Spare parts inventory management at multi-brand car service enterprises

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Abstract. The article presents a comprehensive study of the state and problems of spare parts inventory management at multi-brand car service enterprises on the example of the Republic of Cyprus. The general characteristics of the specifics of spare parts inventory management at multi-brand car service enterprises are presented, the foundations of the organizational model for the functioning of transport enterprises of this type, including those common to the Republic of Cyprus and the Russian Federation, are disclosed. The set of tasks for managing the inventory of spare parts at multi-brand car service enterprises has been clarified. Based on the results of a survey of executives and managers of 64 Cypriot multi-brand car service enterprises, key methods for managing spare parts stocks were identified. The results of the survey were compared with the assessment of the effectiveness of management in the subject area, typical groups of enterprises were identified according to the criterion of the main method of managing spare parts inventory and the expected management efficiency. The elements of spare parts inventory management at multi-brand car service enterprises of the Republic of Cyprus, recommended for reception into Russian practice, are identified, ways to solve the problem of improving the effectiveness of management in the subject area, common to the designated group of transport enterprises in Russia and Cyprus, including the development of automation, digitalization management, combined with the use of organizational methods (flexible supply contracts, franchising and new forms of business).

1 Introduction

The relevance of the study is conditioned by the dynamic development of approaches to spare parts inventory management - one of the key, most important areas of corporate management of a modern car service enterprise. During the period of relatively favourable economic development in the Russian Federation, car service enterprises of the country increasingly reoriented to work with a particular brand, car manufacturer. The monobrand concept of the operation of the car service enterprise significantly simplified the work with spare parts stocks, due to the small nomenclature and the possibility of receiving support from brand representatives, including the prompt delivery of missing spare parts. Under the new...
conditions of unprecedented sanctions pressure, we should expect a rapid growth in the number of multi-brand car service companies that repair and maintain vehicles of many brands and work with multiple suppliers of spare parts. In connection with the reorientation of the market and supplies, it seems important to transform approaches to inventory management of car service enterprises, including on the basis of the experience of companies from foreign countries, where the multi-brand model has historically been the key in the organisation of car service business. Such countries include the Republic of Cyprus, a state well known to a number of Russians as a vacation destination and as a territory for doing business. The analysis of the state, problems, and prospects of spare parts inventory management in multi-brand car service enterprises on the example of the Republic of Cyprus, which is the purpose of this publication, is intended to identify universal solutions to improve management in the subject area both in the Republic of Cyprus and in the Russian Federation.

2 Materials and methods

The present study is based on the analysis of specialised scientific literature, statistical data on the activities of car service companies in the Republic of Cyprus, as well as on the results of a questionnaire survey of managers and executives of 64 Cypriot multi-brand car service companies.

This publication examines the financial and techno-economic performance of multi-brand car service companies in the Republic of Cyprus (respectively, service ratio and spare parts inventory profitability) for the period prior to the COVID-19 pandemic. Recently published studies [1, 2] have shown that, despite previously circulated predictions, the European Union consumer sector has returned to pre-pandemic performance and, more importantly, no sustained radical changes in consumer behaviour appear to have occurred as a result. Consequently, it is necessary and sufficient to rely on statistical indicators for the periods prior to the COVID-19 pandemic when developing practical recommendations for the inventory management of car service companies in Cyprus.

3 Hypothesis

The organisational business model of a multi-brand car service company differs from other existing models, first of all, by the specificity of material stock management and the need to use universal equipment for repair and maintenance (R & M), the alternative to which is the refusal to provide part of the services, their outsourcing, the increase in the cost of works and the increase in the time of their implementation [3].

The Republic of Cyprus is traditionally one of the countries with a relatively low prevalence of monobrand car service centres, which is due to such circumstances as the lack of own car production in Cyprus with a high level of motorisation of the population; the specifics of the rolling stock (associated with left-hand traffic); the high proportion of used cars in private ownership and in rental bureaus; the historical lack of commitment of Cypriots to certain makes and models of cars. At the same time, the rather small size of the territory and population argues for significant difficulties in organising the work of multi-brand car service enterprises, the management of which does not have to rely on economies of scale (in other words, the customer portfolio may include dozens of groups, with a share not exceeding 0.5-5% of the revenue structure, with their number starting from a few regular customers receiving 1-2 services per year). Sufficiently close competition (according to statistical data, on average, there are at least 3.3 car service companies per 100 cars registered in the Republic of Cyprus) does not allow car service companies to arbitrarily refuse customers in service [4]. However, without the availability of necessary spare parts and equipment, one has to...
either rely on loyalty (willingness to wait for work to be done beyond the standard time and/or agree to install more expensive as well as used parts and units) or pass customers to competitors. As a result, the multi-brand car service business faces the extremely difficult task of retaining customers and maintaining acceptable profitability.

