COMPREHENSIVE ANALYSIS OF THE COSTS AND EFFICIENCY OF WORK AT ASO IN TERMS OF FUNCTIONING DURING A PANDEMIC

Rafał Burdzik, Adrian Lotko

Abstract

The global coronavirus pandemic and the effects of the COVID-19 disease have had an unprecedentedly significant impact on social behaviour and the global economy. The effects of the epidemic and the resulting restrictions will effect world markets for a long time, in almost every economic sector. The article presents the results of a preliminary analysis of how the pandemic influenced the functioning of the vehicle maintenance sector, using authorized service station (ASO) as an example. As part of the research, a comprehensive analysis of costs and work performance indicators was conducted and the results obtained in 2019, before the pandemic and in 2020 were compared. Additionally, an estimated forecast for the following years was made. The practical effect of the study is to present the extent to which the impact of the environment, an extremely unpredictable factor that has not yet occurred on such a scale in the global economy, affects the balance of costs and the efficiency of ASO work.

Key words

man-hour, ASO service, cost analysis, pandemic, Covid-19

Citation:

Burdzik J., Lotko A., Comprehensive analysis of the costs and efficiency of work at ASO in terms of functioning during a pandemic (5-13)
DOI: 10.5604/01.3001.0015.8708

1. Introduction

The SARS-CoV-2 virus epidemic meant that not only the majority of the society struggled with a large health burden (COVID-19), but also the declaration of a pandemic in the world resulted in the closure or limitation of the operation of many enterprises. Analyses of the economic effects caused by the coronavirus pandemic cover many areas of the economy and the vast majority of these effects are felt only now (after almost 2 years of the pandemic) and, as analysts claim, many of the consequences will only be revealed in the future. There are many studies that analyse the economic impact of the epidemic on various sectors of economy. A significant number of them in the broadly understood transport sector concerns the functioning of supply chains [1,2], the automotive market [3] or the carrier market [4,5]. However, it is difficult to find studies on the vehicle maintenance sector. That is why research on the economic effects was conducted using authorized service station (ASO), of one of the leading brands of passenger cars and commercial vehicles in Poland, as an example. The main focus was on labour costs and the resulting rates for ASO man-hours as well as labour efficiency indicators.

2. Calculation of the costs of running a business in the automotive industry

2.1. Costs and man-hour rates

One of the most important financial management processes at the vehicle repair workshops is the calculation of the labour hourly rate (LHR). It shows, among the other things, the balance of costs and revenues for a specific activity. In addition, it indicates the achieved financial goals, as well as the profits obtained. Thanks to the rate per man-hour, the vehicle repair work-shop can prepare a price list of services in a transparent manner. The man-hour rate is an example of an estimated labour rate. It should take into account not only hourly repair service, but also profit, and should be appropriate to the market rates. In order to calculate costs, one can distinguish between direct and indirect costs. The direct costs include:

- costs of materials used,
- direct salaries,
- other costs (which are directly related to a specific product or service).

However, the indirect costs include mainly:

- technical costs (departmental),
- plant production costs,
- selling costs.

In a slightly different classification, costs can be broken down due to changes resulting from the sales volume of services. Therefore, there are: costs strongly proportional to the number of services sold, and costs showing very little dependence on the number of products sold. Therefore, this classification includes: fixed costs and variable costs. Fixed costs include: employees' salaries, plant maintenance costs, rent, marketing, depreciation of fixed assets. On the other hand, variable costs are nothing else, but spare parts, varnishes or consumables. However, the costs that depend on service delivery processes and are difficult to calculate using the hourly repair calculation, can be counted as fixed costs. For example, such fixed costs most often include the consumption of energy, tools or health and safety measures [6].

Records of costs of the services provided at a given facility, for example in a car repair shop, should take into account criteria classification in order to optimize and manage costs. An example of the breakdown of cost criteria is as follows:

- costs of materials and energy used,
- costs of external services,
- costs of licenses,
- costs of rent and lease,
- costs of depreciation of fixed assets,
- other costs,
- costs of fees and taxes,
- costs of personal and impersonal remunerations,
- employees' benefits costs.

An insightful balance of costs and continuous monitoring of individual components enables flexible price management and dedicated cost optimization [7,8]. Such activities are the basis for estimating unit costs, including man-hours, especially in the case of service enterprises, such as ASOs or other repair shops or vehicle service stations, where the share of costs not related to the production (service) cycle is significant. This approach is particularly important in the case of random external factors, strongly affecting close and distant environment, that affect the profitability of the enterprise. Probably just such an event is the global pandemic and economic constraints as well as changes in the consumer attitudes.

