

## METHODS OF CLASSIFICATION AND EVALUATION OF LSP SERVICES – IN A TURBULENT ENVIRONMENT

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**Abstract** – The article represents subsequent part of the cyclical publications of the Laboratory of Economics and Accessibility of Transport (former Department of Economic Research). There is a large variety of services offered by companies operating in the LSP sector (transport, forwarding and logistics) in Poland. These companies differ in size, organizational structure, ownership, and business model. There are many companies that provide only one type of logistics services, e.g. transport, warehousing, contract logistics, and many entities that offer a wide range of logistics services. In Poland, the LSP sector is currently undergoing profound transformations, which are the result of post-pandemic changes, restrictions of the current war in Ukraine and the implementation of the so-called Mobility Package, which affect not only the condition of individual companies, but also dismantling or transforming the existing supply chains. However, there is still no uniform method of classifying and evaluating LSP services that would be widely applicable and would ensure comparability of results according to specific criteria. The aim of the article is to review the existing classifications and methods of evaluating LSP services and to propose our own taxonomy considering the changes and trends observed in the Polish LSP sector. The article presents definition of logistics services, their components and evaluation criteria. The analytical part discusses the structure of companies providing these services on the Polish LSP market. Empirical results for the strategic segmentation of the LSP sector are presented. The authors presented methodological problems of analysing and presenting the results of LSP units. They also proposed their own balanced method of ranking LSP companies. To this end, they reviewed the available ranking methods. Considering the identified limitations and the results of the study of correlations between indicators used to create publicly available LSP rankings, a new method was proposed, indicating the way of selecting evaluation measures. Economic measures belonging to various groups of analysis used in the economic analysis and assessment of the investment potential of LSP companies were considered. In the proposed method of ranking LSP companies, the authors also considered the fleet emissivity measure, which is of particular importance among the still dominant transport sector on the Polish LSP market.

**Key words** – classification of logistics services providers, LSP's sector, evaluation of LSP's companies

**JEL Classification** – O18, R11, R42

### INTRODUCTION

The LSP sector (transport, forwarding, logistics) is one of the industries with the highest development potential, on an international and national scale. In Poland, the voivodships most dynamizing the development of the LSP sector have been for many years, in order: Mazowieckie, Wielkopolskie and Śląskie. The road freight transport market in Poland,

worth nearly PLN 200 billion and based on over 120,000 companies employing nearly 1 million people, with a fleet of over 3 million trucks and 160% absorption capacity requires standardized and efficient monitoring through ongoing analysis of correctly identified data.

The capacity of the LSP market, as a quantitative category, is calculated as the product of potential customers and the average number of ordered

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transport and logistics services. The formula is as follows:  $Q = N * s$ , where Q is in this case the market capacity, N is the number of people, and S is the indicator of the average number of orders for transport and logistics services per inhabitant. If one wants to calculate the capacity for specific groups of customers (selected LSP market segment), e.g. those ordering logistics or warehousing services, or only transport services, the formula looks like this:  $Q = K * p * q$ , where Q is the market capacity, K is the number of units ordering a given type of services, P the probability of purchasing a given type of service and Q the number of services. The value of the 160% indicator estimated by the author refers to the current value of the road freight transport market in Poland, which is valued at PLN 200 billion. This means that, according to the adopted formula and based on the calculations made by the author, the absorption capacity of the Polish road freight transport market (including international transport performed by Polish companies) is PLN 320 billion.

In the last decade, the dynamic development of the LSP sector in Poland was observed, which was accompanied by an intensification of competition, particularly noticeable during the Covid-19 pandemic and the current war in Ukraine. It has forced restrictions on mobility and a slowdown in most sectors of the world, as well as huge changes and interruptions in supply chains. The Polish LSP sector was additionally struggling with the growing shortage of employees, increased wage and regulatory pressure, which limited the development of these companies to the greatest extent. As a consequence of the implementation of the so-called Mobility Package, these changes are still profound and dynamic. Analyses conducted by the ITS Transport Economics and Accessibility Laboratory in cooperation with the Association of International Road Carriers (ZMPD) indicate a significant impact of the Covid 19 pandemic and the current war in Ukraine on the Polish sector of international road freight transport. This is consistent with the situation observed in other EU countries, but it is felt much more strongly among Polish companies, because Polish international road carriers gain nearly half of their turnover in connection with transport performed outside Poland.

The research conducted by ITS in cooperation with ZMPD in 2021-2022 shows that the development of the international freight market was accompanied by intensification of competition. External factors have caused deep and inhomogeneous changes among Polish carriers, which should be analysed and forecasted on an ongoing basis. They are determined - as clearly indicated by the surveyed carriers - by new restrictions resulting - first of all - from the

provisions of the Mobility Package (5), shortage of drivers (4-5), fluctuations in production (4), energy threat (3-4), inflation, broken supply chains (3-4), changes in supply or transit directions (2-3), emission regulations (3-4).

Rapid changes in the external conditions of the LSP sector mobilize managers, owners, and investors to analyse more often related services, diagnose the condition of companies that provide them, and search for effective comparative tools. In Poland, no experimental research has yet been conducted on the evaluation of the effectiveness of the provision of LSP services, considering a wide set of criteria, although the demand from the owners and management staff of LSP entities is high in this respect. The market is dominated by rankings containing basic or incomplete financial data of LSP companies. Meanwhile, in-depth comparative studies of companies from the LSP sector are conducted on request of selected customers, only ad hoc. It would be advisable to regularly monitor the financial results and selected technical or quality parameters of services provided by companies in various sectors of LSP activity and compare them with the results of competitors in the same strategic groups. This would give a more accurate picture of the changes taking place in LSP companies. The key element of the study should be a multidimensional analysis of enterprises based on the objectively selected partial indicators, conducted on the basis of specialized external databases, supplemented, if necessary, with surveys.

The stage preceding the evaluation of services should be their reliable classification. In view of the multitude of existing methods of separating LSP services and companies providing them, there is a need for their taxonomy to the extent that comparative analyses can be conducted, also in separate groups of companies or services provided by them.

The literature on the subject currently contains several dozen concepts of classifying LSP services, in national scientific studies several concepts of classifying LSP services can be singled out. Some of them present an original approach, while others are imitative. However, their use in the economy is determined by application values from the point of view of LSP entrepreneurs, their contractors and potential investors. There are many approaches to evaluating service delivery. Some of them have a greater empirical application, while others, on the contrary, have only a theoretical character. The multifaceted nature of research on LSP services and the variety of terminology associated with it is a contribution to the systematics of concepts and methods of research in this area.

## 1. DEFINITION OF SERVICES IN THE LSP SECTOR

In Poland, logistics services and companies that provide them are commonly referred to as TSL (transport, forwarding, logistics). This term, despite the extremely high frequency of use, is still not very precise. The abbreviation TSL suggests the separateness of three types of services: transport, forwarding, logistics.