Based on the theoretical and methodological aspects of inventory management in car service [5-9], it seems possible to state that the model of functioning of a multi-brand car service enterprise is almost an ideal testing ground for scientific tools and methods of spare parts inventory management. Only thanks to non-standard solutions it is possible to ensure profitable operation of such companies under numerous constraints.

Spare parts inventory management is a complex section of corporate management and its most important element at car service enterprises, where 40-85% of all corporate assets and more are used in such inventories [10]. Based on the analysis of special literature [11, 12] the following tasks of spare parts inventory management at multi-brand car service enterprises can be singled out:

- rationalisation of spare parts inventory costs;
- compliance with insurance and minimum stock requirements;
- retaining customers by ensuring a high level of actual availability of spare parts in stock and meeting customer needs at the point of call;
- providing complete, reliable and up-to-date information on the status and movement of spare parts inventories, retrospective and prospective demand.

4 Results

As practice shows, multi-brand car service companies in Cyprus also manage to survive with a predominantly intuitive approach to spare parts stock management: in small, sometimes family-run companies, the owners—who are usually also the managers—prefer to set stock levels, determine their nomenclature and depth based on personal experience, including a "gut feeling" developed over the years as to which customers may request the relevant services at which time and for which make and model of car. A few miscalculations in this area can be critical according to the statistics office, every year about 5-8% of registered companies classified as car service companies suspend or terminate their registration (in the pandemic, the figure almost doubled to 13% and 14% in 2021 and 2022 respectively). [4]. And, although the statistics do not distinguish between different types of car service companies, it is quite obvious that mono-brand companies, especially those under brand protection, for example, through franchising instruments, will show better survival rate. For the survival and market development of multi-brand car service enterprises it seems necessary to move away from the exclusively intuitive type of decision-making in the system of spare parts inventory management. This conclusion is supported by the author's questionnaire survey of managers and executives of 64 Cypriot multi-brand car service companies in October-November 2022. The survey was aimed at identifying the preferred methods of spare parts inventory management, with a prerequisite for participation in the survey being the organisation of the business at least a full financial year before the pandemic, i.e. no later than 2018. As a result, it can be stated that the mass practices identified in the survey are at least consistent with the survivability of auto service businesses in a coronavirus crisis. Among the aspects identified in the course of the questionnaire are the characteristics of the specific method of inventory management, the use of specialised software for these purposes, the presence of a dedicated spare parts inventory management specialist or unit, the change in the spare parts inventory management model in recent years (including self-assessment of its success by respondents), the existence of problems and proposed solutions.
According to the results of the questionnaire survey, it was revealed that 54 enterprises (84.4% of the total number of employees) have specialised spare parts management, while only 12 enterprises (18.8%) have specialised units, and 32 enterprises (50.0%) have a dedicated employee (Figure 1). Another 10 enterprises (15.6%) outsource spare parts stock management, including leased warehouse operators.

The presented circumstances indicate, rather than a lack of understanding of the importance of spare parts inventory management in the development of the car service business, but rather the limited opportunities in this area, including those related to the small size of the enterprises themselves - the car service system in Cyprus is characterised by an abundance of small and medium-sized, including family-owned, enterprises, especially in the multi-brand segment. Increasing awareness of the importance of subject matter management for business well-being leads to an increasing use of specialised inventory management software (software) - entrepreneurs themselves or their outsourcing counterparties in 50 out of 64 cases (78.1%) resort to automation of spare parts inventory management (Figure 2).

Among the inventory management models, intuitive approach, ABC-analysis, automated systems based on statistical analysis (respondents could choose only one model that was the most dominant in the past years) were prevalent. The corresponding distribution is presented in Figure 3 and does not allow us to draw a definite conclusion about the dominance of the scientific approach in spare parts inventory management in multi-brand car service companies in the Republic of Cyprus.

