing dynamically (fig. 1).

At the same time in the USA a decreasing tendency was observed while in Poland the small number of tractors available were assigned to state farms and to machinery stations serving co-operative farms, similar to Soviet kolkhoz, that the communist government tried to develop in spite of the resistance of Polish farmers. Most tractors purchased at that time in North America served for replacement for old units. However, in Europe almost all purchases were still undertaken for new investment purposes.

Over the second half of the fifties and sixties the sales of tractors in France and FRG were on a high level. However, there were significant fluctuations between years. Changes in demand caused by farmers' attitude towards the current state of the market were the main reason for these fluctuations. In the USA, the trend of decreasing sales of tractors continued, with fluctuations similar to the ones observed in West European countries.

At the same time in Poland some increase in tractor sales was occurring. The shipments were addressed to state and co-operative farms, and since 1959 also to agricultural circles, being farmers' organizations aimed at mechanizing private farms in the form of machinery services. After 1956, the state authorities resigned from the idea of forced agricultural collectivization. As a result, Poland was the only country in Central and East European socialist block, where private sector agriculture dominated. However, for doctrinal reasons, private farmers were not permitted to buy tractors. That is why in spite of the increase in the number of tractors in agricultural circles, animal power dominated on private farms with a 70% share in total power

resources in 1970. Besides, the tractors of the agricultural circles were only in 20-30% engaged in services for farmers. The dominant work assignment for the tractors was as transport services for state industrial enterprises.

The decrease in number of horses only started during the seventies, when private farmers were allowed to buy tractors (at the beginning second-hand from state farms and agricultural circles, then also the new-built ones). The appearance of private farmers on the farm machinery market caused the demand for tractors in Poland to increase. During the seventies and eighties tractors were mainly supplied by the national factory "Ursus" and partly by imports from Czechoslovakia and the Soviet Union, which were lower then market demand. At that time the government established the price of farm machines as well as of other goods. The price relations between farm machines and agricultural products were, in general, favorable for farmers.

