



WEAR OF FARM BUILDINGS IN SELECTED FARMS¹

Zbigniew Kowalczyk, Katarzyna Grotkiewicz

Institute of Agricultural Engineering and Informatics at the University of Agriculture in Krakow

* Corresponding author: e-mail: Zbigniew.Kowalczyk@ur.krakow.pl

ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received: November 2015 Received in the revised form: February 2016 Accepted: March 2016</p> <p><i>Key words:</i> physical wear, functional wear, investment expenditures, farm buildings</p>	<p>The objective of the article was to compare the level and structure of wear and tear of various types of the most popular agricultural buildings in the selected agricultural farms. A comparative analysis of physical and functional wear as well as investment expenditures of the selected objects in 2010-2014 was carried out. The scope of the article covered agricultural buildings with which 90 farms in the southern Poland are equipped. These farms were varied on account of the surface area and the production nature. The detailed analysis covered: cowsheds, piggeries, garages, fruit and vegetable storages, greenhouses and barns. The average age of the majority of farm buildings as well as a considerable degree of physical wear in comparison to a lower functional wear was determined.</p>

Introduction

Buildings constitute a significant component of fixed assets in farms without which rational agricultural production cannot be imagined. Even a plant production trend requires suitable infrastructure in the form of storages, garages, workshops areas, etc. According to Wójcicki (2007) and Wójcicki (2001), new and modernized buildings and constructions are, next to newer sets of machines, the technological progress carrier in development of farms and the construction progress is one of the components of the technological progress next to the energy power and mechanization progress.

Farm buildings are related to farming activity in a farm, including those which are used for production, storage of production means and storage of farm products mainly: livestock buildings, warehouses, storages, greenhouses etc. On the other hand, farm buildings are buildings constructed for the purpose of farming and storing agricultural products, in particular such as:

- containers for liquid manure,
- manure pads,
- silage silos,
- grain and fodder silos,
- fermentation chambers,

¹ This Research was financed by the Ministry of Science and Higher Education of the Republic of Poland

- biogas containers,
- fencing.

In the light of structural changes which take place and possibilities of implementation of new technologies in agricultural production there is a natural need to balance construction resources and assess their technical and technological condition. As a rule, data from the Main Statistical Office census are the only data which reflect the existing number of farm buildings. The quantity condition of farm buildings with regard to the technical condition as well as to modern solutions is not subjected to stock-taking (Mulica and Hutnik, 2007).

The degree of technical wear of a building results from its age, endurance of the used materials, quality of construction, manner of use and exploitation conditions, defects in design, renovation management, etc. This wear is usually determined in percentages (Professional standards for property appraisals, 2001; Kowalczyk, 2011b). The size of physical wear determines the technical condition of the building.

Determination of the level of functional wear (moral one) is important when assessing the general degree of wear and tear. The functional wear means permanent, undesired changes of functional and utility solutions of buildings, referred to the currently applicable standards resulting from technical and technological progress (Borcz and Kosek, 1994). On the other hand, according to Professional Standards for Property Appraisals (2001) functional wear results from comparison of the applied design solutions used in a particular case to presently preferred ones (modernity assessment) and specialistic designation which impedes or renders the change in the manner of use impossible.

Environmental wear of buildings results from the made or planned changes in the surrounding of real properties which cause nuisance in using them, carried out or planned mining exploitation in a given area which cause permanent damage to real properties or hazardous impact of ecologically destructed environment on the resistance of buildings and land quality (Professional standards for property appraisals, 2001).

There are no clearly determined criteria of assessment which concern the degree of wear of fixed assets and there are no legal provisions concerning these issues. Calculation techniques applied by experts or economists, particularly for evaluation of the movable assets value with the cost methods (non-market ones) do not include many issues and the degree of wear of fixed assets is defined imprecisely, often intuitively or based on the current period of amortization (Cedzyński, 2001).

The condition and degree of wear of agricultural buildings is essential, inter alia, from the point of view of a farm as an entity on the loan, insurance, fiscal market, etc. Analysis of the condition and level of wear of the selected buildings was the object of research which was carried out in 90 farm of southern Poland.