In fact, transport and forwarding are concepts much narrower than logistics and are part of it. Generally, it should be stated that transport is an element of logistics related to the movement of goods. Transport and forwarding services are designed to deliver goods to the indicated places at the agreed time. At the same time, the condition *sin qua* none of the transport and forwarding service is not damaging the cargo and enabling further use of the goods [24], [27], [31].

Regardless of the adopted division criterion, transport and forwarding services still dominate the Polish market (82-88%). This is evidenced by the reports of the Central Statistical Office - section H [8] as well as the annual LSP (TSL) rankings. Warehouse management services are developing very dynamically, although the number of companies providing them is still smaller (72-77%) than in the case of transport and forwarding. The services with the highest development dynamics in the sector for ten years have been courier services, followed by services related to contract logistics. The importance of the LSP sector in the economy has been growing for years, as evidenced by the constantly growing share in GDP.

### 1.1. TRANSPORT

Transport in the context of the LSP sector includes activities related to the movement of material goods using appropriate means. It covers both the movement from place to place as well as all activities necessary to achieve this objective, i.e. loading activities (loading up, unloading, reloading) and handling activities (e.g. fees). Transport is also commonly referred to as a batch of transported loads [5]-7], [13]. The links of the transport process form the so-called transport chain, e.g. sea, rail, car transport. On the other hand, multimodal transport is a movement of loads using at least two branches.

### 1.2. FORWARDING

Forwarding is a more extensive service than transport, under which, in addition to transport, the process is supplemented with the necessary documentation, cargo insurance, preparation by appropriate packaging, etc. Forwarding is therefore an economic activity involving organizing the transport of goods at the request of a legal or natural person and performing the necessary group of additional

activities, resulting from the specificity of the order. As part of forwarding, the tasks also include taking over, completing and combining loads in order to optimize the cargo space in the transport process. Aspects related to the choice of the means of transport due to the characteristics of the cargo, costs and transport distance are most often also part of forwarding services [13], [16], [20].

### 1.3. LOGISTICS

Logistics is the foundation of the modern and globalized world. It covers all activities related to the transfer of goods, and broadly understood warehousing. It includes transport and forwarding.

Logistics is an integrated system of planning, organizing and controlling physical processes in the circulation of goods and their IT, in terms of optimization of the activities carried out. The essence of logistics is the time-spatial flow of cargo and related information. The aim of logistics activities is to deliver: to the right customer - the right products - in the right quantity - in the right condition - in the right place - at the right time - at the right cost.

Contemporary logistics is a much broader concept. It includes not only the management of a network of suppliers - recipients, or the storage of products - goods, but also the entire supply chain management together with the accompanying processes, tools and technologies. Thanks to the global development of advanced digital technologies, logistics management is largely information management, transmitted in real time and processed using the latest IT technologies [12-16].

## 2. CLASSIFICATION OF LSP'S SERVICES AND COMPANIES PROVIDING THEM TEST TRACK CONFIGURATION

The division into simple three sequences of LSP's services, i.e. transport, forwarding and logistics, does not exhaust the issue of their classification. Nowadays, the typology of services provided by LSP companies can be based on various criteria. The most commonly used classification criteria include:

- company size, legal form;
- structure and origin of capital (foreign, domestic, mixed; private, public);
- type of activity (e.g. logistics, transport, forwarding, customs and insurance, reloading, terminal services, warehouse management, etc.);
- sectors of activity served;
- scope and level of service integration (2PL, 3PL, 4PL, 5PL-....-10PL);
- subject and type of cargo handled (passenger, freight, full truck load, partial load, general cargo, bulk, etc.);

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- type of transport mode - in the case of transport and forwarding (car, rail, pipeline, sea, air, inland waterways);
- resources, competences, links in the chain [11-15].

**Table 1. Segmentation of the LSP sector - according to subject criteria**

Segmentation criterion	Sample segmentation
Type of transport means	Road, rail, sea, air...
Cargo size	general cargo, full truck, container; carriage
Scope of the operation	country, international; country, continent, world
A link in the logistics chain (type of service)	transport of goods, warehouse logistics, forwarding, courier services, production supply, distribution of finished products, customs services, freight management, other
Type of sector served, market segment	automotive, food, alcohol, textiles, press and books, electronics, cosmetics, RTV and household appliances, furniture, construction, fuels and oils, pharmaceuticals, other
Load requirements	universal, non-standard load (loose, liquid, live, requiring controlled temperature, other)

Source: own study based on [2], [4], [7], [17-18], [28], [30-32]

**Table 2. Classification of modern LSP services in functional terms**

MODERN LSP SERVICES			
1	2	3	4
<b>Cargo transportation and handling</b>	<b>Storage and accompanying activities</b> <b>Contract logistics</b>	<b>Consulting, financing and administrating</b>	<b>Brokerage, technologies and communication tools</b>
Cargo transport (e.g. domestic groupage, international full truck load, specialized) Intermodal transport Bimodal, multimodal transport Securing cargo and transport Cargo marking Service at the reloading points Transport planning, routing Planning of space and loading capabilities Last mile transportation service Terminal and consolidation transport Courier services (CEP)	Storage and warehousing of goods, monitoring of these processes Ramp handling Arrangement Assembly and disassembly Determining loading units Packing (including co-packing) Packaging Planning and expansion of warehousing space As part of contract logistics: Logistics support for production and distribution processes (retail chains) Individualized storage, Courier services integrated with the ordered processes (KEP) Co-manufacturing and co-packing Specialist service of warehouse infrastructure and specialized equipment Handling returns and complaints	Transaction financial services, credit and leasing, banking services Insurance services, Tax consultancy, Administrative, HR and accounting services, etc. Market research MIS, demand forecasts PR promotion and advertising Financial and statistical analysis Handling transport, warehouse, customs and tax, phytosanitary documentation, etc. Document repositories and archiving Extras, fuel and road fares CAF currency adjustments for international operations Road surcharges (e-toll) in domestic and international transport	Service Platforms Information management Data warehouses Suppliers of technology, devices, applications (e.g. my order, my offer, truck & trace solutions, etc.) Integrated IT systems to optimize warehouse and transport operations  Managing orders within various services, data centre  Apps to track the movement of goods with the parameter ETA ( <i>estimated time of arrival</i> )

Source: own study based on [3], [5-11], [32]

### 2.1. SUBJECT TYPOLOGY

Table 1 groups up the most frequently used methods of classifying LSP services and the companies providing them in terms of subject matter. Based on them comparative analyses of LSP companies are most often conducted, focused on economic and financial aspects and market conditions of their operation. [2], [4-5], [18].

### 2.2. FUNCTIONAL TYPOLOGY

A slightly different way of classifying LSP companies and the services they provide is proposed by Jedynak. It focuses, like Pfohl, on the functional approach to services, but offers a broader, eight-component set of division criteria, namely: the subject of the service, functions performed by it, type of activity supported (e.g. production, supply, returns logistics), geographical scope of operation, legal form, type of ownership (public, private), size of enterprise and type of key resources. The list of modern LSP services proposed in Table 2 refers to this approach.