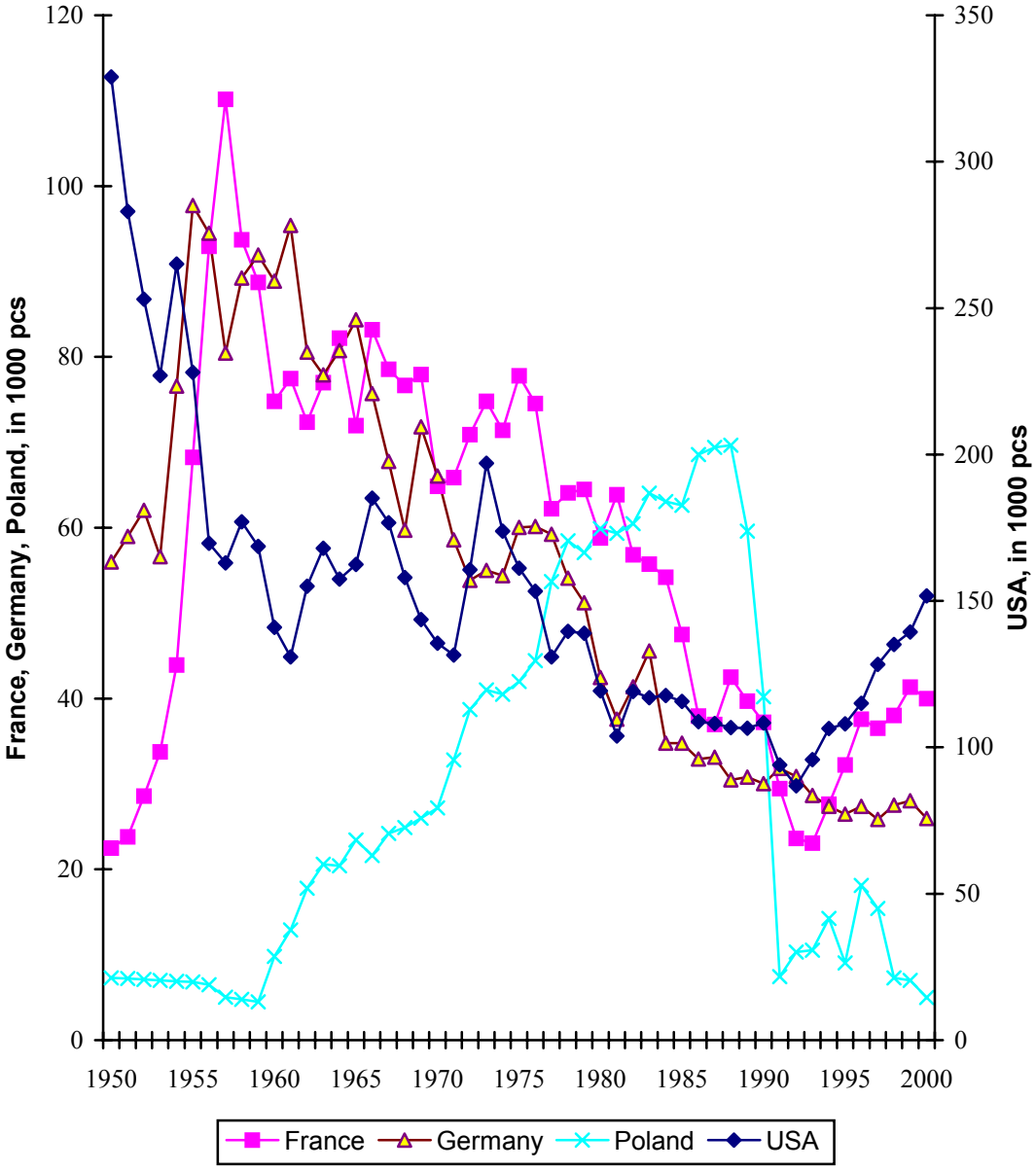

Fig. 1. Sales of tractors in selected countries

In West European countries the sales of tractors had the decreasing tendency during seventies, eighties and nineties. The relative saturation of farms with tractors was the main reason for the declining trend in France and FRG. In the USA saturation was reached even earlier. The decreasing trend on the American tractor market appeared already during the fifties. However in the first half of the sixties, the beginning of seventies and after 1993 an increase in number of sales was observed. In France some increasing trend on tractor market appeared after 1992. The majority of purchases were made to replace the old, depreciated machines with new, in general, more modern versions. The need to modernize the tractor fleet was the main reason for above-mentioned increases in sales.

The need to overcome the economic constraints forced the farmers to look for more efficient use of production factors. One of the solutions was specialization, which consisted of limiting the number of types of crops and animals on the farm. In plant production this made it possible to enlarge the size of fields and scale of production of chosen crops and at the same time limit the number of types of machines needed and increase the annual use of the rest of the machines. From the point of view of farm mechanization this was a good solution, ensuring reduction of investment inputs as well as the operating costs of farm machines thanks to higher annual use and higher working capacities achieved on larger fields. Progress in the specialization of agricultural production was another reason for the decrease in the number of potential buyers of farm machines.

On the other hand, on larger and more specialized farms the equipment of higher capacity was needed. In the USA, between 1964 and 1974 the average power of tractors sold increased by 52% from 43,6 kW (59,3 HP) to 66,5 kW (90,4 HP). Also in Western Europe a growth in sales of high power tractors as a percentage of total tractor sales was observed. Using France as an example this trend is shown in (fig. 2).