Objective and scope of the study

The objective of the paper is to compare the level and structure of wear of various types of the most popular agricultural buildings in the selected farms. A comparative analysis of physical and functional wear and investment expenditures of the selected objects in 2010-2014 was carried out in 90 farms in the southern Poland. The paper covered the most popular buildings in farms, including: cowsheds, piggeries, garages, fruit and vegetables storages, greenhouses and barns.

Methodology of research

The analysis of the wear degree and expenditures on investments and renovation of farm buildings was carried out based on the field research. The research was carried out with the use of questionnaires and a guided survey in farms in Kraków and Nowy Sącz province. The scope of investments was determined. Based on the collected information, the size of expenditures concerning construction and renovation of farm buildings within the last five years was determined (2010-2014).

Evaluation of the technical condition of buildings was made with the use of methods presented by Baranowski et al., (2002), Winniczek (1993), Hajdasz (1991), Kowalczyk (2011a), Dębowski (2007).

Particular elements of buildings were assessed. Moreover, weights for particular elements were defined by taking into consideration the replacement cost of an element in the total cost of the building.

A technical condition of each element was evaluated in the scale from 0 to 3 where:

- 0 – a given element was qualified for a general renovation (possibly replacement),
- 1 – average condition,
- 2 – good condition,
- 3 – very good condition,

Based on the obtained description of the technical condition of a building its physical wear was calculated from the following relation:

$$S_{fz} = [1 - \sum_{i=1}^n (\frac{O_i}{P_i} \cdot w_i)] \cdot 100\% \quad (1)$$

where:

- S_{fz} – physical wear, (%)
- n – number of the assessed elements of a building,
- i – i -th element of a building,
- o_i – the obtained number of points of evaluation of the technical condition and i -th element of a building ($o_i =$ from 0 to 3),
- p_i – maximum number of points in the evaluation scale ($p=3$),
- w_i – weight of evaluation of i -th element of a building (from 0 to 1; sum of weights = 1).

The functional wear degree was determined according to the methodology presented, *inter alia*, in the Standards of Professional Property Appraisals (Standardy Zawodowe Rzeczoznawców Majątkowych (2001), taking into consideration proportions of changes in technical parameters of the evaluated and compared building – a modern building. The assessment was carried out with regard to the following parameters: modernity, functionality, reliability, energy demand, safety, environmental impact. Based on the above factors the so called weighted average of the wear degree according to formula 2 was calculated. Weights were admitted discretionary – individually for particular types of objects.

$$S_{fn} = [1 - \sum_{j=1}^m (\frac{O_j}{P_j} \cdot w_j)] \cdot 100\% \quad (2)$$

where:

- S_{fn} – functional wear, (%)
- m – number of parameters/criteria of assessment,
- j – j -th parameter/criterion of assessment,
- O_j – the obtained number of points of assessment of the j -th parameter ($O_j =$ from 0 to 3),
- P_j – maximum number of points of assessment of j -th parameter,
- w_j – weight of j -th parameter (from 0 to 1; sum of weights = 1).

During the research it was found out that the environmental wear of buildings occurs only in marginal cases, therefore they were omitted in the analysis.

Research results

In the region where research was carried out, horticultural production prevails but in case of Kraków province it was vegetable production whereas in case of Nowy Sącz province – horticulture. In 30 farms covered by the research, vegetable production was the main source of income, in 30 – horticultural production, and the remaining 30 carried out multi-trend production. In the group of vegetable farms, the average area of agricultural land was 7.21 ha and participation of vegetable crops in the area of AL was 134% which results from the usage of spring and autumn cultivation in particular in case of cabbage plants. In the group of horticultural plants the average area of agricultural land was 6.72 ha and the participation of horticultural plantations in the area of AL was 88%. On the other hand, in the group of multi-trend farms, the average area of agricultural land was 6.63 ha. The animal production on the commodity scale was carried out mainly in multi-trend farms where the livestock in farms was at the average of 9.83 SD. In the farms covered with the research, greenhouses for production of seedlings and storages of fruit and vegetables occur. The last ones are often objects which are adapted from other farm buildings (cowsheds, piggeries etc.) which on account of the change of the production profile were not used any more. Table 1 presents general information concerning buildings covered by the research. Garages were the buildings which occurred the most often among the buildings which were the object of the research – 79 and barns – 72 and the rarest were fruit and vegetable storages – 29. Average age of buildings was within 16 years (storages) to 37 years (barns).