Pfohl, similarly to Jedynak, adopting a functional approach to distinguishing LSP services, however, proposes a simpler division, i.e. with regard to the degree of their complexity. It distinguishes services and functions: basic, supplementary, special (niche). Rydzkowski, in turn, emphasizes the importance of the resource criterion in classifying services, distinguishing:

1. Resources-based services in which enterprises use their technical equipment to implement them,
2. Skill-based services, which involve planning, organizing, supervising activities that are not based on fixed assets, but on knowledge, specialist qualifications and competences.

In the classifications of LSP services proposed by Jacyna, Biesiok, Stajniak or Rydzkowski [9-13] we also encounter three or four basic groups of services, which are then differentiated into subgroups. These classifications are characterized by a functional-object approach, with a predominance of the functional approach (compare Table 2) [5-7], [11], [14], [18], [26].

### 2.3. OBJECT-FUNCTIONAL (FUNCTIONAL) TYPOLOGY

LSP sector rankings, which are one of the simplest methods of comparing LSP companies against the competition, also propose a typology of mixed services. For example, the LSP Ranking, published annually by Journal "Gazeta Prawna", uses the classification of LSP companies according to the basic scope of activity and additional functions performed, resulting from the nature of the cargo handled. This is the following breakdown:

1. Transportation,
2. Forwarding,
3. Load consolidation,
4. Warehousing services,
5. Customs services,
6. Freight management,
7. Logistics services:
  - a. Terminal logistics,
  - b. Supply and distribution logistics,
  - c. Comprehensive logistics solutions,
  - d. e-logistics,
  - e. One stop shopping,
  - f. „one stop shopping – using its own and contracted resources, the LSP is able to provide a full range of LSP services",
  - g. Other Logistics Services.
8. Courier services.

Mixed classifications, used, among the others, in the sector rankings, are the closest to descriptions of service offers presented by LSP companies. The scope of services proposed within individual categories and subcategories requires unification.

### 3. TYPOLOGY OF THE LSP SERVICES PROVIDING METHOD

The subjective structure of the LSP market can also be represented by a pyramid, the top of which occupy logistics integrators (4PL-10PL). The 4PL and 5PL models are the most developed models of operation on the LSP market. Other, higher models of service delivery (PL 6-10) are rather prognostic. The simplest model is the simple service provider model, located at the bottom of the pyramid (PL 1). This way of presenting LSP services is shown in Figure 1 and 2 and described in Table 3.

According to the resource division criterion adopted by Rydzkowski and the terminology of the description of LSP services providing developed in the 1990s by Accenture, the middle part of the pyramid is represented by modern logistics operators (2 PL, 3 PL). They operate based on the extensive infrastructure serving e.g. warehousing, inventory and cargo handling, transport, with the addition of marketing, customs, forwarding, or financial and insurance services. Most of them have a significant technical potential in the form of: transport means, warehouses, sorting plants, reloading stations and even consolidation centres. The second group is represented by network organizations performing functions of the so-called virtual, leading operators or integrators of logistics services (4 PL, 5 PL and further prognostic variants: 6PL, 7PL, 8PL, 9PL, 10 PL).

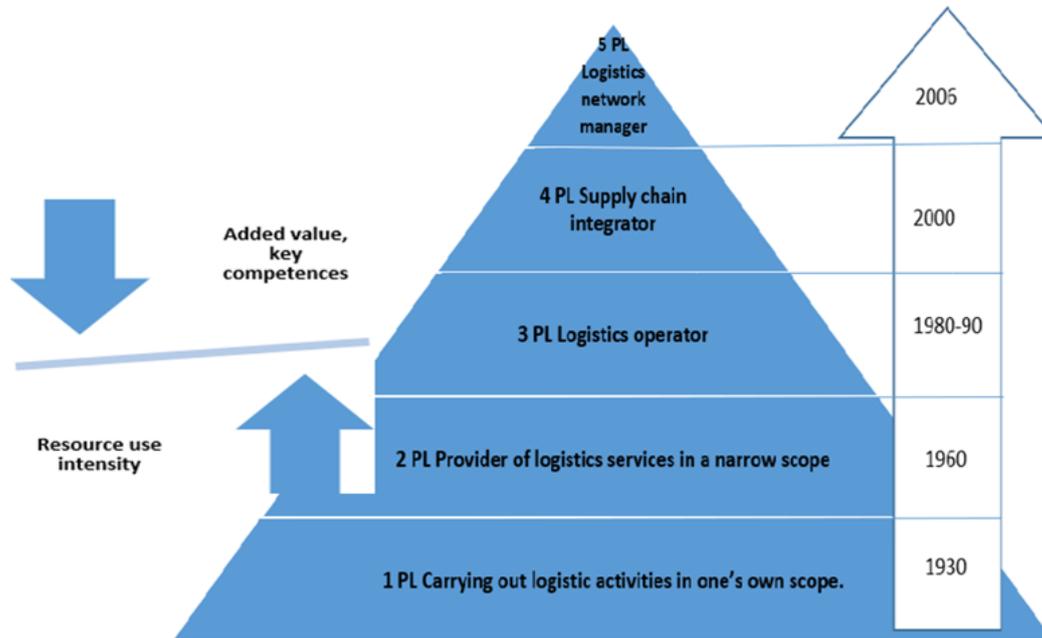


Fig. 1. Methods of providing logistics services based on Accenture terminology  
 [Source: own study based on [5-6], [9-11], [18]]

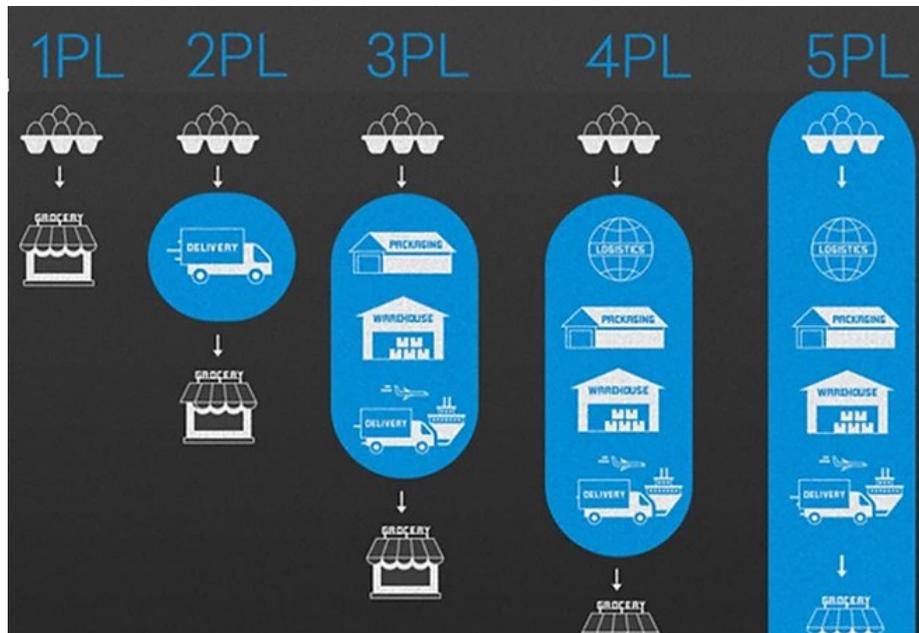


Fig. 2. Methods of providing LSP services based on Accenture terminology – development of LSP  
 Source: own study based on [9-11], [14], [18], [30-31].

