Cost-assessment Analysis of Local Vehicle Scrapping Facility

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Abstract. The purpose of the paper was to analyse the costs of recycling vehicles at local vehicle scrapping facility. The article contains regulations concerning vehicle decommissioning, describes the types of recovery, vehicles recycling networks, analyses the structure of a disassembly station, as well as the financial and institutional system in charge of dealing with the recycling of vehicles in Poland. The authors present the number of scrapped vehicles at local recycling company and the level of achieved recovery and recycling. The research presented in the article shows financial situation of the vehicle scrapping industry. In addition, it has been observed that the number of subsidies are directly proportional to the number of scrapped vehicles, and achieved levels of recycling and recovery depends on the percentage of incomplete vehicles.

1. Introduction
Civilization growth leads to the economic development. The automotive industry is one of the most intensively developing industrial branches in the world. The number of new generation vehicles on the road is still growing. Due to the increasing numbers of cars, there is a growing interest in the issue of the development of the out-of-date vehicles [1-3].

The problem of the end-of-life vehicles utilization occurs globally. Volumes of car production and sales are characterized by high dynamics, which over time will result in the necessity and pressure for better recovery solutions. The implementation of appropriate measures in this area is justified not only from the environmental but also economic point of view. World leaders in vehicle production and sales are the United States of America, Germany, Japan, South Korea and China. Obligatory measures will be taken to increase the effectiveness of processes, which gives initial utility value to products and improve its efficiency. [4-6].

In 2015, 33% of cars were over 21 years old and 23% were between 16 and 20 years old, which means that outdated cars (over 16 years old) represent more than a half of the overall age structure. The number of registered vehicles in Poland is largely shaped by imports behind the western border. Since the accession of the Poland to the European Union, the imports of the cars used for more than 10 years have increased significantly. The age structure of the resident cars in Poland is one of the oldest
in Europe. Older vehicle models, compared to modern ones, are more dangerous to the environment and to humans, especially because they are emitting more harmful substances and do not have advanced safety systems. Compared to the standards of the European Union, the car market in Poland is unsatisfactory in terms of quality [7-9].

Directive 2000/53/EC imposes an obligation on producers and car importers to pay the costs incurred by the last owner of the end-of-life vehicle. In the case of transfer of an incomplete decommissioned vehicle to a dismantling station, the charge could be up to 10 zł for each missing kilogram on vehicle weight. According to the Act on the Recycling of End-of-Life Vehicles, importers who introduce no more than 1000 vehicles per year are exempted from the obligation to create networks. However, they are obliged to pay the amount of 500 zł for each entered car into the account of the National Fund for Environmental Protection and Water Management (pol. NFOŚiGW). Funds from that institution are given as a donation to support recycling activities. The subsidy amount from that Fund depends on the number of vehicles scrapped and the recovery rates which a dismantling station achieved [9,10].

An important element of the dismantling station's financials is the revenue generated from the company's operations. The main income is obtained from the sale of scrap metal, used batteries, used spare parts, and waste oils. Entrepreneurs running vehicle dismantling station transfer the part of their profit for additional utilization parts and materials such as: tires, plastics, glass and filters, which reduce general income. Dismantling stations cover the costs associated with waste neutralization. In order to obtain a favourable financial result, it is necessary to obtain as many reusable parts as possible, to obtain clean, good quality raw materials and to sign contracts on favourable terms with waste disposal companies [9-12].

2. Materials and methods

The basis for financial analysis is the local vehicle scrapping facility in the Małopolska voivodeship. The analysis covers the years 2011 - 2015. Most vehicles were scrapped in 2011 (135). The year 2014 was the worst if we take under the consideration a number of the vehicles, which were scrapped (71). In the remaining years the number of scrapped vehicles was 100.

The main part of the research was a total cost analysis with the consideration of costs incurred by the local vehicle recycling company in 2011 - 2015. In this particular case, the following costs, revenues and subsidies were collected:

- wage costs,
- waste disposal costs,
- costs related to the acceptance and demolition of vehicles,
- revenue from the sale of scraps,
- grants from National Fund for Environmental Protection and Water Management.

In order to achieve the aim of work, it was necessary to compare individual budget lines of the plant in the years 2011 - 2015. Based on the information received from the company, the financial analysis was performed to identify the main factors affecting the financial result. Due to the specificity of the issue, it was necessary to adjust the financial result as described in equation (1)

\[ Z = (S + P) - (Kp + Ku + Kr) \]  \hspace{1cm} (1)

where: \( Z \) - profit (loss), \( S \) - budget subsidy for scrapping vehicles, \( P \) - net income from scrap and scrap sales, \( K \) - net costs (\( p \) - wage costs, \( u \) - waste disposal costs, \( r \) - demolition of vehicles)

3. Results and discussions

Figure 1 shows that revenue from sales of recovered parts and scrap in years 2011 - 2015 has a clear downward trend. In 2011 the revenues amounted to 85 206.98 zł, while in 2012 it was 65 143.88 zł - it is the change for almost 24%. In the following year 2013, the revenues were 63 117.08 zł, which
represents a difference of more than 3% since 2012. Then it fell by almost 23% in 2014 to 48,795.12 zł. Between 2014 and 2015, when revenue was 48,289.98 zł, the variation was just over 1%. Over 5 years the maximum difference was over 43%. The main factor influencing this result was the number and content of individual raw materials of scrapped vehicles in the plant. The requirements for achieving even higher recovery rates have also influence on the process that dismantling stations had to develop low-profit products that are costly to recover.