2.2. Time and efficiency of car repair shop work

In the service sector, the basic unit for calculating the rate for a particular service is the hour or the specific single service. Above all, it is important to correctly identify the activity that was performed during the repair. Therefore, two concepts should be distinguished: the duration of the repair and the duration of the service performed. It is accepted to use the term "time-consuming" service, instead of "service time".

The total time of a mechanic's work includes many activities. Therefore, during the working time of the mechanic, the following are distinguished:

- time of repair activities (technological time) - related to performing specific repair procedures,
- rest time, which is required mainly after carrying out work that required physical effort,
- break time related to compliance with health and safety rules (meal breaks),
- break time related to organizational activities during work (e.g. moving the vehicle to another location, looking for tools, spare parts),
- break time resulting from verifying and monitoring the work of newly hired employees, or due to conducting training,
- break time related to reading the vehicle documentation, repair analysis,
- time that is required to prepare the workplace,
- time to clean the stand, after the repair [6].

However, in the case of calculating the effective working time, it is important to take into account also the periods of breaks, resulting, among the others, from: the absence of employees in the event of vacation or in the event of sickness. In addition, the efficiency of working time should be taken into account in relation to the entire car repair shop and its organization. Working time efficiency is so important as it is a determinant for the calculation and determination of the rate per man-hour [6].

2.3. Cost calculation

Cost calculation is the determination of the total sum of costs per costing object and the calculation of the unit cost. The unit cost allows to:

- correctly determining the costs of providing services,
- cost monitoring,
- shaping the sale prices of services,
- analysis in terms of the most productive services,
- developing strategy to reduce operating costs [6].

Usually, for cost calculation, split calculation and additional calculation are used. The split calculation works by calculating the unit cost of goods, in this case mass-produced services or several similar ranges. The formula for cost calculating using the unit method is as follows:

$$K_{jp} = \frac{K_c}{P_C}$$

Where: K_{jp} - unit cost by split calculation method, - total cost (sum of variable costs), - total production (number of services sold) [1].

At the companies that manufacture a wide range of products which differ in terms of production, an additional calculation is used. The method consists in calculating the costs of individual services from a specific group on the basis of direct costs. Indirect costs are included with the use of appropriate accounting keys according to the mark-up indicator determined by:

$$W_n = \frac{K_p}{k_r} \cdot 100\%$$

Where: W_n - Mark up indicator, - indirect costs, - accounting key [6].

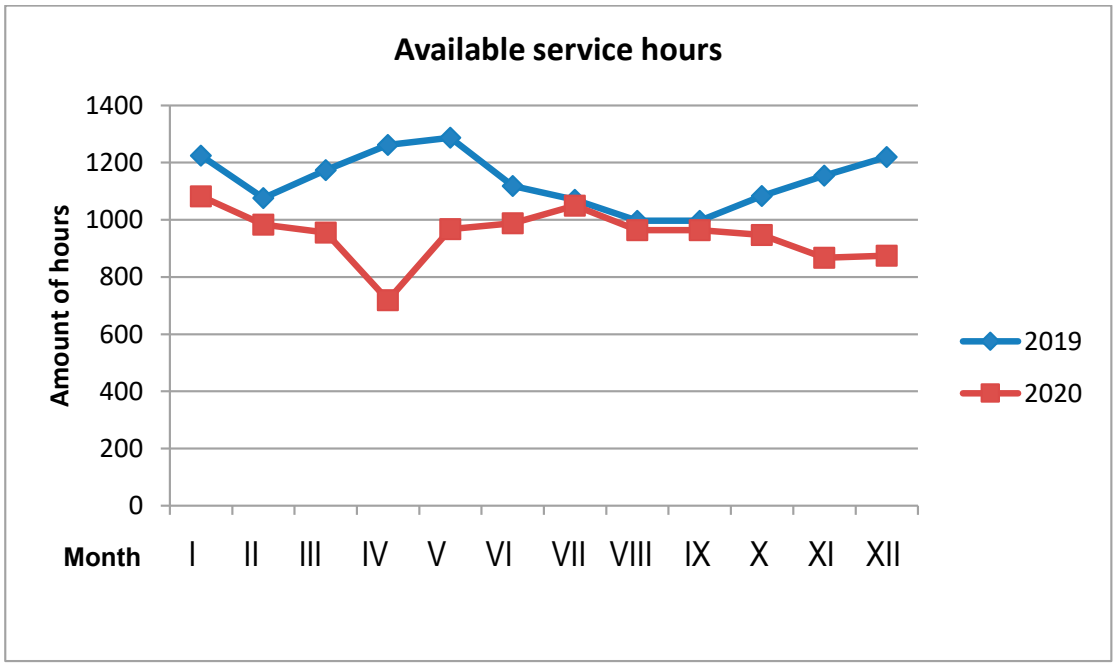
3. Analysis of ASO working time during a pandemic

For research purposes, an authorized service station (ASO), of one of the leading makes of passenger cars and commercial vehicles in Poland, was selected. During the research period, the surveyed company employed five mechanics and three full-time diagnosticians. The audited entity employs additionally four service advisers.
The ASO is open from Monday to Friday from 8 am to 6 pm, and on Saturdays from 9 am to 2 pm. On Saturday, one service advisor and two technicians work. A comparison of the average monthly working hours per technician in 2019 (before the pandemic) and 2020 (during the pandemic) is presented in the Table below. The comparative period (before and during the pandemic) is marked in gray. Additionally, the diagram in Figure 1 has been plotted for illustrative purposes.