The essence of their activity is the management of processes and information. They usually do not have means of transport, warehouses, logistic centres, terminals and related infrastructure. Instead, they combine and control the technical, technological and organizational resources of many entities in order to design comprehensive solutions for the entire logistics chain. Ciesielski emphasizes that the 4PL, 5PL models and their subsequent versions meet the needs of customers based on identified and constantly supplemented resources and capabilities by the created partner network on the principle of double outsourcing. Their activity is now more likely to be design than process based, due to the unique nature of the logistics solutions they provide based on technologies related to the so-called artificial intelligence, big data management. Their functioning is based mainly on highly developed information technologies. The solutions offered by 4PL (fourth party logistics) and 5PL (fifth party logistics) are based on network architecture: organisation, resources, information. This way of presenting LSP services is also described in Table 3.

### 3.1. TYPOLOGY OF COMPANIES PROVIDING SERVICES

According to Jedynek, the use of a broader set of criteria for the division of logistics companies in

a systemic approach takes into account the economic and technical parameters of the functioning of LSP companies (compare Table 4). This type of classification is not limited to the functional or functional-subjective characteristics of LSP services, which dominate in various types of sector listings and rankings. In conditions of perfect availability of the source data on LSP companies and the services they provide, such a model would be desirable. However, due to the problems of sensitive data protection that are particularly noticeable in the LSP sector, the difficulties with obtaining technical and economic data, the Jedynek classification model, despite a wide and systematized set of classification criteria, may have low application values in the analysis of specific entities and LSP services provided by them.

Ciesielski, on the other hand, proposes a four-element division by the type of services: basic services related to transport and storage (I), additional sales and marketing services (II), financial and insurance services (III), and information and management services (IV).

Considering the limitations related to the availability of data, the results of previous research and the understanding of the terminology of the classifications used from the perspective of the evaluated companies,

**Table 3. Ways of providing logistics services based on Accenture terminology**

10PL – Supply Chain Becomes Self Aware and Runs Itself	Self-learning, autonomous supply chain
9PL – Crowd Sourced Managed Logistics Strategy	Crowd based logistics management strategy
8PL – Super Committee Created to Analyze Competitor's Results	Fully autonomous service integrator, provides technologies tailored to customer needs, outperforms competitors' results, unrivalled in terms of operational efficiency
7PL – Autonomous Competitor Created to Test Alternative Supply Chain Strategies	Autonomous, competitive logistics integrator closely cooperating with its partners from many market segments, provides services with a far-sighted approach, pioneers alternative solutions, anticipates technological trends and quickly adapts to them
6PL – Artificial Intelligence Driven Supply Chain Management	Advisor - a logistics integrator whose process management is based on technologies that use the so-called artificial intelligence
5PL – Consulting for the High-Level Logistics/IT Consultants	Advisor - a logistics integrator whose process management is based on information management using the IT tools and systems developed
4PL – High Level Logistics / IT Consulting	Highly developed logistics, Supply chain integrator, Leading provider of integrated logistics services
3PL – Integrated Logistics Service Provider	An integrated logistics service provider that performs a variety of logistics service activities such as warehousing, transportation, and other functional activities that constitute a total service package.
2PL – Traditional Transportation Provider	Traditional carrier
1PL – Shipper	Forwarder, supplier, warehouse operator

Source: own study [11-32]

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Table 4. Classification of LSP services in ten sectors of activity

No.	Sector name	Definition	Scope of services
I	Wheeled, parcels (courier services)	Domestic forwarding of shipments with maximum parameters of one package: weight up to 50 kg	Transportation, reloading, additional services (e.g. handling documentation, downloading, declaration of value)
II	Domestic, wheeled, groupage	Domestic forwarding of consignments weighing up to 5 tons	Transport, reloading, consolidation, additional services (e.g. ADR, palletizing, foil rapping, documentation handling, collection, return of packaging, declaration of value)
III	Wheeled, groupage, Europe	International forwarding of shipments weighing up to 5 tons	Transportation, reloading, consolidation, deconsolidation, customs handling, palletizing, foil rapping, return of documents, ADR, declaration of value, cargo insurance
IV	Partial and full-vehicle, domestic	Domestic forwarding of consignments weighing from 5 to 15 tons and above	Organization of the transport process, transport, organization of loading and unloading of goods/additional services, return of pallets/additional services, return of documents/additional services consolidation, deconsolidation, palletisation, foil rapping, ADR, declaration of value, cargo insurance
V	Wheeled, full truck loads, Europe	International forwarding of shipments weighing over 15 tons	Transportation of cargo as part of export or import, transit, small and large cabotage, customs service, ADR, CARGO insurance
VI	Maritime FCL, LCL, World	Forwarding of full container loads by sea and land transport of a container worldwide	Organization of sea and land (road) door-to-door transport (+ intermediate variants) of full container loads and groupage (FCL, LCL), organization of port reloading in the country and abroad, full customs service; CARGO, organization of additional cargo port services in the country and abroad - e.g. storage, warehousing, packaging, palletization of cargo, packaging, etc.
VII	Air, cargo	Forwarding of parcels, groupage and special shipments using air transport	Transport (between airports), reloading (at airports), handling dangerous goods DGR, customs services, value-added services (palletizing, foil rapping, storage), consolidation
VIII	Contract logistics	Implementation of warehousing services, additional services for goods and "tailor-made" customs services	Warehouse services: storage and inventory management, cargo services, picking, packaging additional services on goods: co-packing, customs services: customs clearance, bonded warehouse and bonded stores
IX	Logistics services	Terminal logistics, supply and distribution logistics, comprehensive logistics solutions, consolidation	Handling of cargo in terminals, between them, co-packing, co-labeling, consolidation of cargo at various levels, one-stop-shopping
X	Warehousing services	Traditional warehousing services	Warehousing services: storage, inventory management, cargo services, bonded warehouse,

Source: own study based on [9-11], [18], [30]

the authors propose a typology of services taking into account the technical and economic parameters of the division and its functional and objective nature. The adopted classification takes into account the

market dimension, the value delivered to the client, the subject of the service, the geographical dimension, technical specificity and quality.