Table 2 presents investment expenditures concerning construction and renovation of buildings covered by the research within 5 years namely from 2010 to 2014. The highest number of investments was related to garages, where 9 were built and 29 renovated. When considering renovation investments, one may notice that the most expensive renovation works (at the average PLN 9,425) concerned fruit and vegetable storages while the lowest amount was invested in renovation of barns – at the average PLN 2,442. Renovation of barns, referred to the total number, took place the least often (inter alia because of their simple structure), only in 29% of cases, while piggeries and cowsheds were renovated the most often; respectively in 65% and 55% of the total number of objects of this type. Reno-

Wear of farm buildings...

vation of livestock buildings was related often to the introduction of some modern solutions especially within the scope of internal equipment.

Table 1.
Number, usable area and age of selected buildings

Specification	Number of buildings (pcs)	Area (m ²)			Age (years)		
		Average	Minimum	Maximum	Average	Minimum	Maximum
Cowsheds	31	89	27	820	29	2	49
Piggeries	29	41	19	644	24	1	42
Garages	79	129	18	439	21	1	36
Fruit and vegetable storages	29	214	27	617	16	3	40
Greenhouses	34	132	41	294	19	5	35
Barns	72	119	36	495	37	7	59

Table 2.
Expenditures incurred on construction and renovation of selected farm buildings

Specification	Construction		Renovation	
	Number of investments (PLN)	Average value (PLN)	Number of investments (PLN)	Average value (PLN)
Cowsheds	3	340000	17	8175
Piggeries	1	270000	19	6650
Garages	9	73000	29	5350
Fruit and vegetable storages	2	189500	15	9425
Greenhouses	1	95000	12	2925
Barns	0	-	21	2442

When analysing the data included in table 3 one may state that fruit and vegetable storages, whose average level of physical wear is 32% are in the best technical condition. Such state of affairs may be justified with inter alia, the highest investment expenditures concerning renovations (table 2). Piggeries (50%) and barns (49%) have the highest physical wear. In case of barns, this situation may result from a considerably old age and low renovation expenditures. On the other hand, high level of physical wear of piggeries may result from unfavourable conditions of exploitation of these objects, namely by moisture, air composition etc. Both above mentioned types of buildings generally were characterized with a bad condition of both roofing and roof structure. Besides, barns had a high wear of wooden elements and walls.

Table 3.
Physical wear of selected farm buildings (%)

Specification	Physical wear		
	Average	Minimum	Maximum
Cowsheds	43	14	81
Piggeries	50	5	73
Garages	32	5	66
Fruit and vegetable storages	28	7	51
Greenhouses	35	12	95
Barns	49	15	82

The functional wear (table 4) reflects the modernity level of a building. From among the investigated buildings, barns had the lowest average degree of the functional wear, which was 9%. Such state of affairs results mainly from a low progress with regard to the structure and mainly from functional parameters which take place in case of buildings. On the other hand, greenhouses and fruit and vegetable storages have the highest functional wear, respectively 33 and 29%. Both greenhouses and storages are generally buildings with a greater progress every year, which mainly relates to the internal equipment and elements which control micro-climate parameters.

Table 4.
Functional wear of selected farm buildings (%)

Specification	Functional wear		
	Average	Minimum	Maximum
Cowsheds	18	6	42
Piggeries	21	8	68
Garages	14	4	25
Fruit and vegetable storages	29	8	61
Greenhouses	33	5	49
Barns	9	0	28

Conclusions

Based on the research which was carried out, it was found out that:

1. The investigated buildings are considerably old: from 16 years in case of storages to 37 years in case of barns, which may prove quite low level of modernization of buildings infrastructure of farms.
2. The average size of investment expenditures concerning construction of new buildings within the last 5 years is within PLN 73,000 in case of garages to PLN 340,000 in case of piggeries. On the other hand, the value of expenditures on renovation of buildings was within PLN 2442 (barns) to PLN 9425 (fruit and vegetables storages)