Table 1. Distribution of the average monthly working time of a technician in 2019 and 2020

	2019	2020	2019	2020
	Average hours per technician		Sum of all available hours	
January	153	135	1224	1082
February	134	123	1076	983
March	147	119	1174	955
April	158	90	1263	719
May	161	121	1287	968
June	140	124	1118	988
July	134	131	1070	1050
August	125	121	997	964
September	125	121	997	964
October	135	118	1084	947
November	144	108	1154	867
December	152	109	1220	875
Total	*1708*	*1420*	*13664*	*11363*

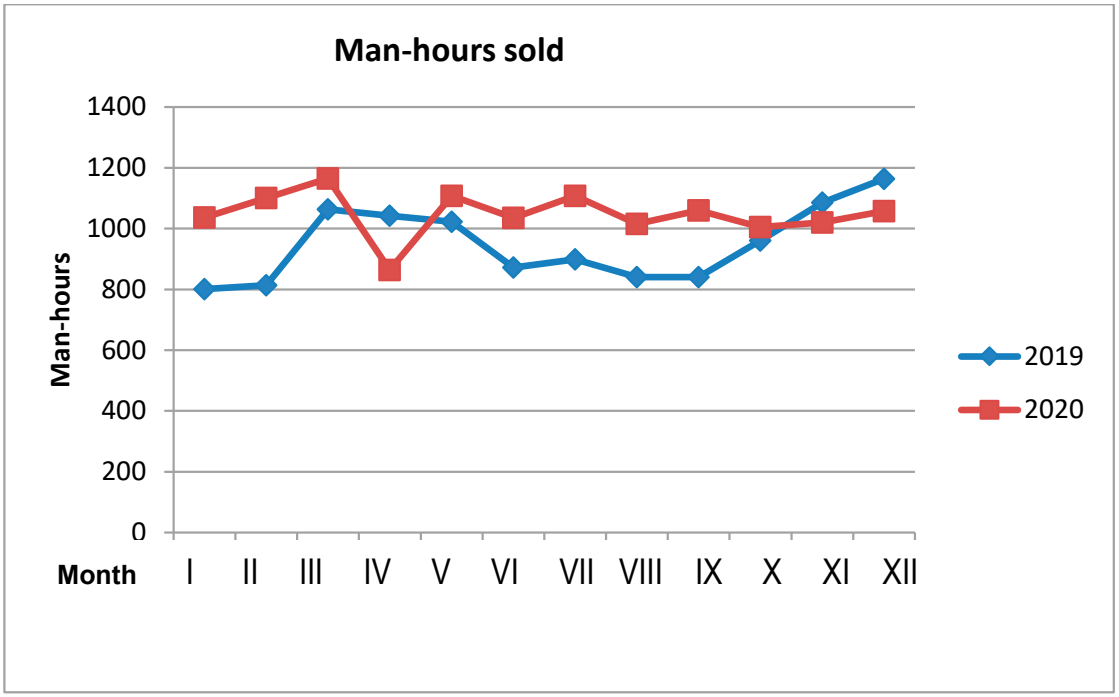
Fig. 1. Available service hours in 2019 and 2020