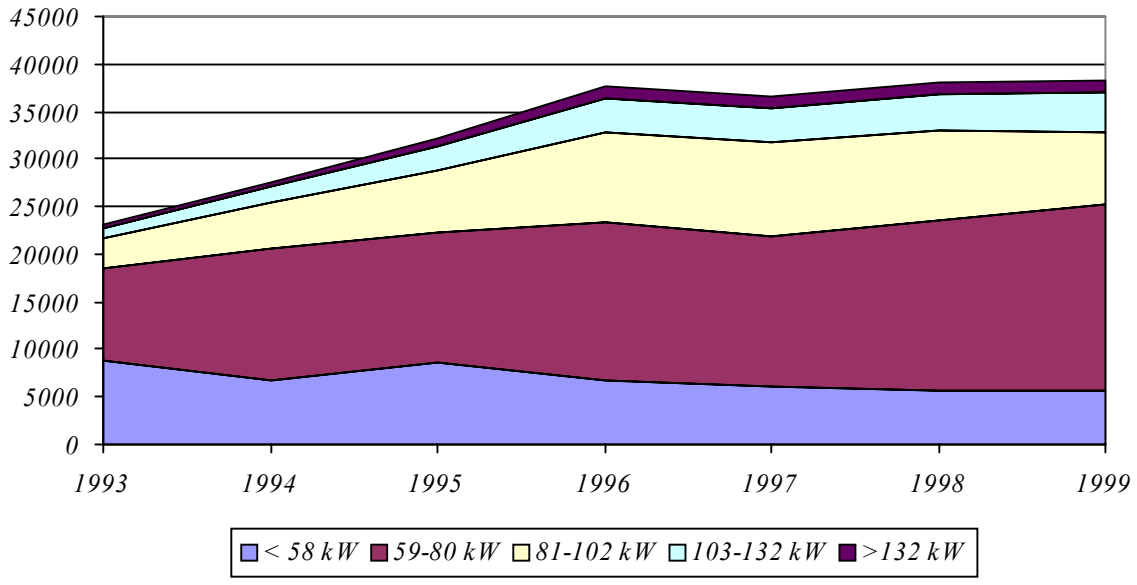

Fig. 2. Sales of tractors in France by categories of power

The other reason of decreasing trend in tractor sales were changes in the relative price between farm machines and agricultural products, which were unfavorable from farmers' point of view. Continued growth of farm machinery operating costs forced farmers to look for

more efficient ways of utilization. One solution was multi-farm use of farm machines. In particular countries, these forms are different. In the USA, where large-scale farming has dominated, the contractor system is typical. Instead in FRG, where farms are rather small, the