### **3.2. TYPOLOGY OF LSP COMPANIES ACCORDING TO THE AUTHOR'S CONCEPT**

Considering the limitations related to the availability of data, the results of previous research and the understanding of the terminology of the classifications used from the perspective of the evaluated companies, the authors propose a typology of services taking into account the technical and economic parameters of the division and its functional and objective nature. The adopted classification takes into account the market dimension, the value delivered to the client, the subject of the service, the geographical dimension, technical specificity and quality.

In the practice of evaluating the services of LSP companies, both quantitative and qualitative tools are used. Although qualitative methods carry the risk of subjectivity, they are most often used on the Polish market. Combined methods, i.e. based on quantifiable indicators, supplemented with qualitative analysis, are also quite common in the assessment of services provided by LSP companies [2-3], [10], [19], [24], [30].

### **4. EVALUATION OF LSP SERVICES AND COMPANIES PROVIDING THEM**

In the practice of evaluating the services of LSP companies, both quantitative and qualitative tools are used. Although qualitative methods carry the risk of subjectivity, they are most often used on the Polish market. Combined methods, i.e. based on quantifiable indicators, supplemented with qualitative analysis, are also quite common in the assessment of services provided by LSP companies [2-3], [10], [19], [24], [30-32].

#### **4.1. METHODS OF ECONOMIC EVALUATION OF LSP SERVICES AND COMPANIES**

Enterprises belonging to the LSP sector are among the most susceptible to fluctuations of economic factors. Therefore, in LSP companies, the role of comprehensive analytical tools for evaluating their condition, forecasting threats and planning remedial actions is above average. There are many methods in the area of fundamental analysis of a company, used to assess its financial standing and reduce the risk of its deterioration based on economic analysis tools, in particular financial analysis. They are closely related to accounting and the company's internal economic information system, based on the processing of data from accounting and statistical records. They are mainly based on the diagnosis made with the use of financial indicators of the company's condition [19], [24], [30]. However, financial analysis, and in

particular its core in the form of indicator analysis, is associated with numerous limitations. The excess of economic and financial indicators makes it difficult to unambiguously diagnose the actual condition of a LSP enterprise (the results of the research obtained in individual sectors and functional areas of activity usually differ significantly from each other). Classic financial analysis involves the need to process a large amount of data. Therefore, even in the conditions of their IT development, this research is extremely time-consuming. Another problem is the enormous diversity of formulas and standards considered normative for individual indicators within different business segments, which in turn makes it difficult to conduct objective comparative studies. It should include: analysis of profitability, debt, operational efficiency, dynamics of revenues, costs, balance sheet structure, liquidity, although there are still other specific sets of measures for financial assessment in individual sectors of activity. Therefore, in highly developed market economies, in addition to traditional financial analysis, tools are used to identify threats to the condition of the company, considering the analysis of external factors in its environment and the evaluation of the operating strategy. The use of more multi-faceted analysis techniques of the LSP company stems primarily from the need for information that is necessary for the effective management of the company, which is particularly susceptible to external factors. Diagnosis of the company's current and potential business partners, its operating strategy, or the assessment of the sectors in which it operates or plans to operate is becoming more and more important, e.g. in terms of their attractiveness.

Effective tools for the strategic evaluation of LSP companies and the services they provide are portfolio methods, and one of the simplest and most commonly used tools is SWOT analysis, more rarely PEST [6], [23]. The SWOT analysis enables a relatively quick diagnosis of the strengths and weaknesses of LSP enterprises in individual sectors of activity. It is desirable to differentiate the SWOT criteria in the case of evaluating services in the LSP sectors, as for example separated under the author's concept (compare point 2.1.5.). SWOT analysis, however, is burdened with disadvantages, which include subjectivism in the assessment of individual factors. For the strategic evaluation of services provided by LSP companies, tools are also used that take into account the conditions of operation in individual sectors for various areas of services. Among them, the most popular are: Porter's Five Forces Analysis (POAS), Key Success Factors Analysis (KCS).

Among the majority of authors of the concept of

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evaluating logistics services, there is agreement as to the key competitiveness criteria and success factors. Among LSP companies, the following are considered the most important success factors:

- cost position,
- level of service quality relative to the price,
- scope of the offer,
- reputation and image of the company,
- forms and ability to cooperate with the client,
- ability to cooperate with other entities in the supply chain,
- financial standing of the company.

### 4.2. METHODS OF TECHNICAL AND QUALITY EVALUATION OF LSP COMPANIES AND SERVICES

Most methods and tools for evaluating quality of LSP services refer to transport or even haulage services. This applies to both qualitative and quantifiable assessment tools.

According to Rutkowski, Przybylska and Rydzkowski [12], [17], [27] the key elements of technical and quality evaluation from the point of view of customer service should be:

1. Duration (service delivery time, availability, frequency, regularity, punctuality / timeliness)
2. Spatial accessibility
3. Safety and security of cargo
4. Reliability (minimization of defects, losses, errors, complaints)
5. Price.

One of the multi-faceted solutions in this regard is the supply chain assessment model proposed by Jacyna [9], [13]. Some of the tools and assessment measures used in it can be used for the technical and quality analysis of individual SLP services.

According to Jacyna, the key research area for evaluating functioning of the supply chain in the process of handling physical goods between the supplier and the recipient are technical and technological aspects. They refer not only to the assessment of the efficiency of operation and handling of loads in logistics facilities, but also to the effective organization of services and processes within the supply chain [16]. Jacyna proposes the following technical measures for evaluating the supply chain and its services:

1. Degree of work efficiency of devices, transport means,
2. The degree of utilization of the load capacity of the transport means in the case of transport between the links of the supply chain,
3. Degree of use of internal transport equipment, in the case of warehouse or terminal services,
4. Number of failures and repairs of transport means,

5. The degree of utilization of the handling capacity in relation to the theoretical handling capacity at the entrance / exit from the storage facility or terminal.

In the developed model, it uses the following measures of qualitative assessment of the supply chain and its services:

1. Loss of delivery time,
2. The time of completing logistics tasks,
3. Reliability of logistics tasks
4. Risk of non-delivery.

In its model, it also uses elements of the so-called, environmental impact assessments, which should also be included in the technical parameters of the evaluation. The environmental evaluation measures proposed by Jacyna are:

1. Minimizing the emission of harmful compounds from exhaust gases [10],
2. Minimization of congestion in supply chains, fluency of service provision.

A slightly different set of criteria for evaluating LSP services is proposed by Fechner [12-13]. According to him, the key elements of the quality assessment of the service include: comprehensiveness, compliance of the service with the requirements, cost vs. quality (price, payment date, additional services), waiting time, technical standard / quality certificates, keeping commitments, condition of the fleet / infrastructure (size, number, technical condition, aesthetics, sanitary condition), availability, partnership relations / commercial connections, distribution capabilities / distribution network / terminals, etc., financial credibility / solvency. The aim of the supply chain assessment model proposed by Jacyna and Fechner is to optimize the use of resources in order to carry out logistics tasks with high quality standards from the point of view of customers.