Source: authors' own study

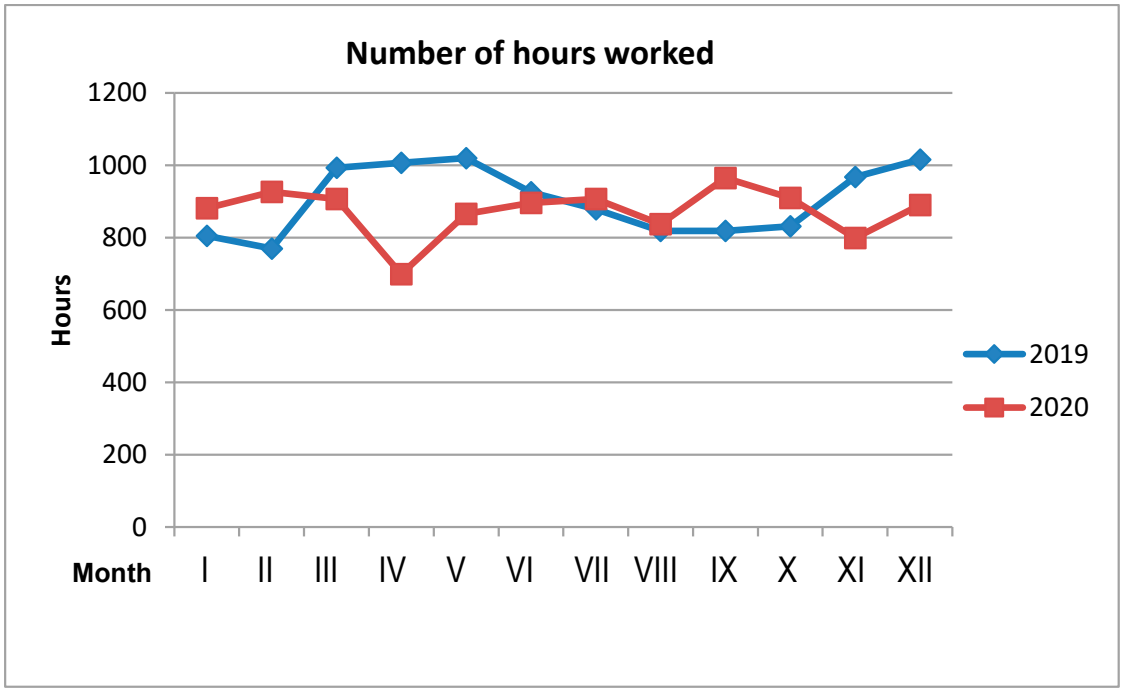
The highest maximum value in 2020 is in January, where the risk of coronavirus did not apply to Poland. It can be seen that the lowest value is in April. This is the beginning of a pandemic in Poland. Then the service work time is reduced to 8 am to 4 pm. Then, the number of service hours sold (man-hours) was compared, Figure 2. Next, the numbers of hours worked by the mechanics in the pre-pandemic and pandemic periods were compared, Figure 3.

Fig. 2. Man-hours sold in 2019 and 2020



Source: authors' own study

Fig. 3. Hours worked in 2019 and 2020



Source: authors' own study

4. Analysis of the efficiency of work in ASO in terms of functioning during a pandemic

As part of the research, an index analysis of work efficiency in the studied enterprise in 2019 (preceding the pandemic) and 2020 was carried out. For the research purposes, working time efficiency index was defined as:

$$E = \frac{rbh}{dh}$$

Where; *E*- efficiency; *rbh*- man-hours (hours sold); *dh*- hours available

The comparison of the values of the working time efficiency indicators is presented in the figure below.

As shown by the calculations in the pandemic year (2020), the effectiveness is greater and, interestingly, exceeds even 100%. This means that the service has sold more man-hours than it had available hours to offer. The duration of repair actions is defined in time units, and 10 units of time make up the man-hour. In authorized services, the repair/service time is specified in the catalogues of time standards. However, the actual repair time may be shorter. Efficiency, which is above 100%, is the result of perfect scheduling, shorter repair time, good organization of human resources by, for example, a foreman, continuous work-load for service hours and the availability of internal orders (e.g. pre-sales inspections, retrofitting, etc.), which are performed when the technician completes the scheduled repair faster.

This is evidence of a psychological phenomenon related to increasing motivation and mobilization at work due to economic dangers, such as another lockdown, reduction of working time and wages. It is related to the phenomenon of the so-called "backup work". However, it is worth paying attention to accelerated burnout in a situation when the period of such work under pressure is extended.

In the case of work of a car mechanic, a very important aspect, which must also be taken into account when the efficiency exceeds 100%, is the quality of the repair, mainly in terms of vehicle safety. The responsibility of the mechanic, and thus ASO, concerns the safety of the vehicle's operation and is a fundamental component of the service. Another area of analysis concerned the productivity of ASO. For this purpose, periodic (monthly) partial indicators were determined, in accordance with the formula:

$$P = \frac{rbh}{ph}$$

Where; *P* - productivity; *rbh*- man-hours (hours sold), *ph*- hours worked. The summary of the results is presented in the chart below

As in the case of efficiency in 2019, the productivity is lower than in the pandemic year 2020. It is worth noting that both in 2019 and 2020 the average annual productivity indicators are greater than 100%, which shows that experienced employees perform repair work and the others in the time shorter than required by the maintenance and repair standards.