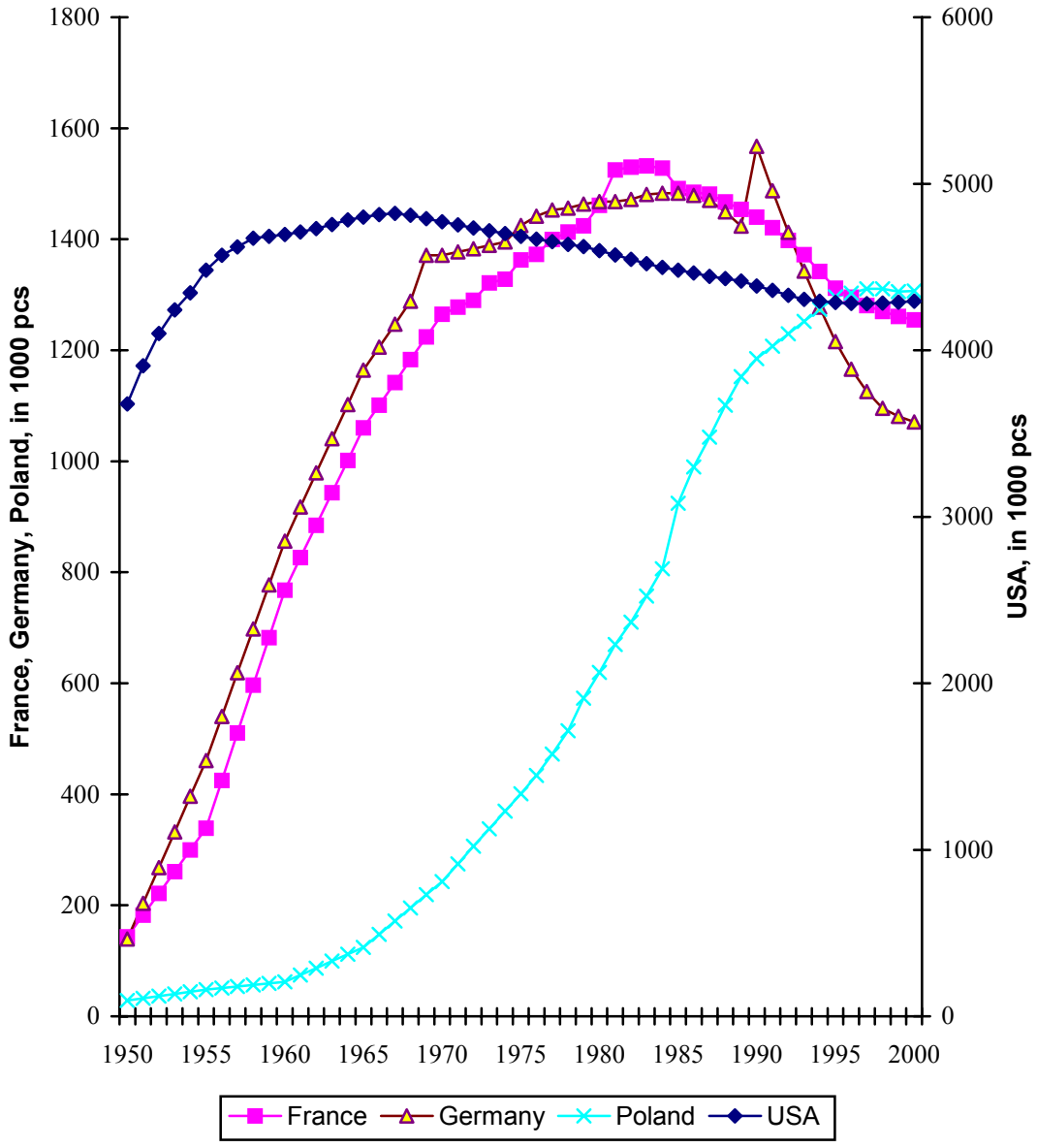

Fig. 3. Number of tractors in use in agriculture of selected countries

system of exchange of services between farmers (within the machinery rings) dominates, though the contractor system also is present. In France the special form of machinery co-operatives (CUMA) is the most popular form of multi-farm use of machines. Implementation of the multi-farm machinery use system results in lower investment needs with a necessity of higher working capacity. As a result of changes in structural, technological, economic and organizational factors, the number of tractors in use for agriculture in industrialized countries tends to decrease. In the USA the decrease in numbers of tractors in use started by 1968, in France – from beginning of eighties, in FRG after 1986 (fig. 3). However, in all of these countries the above-mentioned decrease did not result in lowering the level of agricultural

mechanization. In fact, replacing the older tractors with a smaller number of modern ones ensured greater working capacities, better quality of work, comfort and reliability.
There is a significant difference between effects of decrease of purchases of new-built tractors in Western countries and in Poland. In USA, France and Germany the phenomenon is strictly connected with structural and technological advances (not the regression of mechanization) resulting in increased efficiency. In Poland there is a danger of the decapitalization of resources and the break up the technological advances achieved. Comparison of the rate of renovation of the tractor park[1] in Poland (0.55), in France (2.90) and in Germany (2.22) shows that this concern is based on real background data.
Changes in sales of harvester threshers in particular countries (fig. 4) are similar in nature and have similar reasons as those for tractors. Also in this case in the USA the decreasing trend