3. The average physical wear of the investigated farm buildings does not exceed 50%. The lowest wear of 28% was in case of fruit and vegetable storages which may be justified with, inter alia, the lowest age. On the other hand, the highest physical wear of barns and livestock buildings (piggeries, cowsheds) of 43 to 50% is related to the fact that in the farms covered by research, specialist commodity animal production at a high level was rarely carried out which often results in little care for the technical condition of the above mentioned buildings.
4. The functional wear of buildings is shaped at a considerably lower level (from 9% to 33%) in comparison to the physical wear. Only fruit and vegetable storages are an exception. In their case the functional wear which is 29% exceeds the minimum physical wear. Such state of affairs may be justified with a great technical and technological progress with regard to storing, while low-volume storages often adapted from other farm buildings prevailed in the investigated farms.

References

- Baranowski, W., Cyran, M. (2002). Wycena i zużycie nieruchomości zabudowanych. Poradnik Doradcy Majątkowego. *Instytut Doradztwa Majątkowego, Warszawa*.
- Borcz, J., Kosek, J. (1994). Zasady wyceny maszyn i urządzeń. *Vademecum Rzeczoznawcy majątkowego, Kraków*.
- Cedzyński, J. (2001). Zużycie i deprecjacja środków trwałych. *Zeszyty Naukowe. Mechanika. Politechnika Opolska*, 68, 165-171.
- Dębowski, J. (2007). Problematyka określania stopnia zużycia technicznego budynków wielkopłytych. *Czasopismo techniczne Architektura. Wydawnictwo Politechniki Krakowskiej*, 27-34.
- Hajdasz, H. (1991). Sposoby ustalania zużycia technicznego budynków mieszkalnych. *Promiks, Katowice*.
- Kowalczyk, Z. (2011) a. Poziom i struktura zużycia technicznych środków trwałych w różnych typach gospodarstw rolniczych. *Inżynieria Rolnicza*, 2(127), 5-120.
- Kowalczyk, Z. (2011)b. Zużycie wybranych typów ciągników rolniczych. *Inżynieria Rolnicza*, 4(129), 143-149.
- Mulica, E., Hutnik, E. (2007). Stan zasobów budowlanych gospodarstw rolnych w regionie dolnośląskim. *Problemy Inżynierii Rolniczej*, 1, 131-138.
- Standardy Zawodowe Rzeczoznawców Majątkowych, wyd. VIII. 2001. PFSRM Warszawa.
- Winniczek, W. (1993). Wycena budynków i budowli podejściem odtworzeniowym. *CUTOB – PZITB, Wrocław*.
- Wójcicki, Z. (2001). Metody badania i ocena przemian w rozwojowych gospodarstwach rodzinnych. Wydawnictwo PTIR, Kraków.
- Wójcicki, Z. (2007). Wpływ wyposażenia technicznego na efekty działalności gospodarstwa rodzinnego. *Problemy Inżynierii Rolniczej*, 3, 5-12.

ZUŻYCIE BUDYNKÓW ROLNICZYCH W WYBRANYCH GOSPODARSTWACH ROLNYCH

Streszczenie. Celem pracy było porównanie poziomu i struktury zużycia różnych rodzajów najczęściej występujących budynków rolniczych w wybranych gospodarstwach rolnych. Dokonano analizy porównawczej zużycia fizycznego oraz funkcjonalnego, a także nakładów inwestycyjnych dotyczących wybranych obiektów w latach 2010-2014. Zakresem pracy objęto budynki rolnicze stanowiące wyposażenie 90 gospodarstw rolnych Polski południowej. Gospodarstwa te były zróżnicowane pod względem powierzchni, jak również charakteru prowadzonej produkcji. Do szczegółowej analizy wybrano: obory, chlewnie, garaże, przechowalnie owoców i warzyw, szklarnie oraz stodoły. Stwierdzono m. in. duży średni wiek większości budynków rolniczych, a także znaczny stopień zużycia fizycznego w porównaniu z niższym zużyciem funkcjonalnym.

Słowa kluczowe: zużycie fizyczne, zużycie funkcjonalne, nakłady inwestycyjne, budynki rolnicze