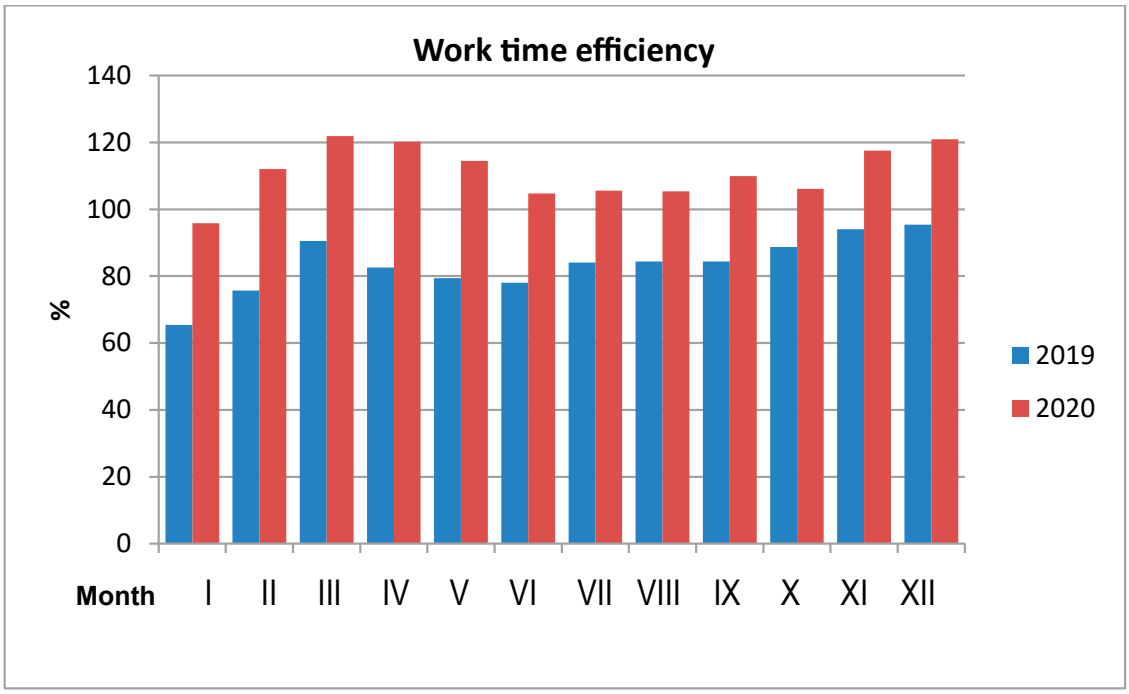
As an additional comparative indicator, the indicator of the use of the available hours was proposed, defined as:

$$W = \frac{ph}{dh}$$

Where; *W* - hours used; *ph* - hours worked, *dh* - hours available

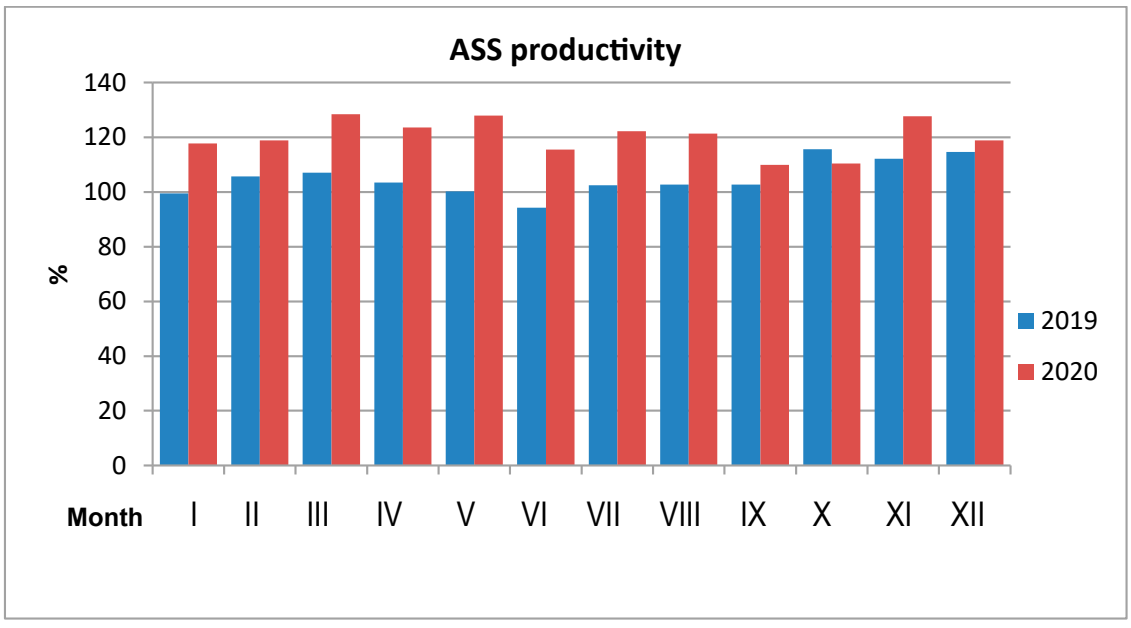
The monthly summary in 2019 and 2020 is presented in the chart below.