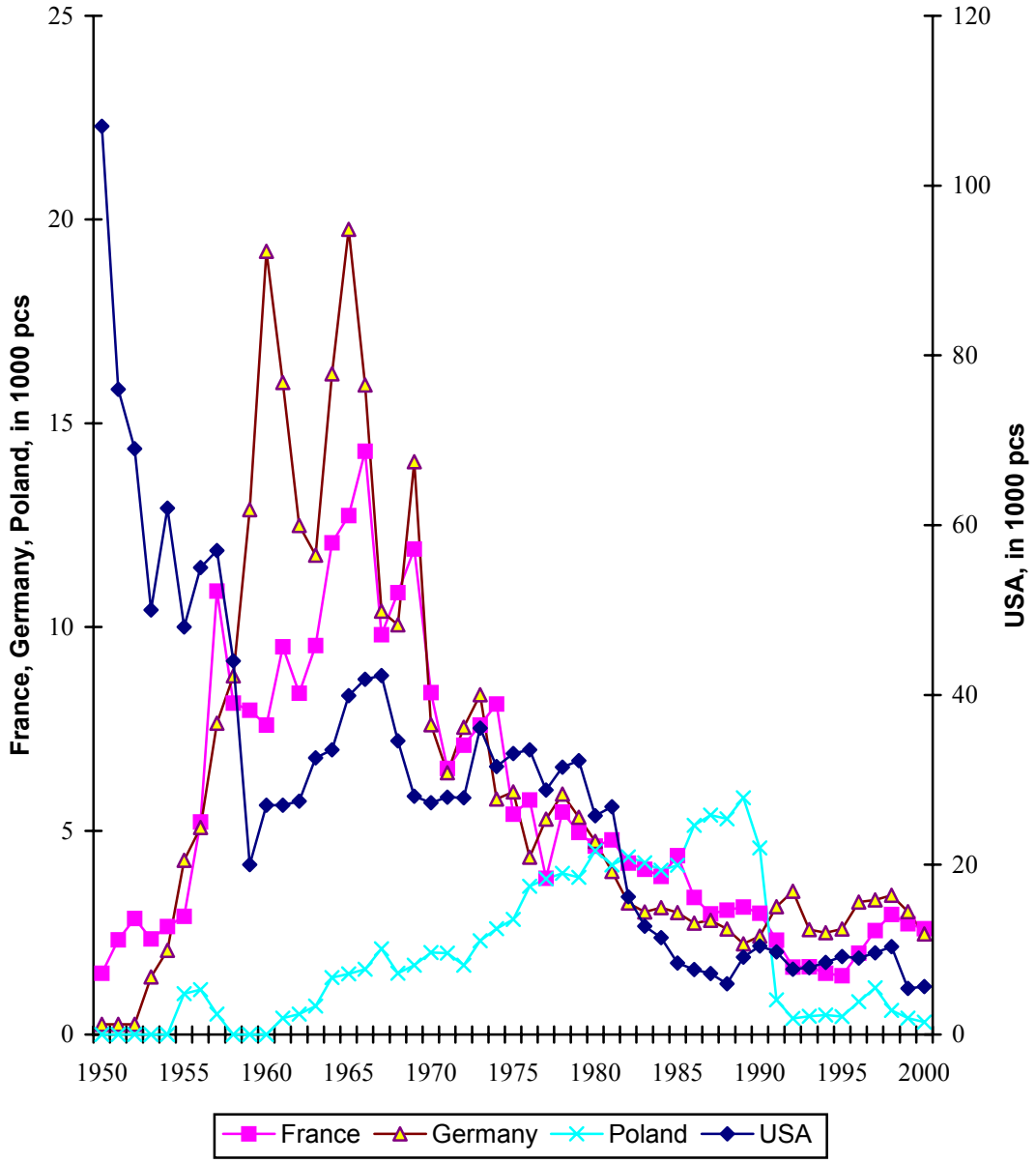

Fig. 4. Sales of harvester threshers in selected countries

[1] Number of purchased new-built tractors per 1000 tractors in use.

was observed during this entire period. In France and FRG dynamic growth of sales took place during fifties, starting from a very low level. The highest level of sales occurred during the sixties. After that the sales of harvester threshers decreased.
In Poland, the growth of sales lasted much longer – until the end of eighties, but the dynamics of growth were less pronounced.
The number of harvester threshers in use was growing in USA until the end of the fifties, in France until 1975 and in FRG until 1976. Only in Poland, did the number of harvester threshers in use grow until the end of the century (fig. 5). The growth in number of harvester threshers in Poland during nineties was achieved mostly because of purchases of imported second-hand machines and prolonging their useful life.