The questionnaire showed that many managers and supervisors of car service companies are thinking about innovations in spare parts management (90.6 per cent of the survey participants), and in 15 companies (23.4 per cent) the relevant approaches have changed over the last few years, while all representatives of this group were satisfied with the results of innovation implementation.

![Fig. 1. Application of variants of spare parts inventory management organisation at multi-brand car service enterprises of the Republic of Cyprus (based on the survey of managers and executives of car service enterprises), % of the total number of survey participants](https://example.com/fig1.png)

![Fig. 2. Use of specialised software for spare parts inventory management in multi-brand car service enterprises of the Republic of Cyprus (based on the survey of managers and executives of car service enterprises), % of the total number of survey participants](https://example.com/fig2.png)
The main problems mentioned by the survey participants include lack of knowledge and competences, lack of labour force, and the high cost of automation. One of the most recent challenges in the field of spare parts inventory management in car service companies in the Republic of Cyprus is the compliance of this management with ESG criteria, i.e., simplistically speaking, the new requirements for climate neutrality, determined by the reduction of carbon emissions into the atmosphere [13-17].

Fig. 3. Main directions (approaches) to spare parts inventory management at multi-brand car service enterprises of the Republic of Cyprus (based on the survey of managers and executives of car service enterprises), % of the total number of survey participants

It should be emphasised that the mere storage of large stocks of spare parts adds to the climate load through the increase in the notional CO emissions generated by machines, units, as well as by people and their processes. Auto service companies in Cyprus should be prepared today for the fact that in the near future indicators will be calculated and rationed and entrepreneurs will have to pay an additional tax. These circumstances stimulate innovations in spare parts stock management, and they are emphasised by the representatives of 92.2% of the companies that participated in the survey. Russian car service companies will inevitably face this problem in the foreseeable future without regard to the actual conditions, which may be a significant increase in the cost of imported spare parts, even if imported through parallel import, if the partners in the import system do not meet the established quotas.

The study also clarified aspects related to the performance of spare parts inventory management models in multi-brand car service centres in the Republic of Cyprus. During the questionnaire process, the participants of the mentioned survey were asked to fill in a statistical section, on the basis of which the author calculated some management performance indicators - service ratio and stock profitability indicator as average values for each company for the five years before the pandemic. Service coefficient "indicates the number of items that are issued in stock on first demand, in relation to the total number of requested items" [18, p. 69]. In turn, the profitability of spare parts stock characterises the ratio of the profit received per the average balance of spare parts stock and reflects the most rational use of this group of stocks in the interests of economic benefit [19, 20]. All the analysed companies can be conditionally divided into IV groups (Table 1) according to the degree of implementation of the scientific approach to spare parts inventory management - the higher the group the company corresponds to, the more advanced the management in the subject area turned out to be.
Table 1. Grouping of multi-brand car service companies in the Republic of Cyprus by the level of implementation of scientific approach to spare parts inventory management

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>Group IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of customised spare parts inventory management</td>
<td>no</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existence of an inventory management department/officer</td>
<td>no/outsourcing</td>
<td>officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advantageous approach to inventory management</td>
<td>Intuitive</td>
<td>ABC</td>
<td>Statistical analysis</td>
<td></td>
</tr>
<tr>
<td>Use of specialised software and other innovations</td>
<td>no/outsourcing</td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of enterprises in the group (in brackets - specific weight of the total number of enterprises in the analysis)</td>
<td>21 (32.8%)</td>
<td>18 (28.1%)</td>
<td>15 (23.4%)</td>
<td>10 (15.6%)</td>
</tr>
<tr>
<td>Group average value of service coefficient</td>
<td>0.52</td>
<td>0.64</td>
<td>0.76</td>
<td>0.94</td>
</tr>
<tr>
<td>Average group value of spare parts inventory profitability ratio, %</td>
<td>4.15%</td>
<td>5.97%</td>
<td>7.99%</td>
<td>13.4%</td>
</tr>
</tbody>
</table>

The analysis revealed the average group values of the service coefficient and spare parts inventory profitability indicators. It is revealed that as the scientific validity of spare parts inventory management increases (inclusion of companies in a higher group in Table 1), at the same time there is an increase in the value of service coefficient and profitability of stocks, which is an argument in favour of improving spare parts inventory management in multi-brand car service companies in the Republic of Cyprus. Another argument is the inverse proportion in the number of participating enterprises as the number of groups increases, which indicates the prevalence of the simplest approaches to spare parts inventory management in multi-brand car service enterprises in the Republic of Cyprus.