The summary of the criteria proposed by the above-mentioned researchers is Figure 3.

Among the wide range of instruments for evaluating the quality level of LSP services, the SERVQUAL quantitative method, which has been developed for several decades and is universal, is worth mentioning. There is currently no consensus on the number, names and descriptions of the individual dimensions of this assessment tool. However, this is due to the fact that in the current market reality, in the face of the intensification of phenomena such as hyper-competition, globalization, co-opetition, it is the customer who de facto decides on the quality criteria of LSP services, because the demand for individual services depends on him. The functioning of LSP companies on such a highly competitive and rapidly changing market forces them to constantly monitor



**Fig. 3. Criteria for the quality evaluation of LSP's based on the customer opinion survey.** Source [23]

market requirements, in terms of revising the adopted strategies and taking effective actions ahead of the competition. Maintaining quality standards enforced by highly variable external demand in accordance with the revised strategy is easier with the use of proven tools for analysing the quality of LSP services, which include SERVQUAL. The relationship between the improvement of processes and the efficiency of services and the efficiency of logistics systems is tautological in nature. The method involves examining five key dimensions of the service in order to identify the sources of problems related to the quality of processes from the customer's perspective (expectations vs. performance). It is based on the construction of several dozen questionnaire questions, constructed separately for each of the assessment dimensions. This method is a relatively simple, and at the same time, multi-stage scale, which can be used to obtain many valuable tips for improving processes related to a given service. Quality attributes are questionnaire questions set for each dimension. Customers assess the services using a five-point Likert scale (1-5). Despite its widespread use in assessing the quality of LSP services, it is often criticized. It is designed to measure the pure services, in which material elements play a minor role, although in market realities their importance is high. Therefore, its basic drawback is the lack of universal application to various services [2-5], [25], [31].

Most of the other rating measures are also based on a customer rating survey. Among the best-known and most frequently used tools today is the CSI (Customer Satisfaction Index), which is a quantitative method. It enables comparability at the level of various LSP services. It is a tool that allows to perform a fairly detailed comparative assessment of the same

services offered by different companies in a universal way. The CSI indicator is a weighted average of customer satisfaction ratings for service attributes (the scores are multiplied by the weights assigned to each factor, and the values are expressed as percentages). Specific percentage ranges corresponding to four different levels of customer satisfaction are adopted for particular types of services (classified in the following groups: transport, forwarding, and logistics). According to Drapińska and Fraś, this tool is too time-consuming due to the large number of open questions and the two-stage nature of the study [28].

Another method of quantitative evaluation of the quality of LSP services is the so-called CIT Critical Incident Method and SERVPERF Method. The CIT method, developed in the 1950s by the British psychologist Flanagan, belongs to the group of incident-based methods. It is still one of the most effective tools for identifying sources of customer satisfaction. It involves detailed analysis of interactions between employees of the LSP company and its clients in the field of service providing. It is based on methods of psychoanalysis and observation of human behaviour. It usually provides reliable and consistent interpretations of results without the distortions typical of other questionnaire studies. However, it requires the involvement of specialists in the field of psychoanalysis. It is costly and time consuming. Studies using this method were conducted, among the others, by such researchers as: Edvardsson, Hu, Grison or Sundling, and among Polish researchers by Kadłubek [18].

Another of the quantitative methods used to evaluate the quality of LSP services is the method of Martilla and James, also called the IP technique (Importance - Performance) [3-4], [22]. It is a method used to measure the perception of the importance of variable factors affecting the quality of services from the point of view of customers. Respondents use it to answer two types of questions regarding the same dimensions of the service, twice (1 - due to their importance for the implementation of the service, 2 - due to the level of performance). The results are summarized in the form of a matrix of significance - implementation, where the value of the degree of service implementation is marked on the abscissa axis, and the value of the significance of individual factors on the ordinate axis. The map obtained this way makes it possible to identify areas requiring urgent intervention (compare Figure 1, Figure 2, Figure 5). Its basic assumption is to focus efforts on improving those areas that are important to buyers, but rated low in terms of performance, instead of improving all the features of a given service.

A tool dedicated to the quantitative assessment

of the quality and efficiency of transport services is also the TUL analysis, referring to the processes and services related to: transport, reloading, storage, forwarding. It enables optimization of the planning of individual processes and their verification based on ex-post research. Based on this type of tools, it is possible to determine the most time- and cost-consuming elements of each process related to the provision of specific services.

Statistical and econometric studies in the area of transport and logistics focused on the technical aspects of LSP services are more frequent than analyses relating to the economic dimension. This is due to two factors. Firstly, it is difficult to isolate the number and structure of LSP entities on the supply side, and the only measure of the demand side of the LSP services market is information on the number and structure of transported cargo. This seriously limits the possibility of conducting full research on providing services by Polish LSP companies, in particular in the areas of effectiveness and efficiency. The knowledge of them is of great importance in the context of dynamically changing external conditions of the functioning of LSP companies. Measuring quality using these methods is possible, but the selection of the tool is related to the selection of the research sample (its size, scope of services, geographical scope of activity) as well as time constraints and the budget allocated for conducting research.

### **4.3. AUTHOR'S METHOD OF RANKING LSP COMPANIES**

In the economic practice of management, there is a large variety of evaluative studies, but their instruments are often superficial or time- and cost-consuming. The LSP companies' rankings available in the literature are based on a limited set of indicators, usually only 3-5, which makes the conclusions based on them incomplete and, as a result, often error-prone. The authors of the rankings do not examine the degree of correlation between the evaluation indicators. This may result in inaccurate assessments and does not eliminate the risk of random listings [1-5], [13], [17].

It should be noted that the average values of partial measures obtained by LSP companies on various foreign markets and the confidence intervals adequate for them may differ significantly from each other, due to the specificity and individual conditions of companies operating in individual countries. This may be a cause to further research in the field of evaluating the implementation of services by LSP companies from different countries and deepening comparative analyses [11], [17].

The method of assessing the quality of LSP services

presented by the authors has numerous application values and can be used in business practice among companies in the sector, regardless of the country of origin. It considers measures of quality evaluation of services providing and the economic condition of LSP companies. And what is its additional advantage in the context of transport companies - the fleet emissivity measure [14-15], [17-18].

Within each of the subgroups of measures of service and economic quality assessment (profitability, efficiency, indebtedness, liquidity), the authors selected sets of all indicators commonly used in quality and fundamental analysis of companies. They were guided both by the selection of indicators most often used in the selection of LSPs, as well as by the evaluation of the investment potential of companies. The final choice of indicators was made based on the study of correlations between them.

Then, in each of the subgroups of quality and economic indicators and one emissivity indicator, based on the data from the available financial statements for the years 2020-2021 for nearly 50 LSP companies (using the EKRS search engine and e-surveys), the economic indicators adopted in the study were calculated for selected entities [17-19].

Using the Cran statistical platform, the degree of correlation between the obtained partial results in groups was examined and the final selection of the set of indicators for the aggregated assessment was made [17-18]. The sequence of the research procedure is shown in Figure 4.