Fig. 4. Work efficiency in 2019 and 2020



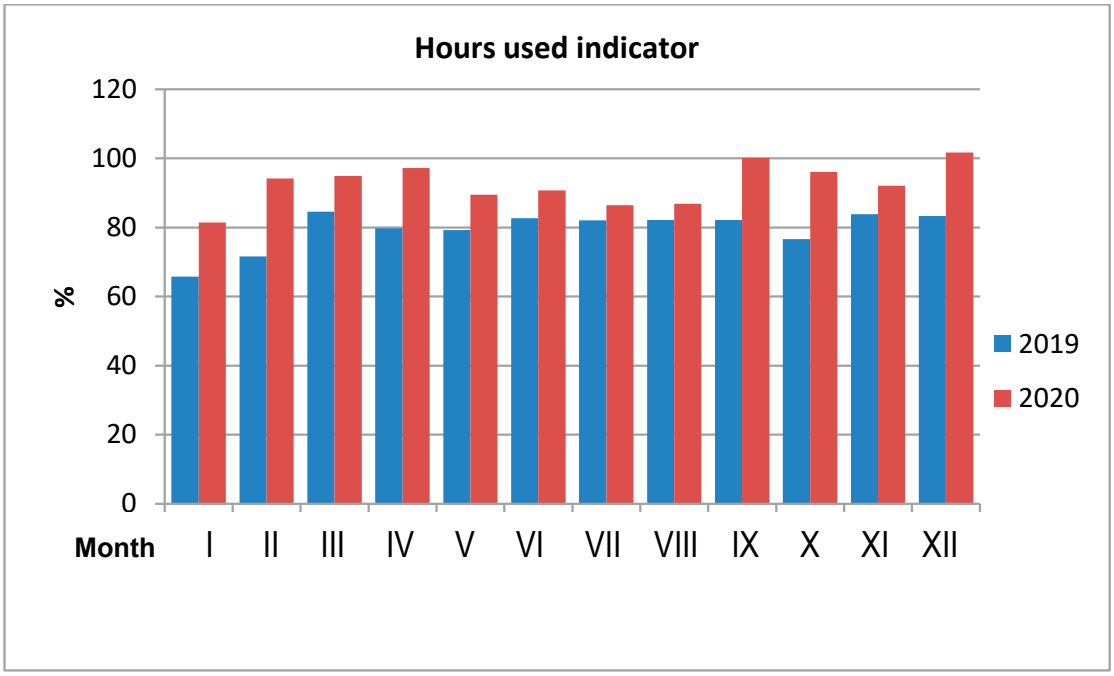
Source: authors' own study

Fig. 5. Productivity in 2019 and 2020



Source: authors' own study

Fig. 6. Indicator of the hours used in 2019 and 2020



Source: authors' own study

In the chart above, it can be seen that in 2019 the average utilization rate fluctuated around 80%. In a pandemic year, the ratio of the hours used is much higher each month, which may mean a higher demand for services from service workers and better organization of work. In December, it even exceeds 100%, which is due to the number of orders and overtime worked.

5. Analysis of the ASO man-hour cost during a pandemic

In order to comprehensively analyse functioning of ASO during a pandemic, a cost calculation was also carried out.

The table below lists the maintenance costs of the ASO service in 2019 and 2020.

Table 2. Service costs

	2019	2020
	Service costs	
Mechanics' salaries	682131	694318
Service consultants' salaries	568454	578581
Salaries of administration and managers	553407	560492
Costs of other personnel	28728	32044
Training	80177	17418
Company cars	36758	46366
Marketing and promotion costs	92906	148547
Office supplies	2718	5296
Consumables	96474	99420
Small tools	16714	4860
Maintenance costs	40423	39887
Diagnostic equipment	0	23347
Other costs in total	188035	12613
Total	*2386925*	*2263189*

Source: authors' own study

Based on the cost analysis, it was found that at the examined ASO 76% of costs are remuneration for mechanics, service consultants, administration and managers. In 2019, the total costs generated by the service facility was PLN 2,386,925. In 2020, i.e. during the coronavirus pandemic, the costs of the service were lower by 123,736, i.e. PLN 2,263,189, but it is worth noting that this year the diagnostic equipment was replenished (PLN 23,347), and the expenses on marketing and office supplies were increased with a clearly lower costs of training and small tools. Moreover, in 2020 the share of personnel costs was 82%, i.e. 6% more than in 2019.