5 Discussion. Practical recommendations

The development of practical recommendations in the subject area is based on the identified problems and contradictions, and is also related to the possibility of adopting the experience of spare parts inventory management at multi-brand car service enterprises of the Republic of Cyprus in Russia. The analysis has shown that the key solutions should combine the experience of automation (or, more precisely, digitalisation, taking into account the content of the advanced achievements of the era) in combination with the transformation of business models of the organisation of car service enterprises in the direction of ensuring maximum flexibility. These solutions are relevant for both Cypriot car service companies and similar companies in Russia, especially those that are planning to organise or are transforming their business model into a multi-service type. Digital transformation should imply, first of all, total automation of spare parts management at all multi-brand car service enterprises without exception. For larger car service companies, it is already relevant to transfer specialised inventory management to E3S Web of Conferences 431, 0804 (2023) ITSE-2023

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digitalisation, in particular by using the tools of neural network analysis of large order data for a number of previous years, which can be used to develop highly accurate forecasts for key inventory indicators. Large companies can support digital innovation in small and medium-sized car service businesses by making relevant technological know-how available.

The automation (digitalisation) of spare parts inventory management in multi-brand car service companies in Cyprus and the Russian Federation can be complemented by flexible organisational solutions, including the joint management of central distribution warehouses (CDWs) and the creation of virtual warehouses based on digital management platforms (VDW, virtual distribution warehouses).

The idea behind CDWs is that such warehouses are organised and leased by several (many) businesses in a shared arrangement, but operate as if they were owned by a large geographically distributed networked enterprise. Since car service enterprises usually do not have sufficient competences to fully manage such services, the organisation and operational management can be outsourced.

VDW is an even more complex system—it is a kind of an analogue of CDW under centralised management of a special provider, while control and manipulation, such as placement and satisfaction of requests, actual tracking of spare parts availability in distributed warehouses are carried out through digital platforms. The warehouses themselves can be rented premises, territories in different locations, from a small area of a few square metres the task of the platform is to analyse what the demand for which spare parts can be in a given area and best satisfy the request of the car service company with minimum time and other logistical costs.

When implementing the CDW and VDW models, the car service company does not need to manage its own warehouse with a large product range of spare parts, while the indicators of actual stock availability, primarily the service factor, will be at a level even higher than that of large monobrand car service companies.

Of certain interest for car service companies in Cyprus and Russia is the toolkit of stock options and other financial innovations that can be used in the subject area to reduce unforeseen losses as a result of any miscalculations in management and forecasting, as well as the unforeseen impact of environmental factors (pandemic, sanctions, etc.). For small enterprises, financial innovation in the digital environment is of particular interest, including tools for decentralised financing and stock insurance (crowdfunding, crowdsourcing).

Flexible contracts with official dealers and distributors of spare parts with a protected (“take-or-pay”) and optional part of the contract (for Russian companies such contracts can be recommended for conclusion, for example, in the sphere of parallel imports, as well as with suppliers of spare parts from friendly countries).

For these purposes, other new forms of business, such as cloud consultants and stock management analysts for small, including family-owned, car service companies, may also be recommended for practical implementation.

Access to knowledge and competences will allow to eliminate key gaps in spare parts inventory management precisely in small and medium-sized car service business, and for Russia, taking into account the sanctions factor, it is fundamentally adjacent to integral provision of car service enterprises of all sizes and forms of ownership with reliable high-tech solutions for spare parts inventory management.

6 Conclusion

Thus, spare parts inventory management in multi-brand car service enterprises is a complex task, relevant both for the practical conditions of the enterprises of the Republic of Cyprus and for the enterprises from the Russian Federation. The scientific approach will allow solving the key problems of management improvement in the subject area, its main elements...
should be based on automation and digitalisation of spare parts inventory management, as well as on the introduction of flexible management models. Russian enterprises additionally take into account the trends in the ESG agenda, according to which the identification and implementation of spare parts inventory management reserves at multi-brand car service enterprises is actualised.

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