It turned out that economic indicators were strongly correlated with each other (correlation coefficient above 0.8). Correlation of indicators belonging to different economic subgroups (profitability, efficiency, indebtedness, liquidity) occurred less frequently. On the other hand, the indices for evaluating the quality of service provision showed a high level of diversified correlations.

The growth of the sharing economy in the LSP sector and the increasing attention that it has received from researchers, entrepreneurs, practitioners, will cause changes in the selection of the LSP services evaluation indicators the worldwide socio-economic importance of this phenomenon, Figure 5.

If it was decided to construct a synthetic measure of the ranking evaluation of the companies, it would be necessary to select from among the indicators with the highest degree of correlation in subgroups or to assign them lower weights in the overall assessment. The use of highly correlated indicators from the same subgroups may cause duplication of certain types of information and increase its importance in the entire analysis [17], [28].

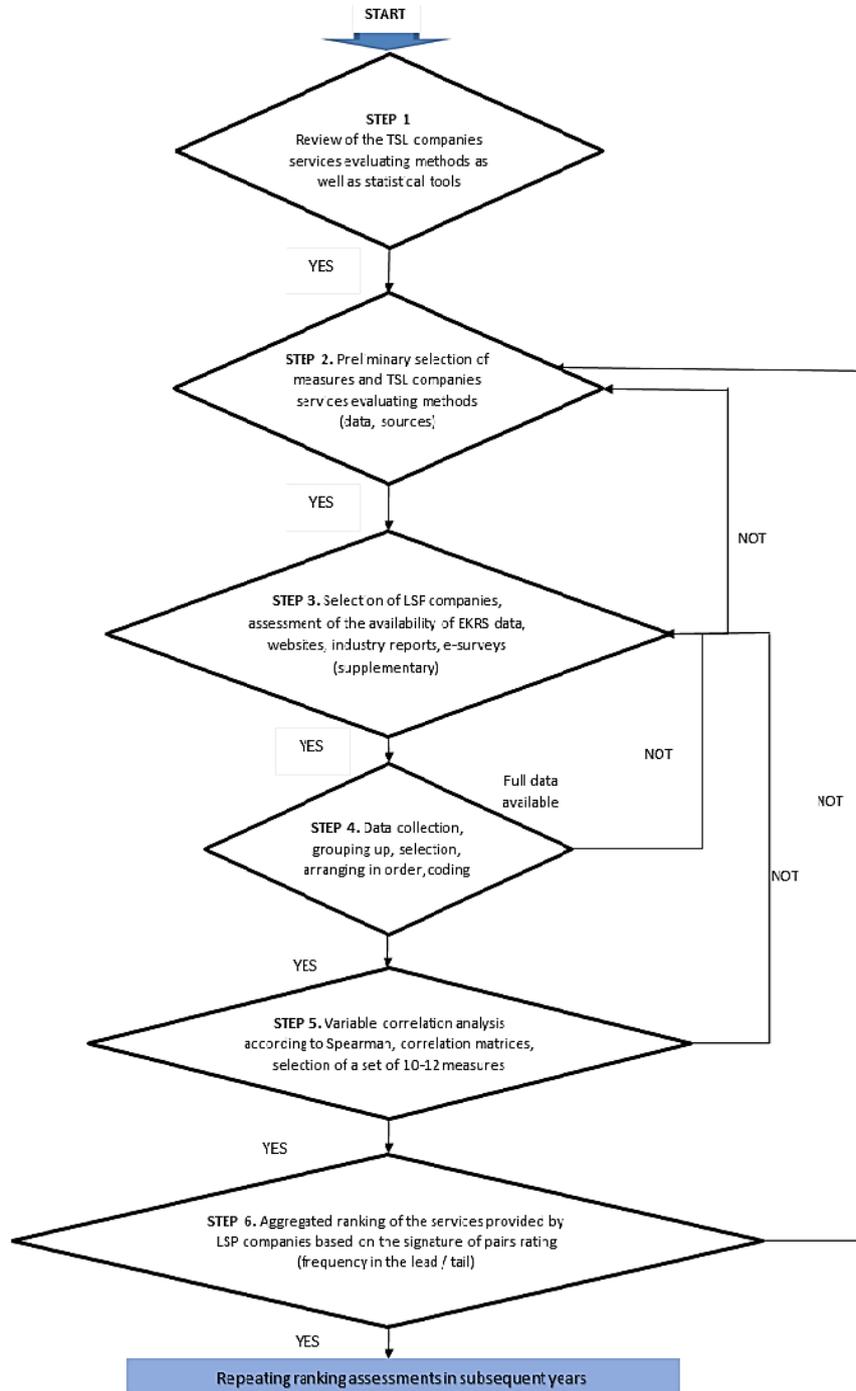


Fig. 4. The sequence of the research procedure (evaluation of LSP's). Source: own study

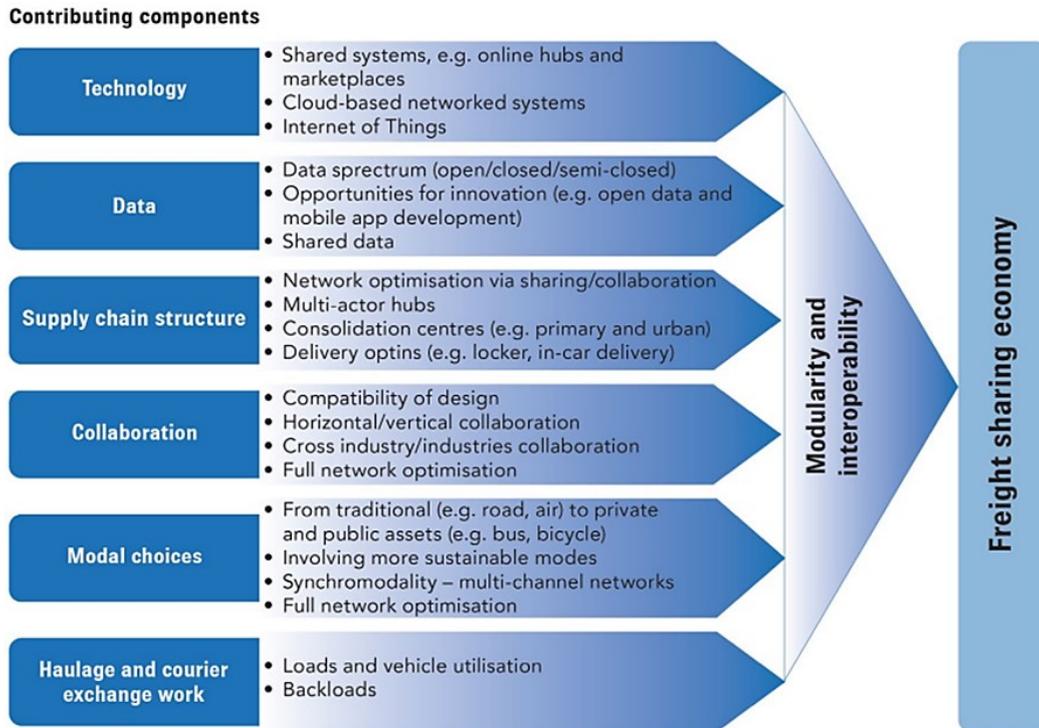


Fig. 5. Criteria for the evaluation of LSP's based on the future state of the sharing economy. Source: [24]

This risk did not occur if a solution based on the linear assignment of the values obtained in the partial rankings is applied and creation of, based on them, only two-number signatures indicating the frequency of the examined entity at the top and bottom of individual rankings. Assuming that the objective is a simple maximizing of the results, without differentiating the weights [17], [28].