![Figure 1](image1.png)

**Figure 1.** The revenues from the sale of recovered parts and scrap

Figure 2 shows that the smallest surcharge until 2015 was in year 2013. The subsidy in 2011 amounted to 53,892.50 zł, and in 2012 to 41,319.00 zł; it represents about 23% decrease. In 2013, where the subsidy amounted to 31,913.50 zł, the difference to the previous year was less than 23%. By contrast, in 2014 the amount was 33,020.50 zł - that means an increase of over 3% relative to the previous year. In the next year 2015, there was another increase compared to the year 2014 by over 22% at the value of 40,370.00 zł. The difference between the highest subsidy in 2015 and the lowest subsidy was just over 40%.

![Figure 2](image2.png)

**Figure 2.** The subsidies for scrapping vehicles
Figure 3 shows that in 2012, wage costs were the highest, amounting to 41,336.08 zł while in 2013 they were the lowest – 31,257.77 zł; it is a change of approximately 24%. In the remaining years, the changes were not so significant. In 2011 the costs were 37,788.53 zł and in 2012 – 41,336.08 zł; therefore, they also increased by over 9%. The change in general costs from 2013 to year 2014, with the costs of 35,641.90 zł, resulted in a difference of around 14%. From 2014 to 2015, with the costs of 32,956.4 zł, a decrease of about 8% was noticed.

The cost of waste disposal shown in Figure 4 describes that in the discussed case a large deviation occurred in the year 2014. In 2011 the disposal costs amounted to 2,486.77 zł, whereas in 2012 to 2,575.59 zł, which means an increase of less than 4%. These costs in 2013 equalled 2,808.03 zł, so they increased about 9% compared to the last year. Between 2013 and 2014 (3,710.65 zł) costs reached a growth by more than 32%. The difference between the extreme amounts of waste disposal costs in the years 2011 - 2015 is 1,434.65 zł, which is a decrease of about 39% from 2014 to 2015.
In the statement of costs related to acceptance and demolition of vehicles, shown in Figure 5, the lowest value occurred in the year 2012 and amounted to 30,931.16 zł, and the highest value occurred in the year 2015 with a value of 52,927.89 zł - it is an increase of over 71%. In 2011 the costs amounted to 34,034.47 zł, so in 2012 they decreased by more than 9%. Between 2012, with costs of 30,931.16 zł and 2013 with the costs of 49,899.86 zł, an increase of approximately 61% occurred. By contrast, in 2014 with the amount of 42,580.99 zł compared to 2013, there was almost a 15% drop. According to the graph, there was a 24% increase in 2015 compared to 2014.

![Figure 5. Costs related to the acceptance and demolition of vehicles at the vehicle scrapping facility](image)

Figure 5. Costs related to the acceptance and demolition of vehicles at the vehicle scrapping facility

Figure 6 shows financial results for 2011 - 2015. The financial position in 2011 was profitable, the profit amounted to 64,789.71 zł, from year to year there was a big decline and in 2015 the financial result was at the level of 499.69 zł. In 2014 the plant was in the worst financial position, namely the financial result was a loss: -117.92 zł. In this year there was also the highest costs level related to waste disposal - 3,710.65 zł.

![Figure 6. Financial results for the years 2011 - 2015 at the vehicle dismantling station](image)

Figure 6. Financial results for the years 2011 - 2015 at the vehicle dismantling station
With the increasing number of vehicles and other branch forecasts, there is a high probability that the vehicle dismantling station will be in a worse financial position. After analysing the presented data, it could be noticed that the financial result generated in a local vehicle scrapping plant has changed a lot over the last 5 years. Revenues are getting lower and scrapping is becoming unprofitable. Also, in the case of the number of scrapped vehicles, downward tendencies were observed.

4. Conclusions
With the development of motorization, the share of individual raw materials groups in vehicles has been changed. The content of iron and heavy metals decreases while the amount of plastics and aluminium is increasing. Raw material that is 100% recyclable is steel. Other materials have a lower recovery rate. Therefore, the reduction of dotation for recovery process had reduced the profitability of scrapping. It will be necessary to plan and implement innovative recycling technologies to keep that industry alive.

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