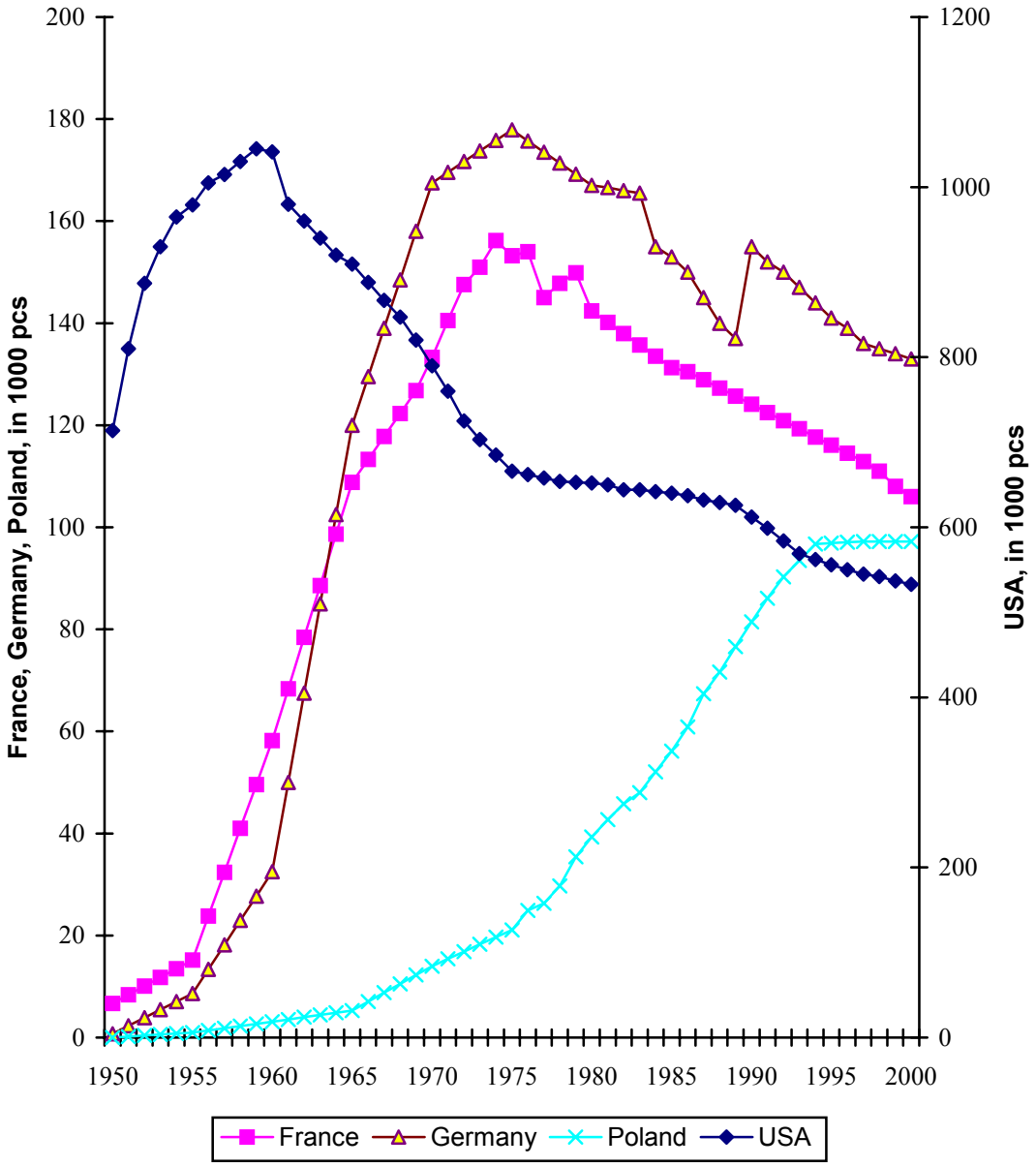

Fig. 5. Harvester threshers in use in agriculture of selected countries

Conclusions

The main factors affecting the demand for farm machines are: (1) level of saturation already achieved, (2) number of potential buyers (farms), (3) number of machines in use related to the number of potential users and amount of work to be done, (4) length of useful life (in years), (5) price relation between farm machines, agricultural products and the economic situation of farmers, etc.

Along with approaching the state of saturation of tractors and harvester threshers in farming the share of new investments in the structure of purchases decreased in favor of unit shares bought as replacements

Reduction in number of farms together with advances in specialization and concentration of production caused the decrease in the number of machines sold and the growth of working capacity, technological standards, requirements toward quality and comfort of work, reliability, safety and environmental protection.
The future development of the farm machinery market in Poland will depend on the evolution of the agricultural situation and of the entire national economy. The present demand is limited by the purchasing power of farmers and currently does not even ensure the simple replacement of existing machines. Improvements in the structure of farming could improve the current situation. For this to happen the creation of new jobs out of agriculture is necessary.

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