The total cost summary made it possible to calculate the costs of a man-hour, i.e. unit costs using the split calculation method, K_{jp}. The results in 2019 and 2020 are as follows:

Man-hour cost in 2019:

$$K_{jp} = \frac{2386925}{11405} = 209{,}2875932 \text{ PLN}/h$$

Man-hour cost in 2019:

$$K_{jp} = \frac{2263189}{12577} = 179{,}9466486 \text{ PLN}/h$$

The results obtained clearly show to what extent the improvement of work efficiency influences the improvement of the profitability of the ASO and the reduction of unit costs.

Additionally, as part of the analyses, forecasting of costs and rates for the next years of ASO activity, was carried out. For the purpose of the forecast for the years 2022-2025, the following service hours were assumed - from Monday to Friday, from 8 a.m. to 6 p.m. At that time, it was assumed that the work was performed by eight mechanics in a shift cycle. It was assumed that on Saturday there are three mechanics working from 9 am to 2 pm. The forecasting did not impose any restrictions related to the reduction of service time due to the coronavirus pandemic. The following distribution of monthly working hours of ASO mechanics was assumed, taking into account holiday days.

In order to estimate the costs of ASO in the subsequent years of the forecast a trend line was designated, Figure 7.

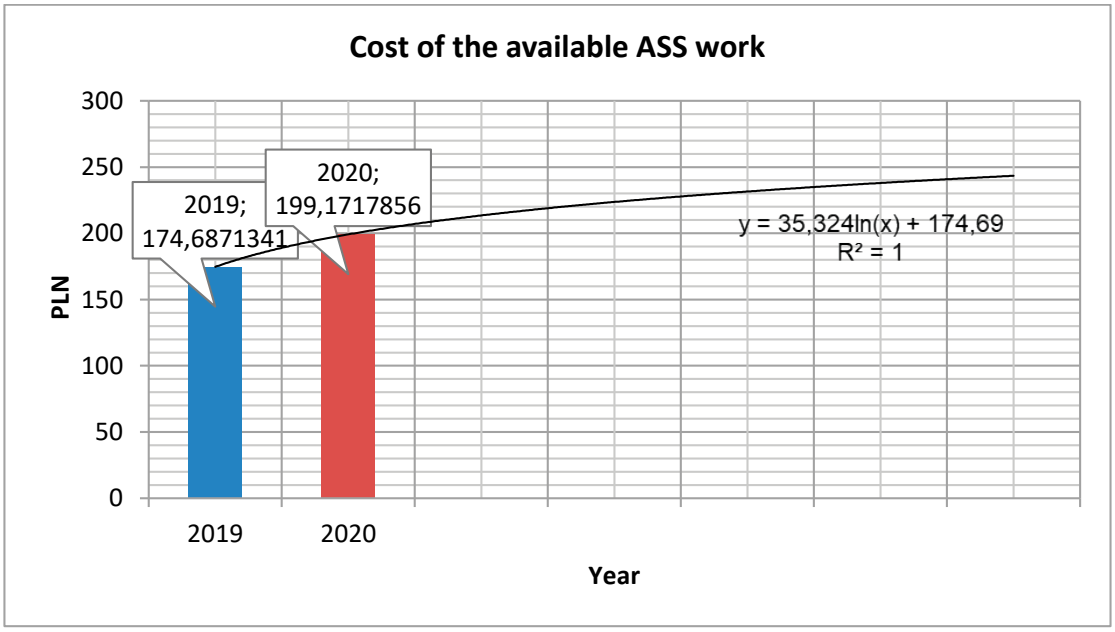
Based on such adopted data, an estimated forecast of the total cost of ASO was made. The results are shown in the table below (Table 4).

Table 3. Number of available hours in particular years

	2022	**2023**	**2024**	**2025**
	The number of mechanics' working hours			
January	1276	1404	1404	1404
February	1340	1340	1389	1340
March	1532	1532	1404	1419
April	1340	1276	1404	1389
May	1404	1404	1340	1340
June	1404	1404	1355	1340
July	1419	1419	1532	1532
August	1468	1468	1419	1355
September	1468	1419	1404	1468
October	1419	1468	1532	1532
November	1340	1325	1276	1212
December	1389	1291	1340	1404
Total	16799	16750	16799	16735
Total with leave	*15135*	*15086*	*15135*	*15071*

Source: authors' own study

Fig. 7. Estimating the cost of available hours (cost of available hours in 2019; 174,6871341, cost of available hours in 2020 - 199,1717856)



Source: authors' own study

Table 4. Forecast of the total costs of ASO

	Number of hours available	Averaged cost of available hour	Total cost
2019	13664	174,6871341	2386925
2020	11363	199,1717856	2263189
Forecast			
2022	*15135*	*224*	*3390240*
2023	*15086*	*232*	*3499952*
2024	*15135*	*238*	*3602130*
2025	*15071*	*244*	*3677324*

Source: authors' own compilation

Based on the estimated total costs, it is possible to determine the estimated costs of a man-hour in subsequent years, taking into account the work efficiency achieved in 2020. The calculations were made according to the relationship:

$$K_j = \frac{K_{sz}}{dh \cdot E_{2020}}$$

Where: K_j- Estimated unit cost, K_{sz}- Estimated total cost, *E2020*- Efficiency for the 2020, *dh*- Available service hours.

For such assumptions, RGB costs were calculated in the subsequent years of the forecast.

Estimated cost of a man-hour in 2022:

$$K_{j2022} = \frac{3390240}{15135 \cdot 111{,}222122494288} = 201{,}398782\ PLN/h$$

Estimated cost of a man-hour in the 2023:

$$K_{j2023} = \frac{3499952}{15086 \cdot 111{,}222122494288} = 208{,}5915956\ PLN/h$$

Estimated cost of a man-hour in the 2024:

$$K_{j2024} = \frac{3602130}{15135 \cdot 111{,}222122494288} = 213{,}9862059\ PLN/h$$

Estimated cost of a man-hour in the 2025:

$$K_{j2025} = \frac{3677324}{15071 \cdot 111{,}222122494288} = 219{,}3808161\ PLN/h$$

The RBG costs values determined are characterized by slight increases year on year, which probably requires an adjustment for inflation rates and changes in consumer attitudes.

6. Summary

Comprehensive analyses of work efficiency and ASO costs made it possible to analyse the economic indicators achieved in the conditions of the prevailing pandemic. As the measures for evaluating its consequences, the indicators determined for the year 2019, were compared, which preceded the pandemic and, at the same time, was the closest in the trend analysis to the current economic and consumer conditions in the repair and servicing sector of motor vehicles. The results obtained indicate an improvement in the time and cost efficiency of the ASO operation in economic terms. Therefore, it can be concluded that the examined enterprise achieved higher profitability ratios despite difficult operating conditions in an unexpected global pandemic. It is interesting that, despite the smaller number of available hours, more services have been sold and the working time of mechanics is greater in 2020 than it was in 2019. This indicates good company management, including risk management, which enabled flexible changes in the organization work. As a result, the effect was achieved much better than just minimizing the effects of risk, and even improved profitability in such difficult environmental conditions. Assuming the achieved efficiency and productivity indicators, the forecasts for the coming years are also promising.
One should however emphasize that the improvement of the ASO work efficiency and the reduction of costs are the result of extraordinary mobilization and a sense of threat resulting from an uncertain tomorrow and the phenomenon of the so-called " backup work ". In the long term, work in such circumstances carries a very high risk of burnout or deterioration of the quality of services, which, as already mentioned in the case of ASO work, affects the safety of vehicle operation. Therefore, continuous monitoring and research in the field of occupational psychology should be conducted.

Rafał Burdzik
rafal.burdzik@polsl.pl
Silesian University of Technology, Faculty of Transport and Aviation Engineering

Adrian Lotko
adrilot689@student.polsl.pl
Silesian University of Technology, Faculty of Transport and Aviation Engineering

Literature:

1. Marel, Małgorzata, and Patrycja Zbroja. "Wpływ pandemii na globalny łańcuch dostaw na przykładzie przedsiębiorstwa z branży AGD." Journal of TransLogistics 6.1 (2020).
2. Pisz, Iwona. "Wielowymiarowy wpływ „czarnego łabędzia"–pandemii COVID-19 na funkcjonowanie łańcuchów dostaw." WYZWANIA LOGISTYKI WE WSPÓŁCZESNYM ŚWIECIE COVID 19 (2021): 33.
3. Stojczew, Karolina. "Ocena wpływu pandemii COVID-19 na sytuację w branży motoryzacyjnej w Polsce." Studies of the Industrial Geography Commission of the Polish Geographical Society 35.2 (2021): 64-84.
4. Świtała, Marcin, and Agnieszka Łukasiewicz. "Road freight transport companies facing the COVID-19 pandemic." Gospodarka Materiałowa i Logistyka (2021).
5. Poliński, Janusz, and Krzysztof Ochociński. "Wpływ pandemii COVID-19 na funkcjonowanie pasażerskiego transportu kolejowego." Problemy Kolejnictwa (2021).
6. Burdzik R., Szymańczak M., Zalewski M.: Organizacja i prowadzenie procesu obsługi pojazdów samochodowych. Warszawa, Nowa Era, 2016. ISBN 978-83-267-2153-3.
7. Jastrzębska, U.: Organizacja i nadzorowanie obsługi pojazdów samochodowych. Warszawa, WKŁ, 2016. ISBN 978-83-206-1967-6.
8. Kowalczyk, S.: Organizacja i zarządzanie przedsiębiorstwem samochodowym. Warszawa, WSiP, 2010. ISBN 978-83-02-11278-2.