Therefore, in the collective evaluation of the LSP companies, the authors used simultaneously low-correlated indicators within and outside the subgroups, as well as one fleet emissivity indicator. The results obtained allowed to conclude that thanks to this, it will be possible to compare many aspects of LSP's activities.

Comparing the correlation of rankings for both years using different sets of indicators allowed to conclude that:

- The use of a set of partial indicators with diversified correlation means greater similarity of rankings in subsequent years.
- Using a set of indicators only from the same group (profitability) and of high correlation (above 0.8) is wrong. It causes duplication of partial ratings and greater randomness of

rankings in subsequent years.

When selecting a set of partial indicators for the ranking evaluation of LSP companies, care should be taken to select indicators from various groups (profitability, operational efficiency, liquidity, debt) and to examine the correlation between them, select and develop a set of indicators with a greater dispersion of the correlation coefficient [9-10], [17], [19-22].

In the case of economic indicators belonging to different groups (e.g. efficiency and profitability), the correlation between them was not so strong. Their correlation with the ratios in the area of debt and investment potential was lower still, as well as a very low or negative correlation with the emissivity indicator [10]. The comparison of the results of the economic analysis of enterprises with the evaluation of their emissivity level was a novelty in LSPs research.

Economic evaluation of the LSP sector based on the author's research method

Based on the economic analysis, derived from the comparative assessment of 10 selected financial indicators from 46 enterprises, it was found that in 2020-2021 the LSP market maintained a positive

trend of changes with high correlation of financial indicators. The market growth rate, measured by the value of net revenues from the activities of the surveyed LSPs in 2021 compared to 2020, amounted to 119% (i.e. in 2021, the average increase in net revenues of companies by 19% was recorded compared to 2020). The value of the LSP market, measured by the net revenues of the 46 largest entities, amounted to PLN 14 billion, which is PLN 2 billion more than in 2020. Other indicators also indicated a good economic condition of the analysed 46 entities [17], [19], [32].

### CONCLUSIONS

Thanks to the appropriate selection of partial indicators (set of characteristics), an aggregated LSPs' ranking was achieved. It will be justified to extend the research with elements related to the evaluation of the degree of greening of logistics and transport entities, with respect to radical changes in EU regulations in this area. It would be interesting to carry out in-depth research on a larger sample of enterprises from other countries to assess their individual conditions of development. However, in the light of existing problems with the availability of data from companies belonging to a highly competitive sector, this seems difficult. Irrespective of the adopted method of preparing the rankings of LSP companies and the measures adopted for their evaluation, the time horizon of the research should be extended in order to minimize the randomness phenomena. It would also be interesting to develop this research towards assessing the impact of the economy of sharing resources and services on the efficiency of LSP companies. In recent years, the Polish market of Logistic services and companies providing them has been particularly strongly influenced by macro-environmental factors. Also, problems with the selection of staff, professional drivers, the effects of the prolonged war in Ukraine, regulations regarding the minimum wage, drivers' working time, as well as other regulations governing the operation of Polish LSP companies on the European Union market, under the so-called Mobility Package, negatively affect it. These external factors stimulate an increasing interest in the concepts of sharing LSP resources. Despite the combination of many negative external factors, the LSP sector is still in good shape and its share in the national economy is growing. It accounts for the production of nearly 12% of GDP. It is expected that in the coming years, solutions and technologies optimizing deliveries under the concept of sharing in particular in the so-called last mile, will be of great importance for the development of services in the LSP sector.

### ABBREVIATIONS

1. **LSP services** – Logistics Service Provider services;
2. **LSPs services** – Logistics Service Providers services.

### METODY KLASYFIKACJI I OCENY USŁUG TSL W TURBULENTNYM OTOCZENIU

Artykuł stanowi kolejną część cyklicznych publikacji Pracowni Ekonomiki i Dostępności Transportu Instytutu Transportu Samochodowego. Istnieje duża różnorodność usług oferowanych przez firmy działające w branży TSL (transport, spedycja i logistyka) w Polsce. Firmy te różnią się wielkością, strukturą organizacyjną, własnością i modelem biznesowym. Istnieje wiele firm, które świadczą tylko jeden rodzaj usług logistycznych, np. transport, magazynowanie, logistykę kontraktową oraz wiele podmiotów oferujących szeroki wachlarz usług logistycznych. W Polsce branża TSL przechodzi obecnie głębokie przeobrażenia, które są efektem post pandemicznych zmian, ograniczeń toczącej się wojny na Ukrainie oraz wdrażania wspólnotowych przepisów, m.in. w zakresie tzw. Pakietu Mobilności, czy związanych z obniżaniem emisyjności w transporcie. Wciąż jednak brakuje jednolitej metody klasyfikacji i oceny usług branży TSL, która miałaby szerokie zastosowanie i zapewniałaby porównywalność wyników według określonych kryteriów. Celem artykułu jest przegląd istniejących klasyfikacji i metod oceny usług i firm TSL oraz zaproponowanie własnej taksonomii uwzględniającej zmiany i trendy obserwowane w polskiej branży TSL. W artykule przedstawiono definicję usług logistycznych, ich składowe oraz kryteria oceny. W części analitycznej omówiono strukturę firm świadczących te usługi na polskim rynku TSL. Przedstawiono wyniki empiryczne dla strategicznej segmentacji sektora TSL. Autorki przedstawiły metodologiczne problemy analizy i prezentacji wyników podmiotów rynku TSL. W tym celu autorki przedstawiły wnioski z przeglądu dostępnych metod rankingowych. Biorąc pod uwagę zidentyfikowane ograniczenia oraz wyniki badań korelacji między wskaźnikami wykorzystywanymi do tworzenia dostępnych rankingów, zaproponowano nową metodę, wskazującą sposób doboru miar ewaluacyjnych. Uwzględniono miary ekonomiczne należące do różnych grup analiz stosowanych w analizie ekonomicznej i ocenie potencjału inwestycyjnego spółek branży TSL. Zaproponowana została własna, zrównoważona metoda opracowywania rankingu firm. Wzięto pod uwagę również ocenę emisyjności floty, która ma szczególne znaczenie wśród wciąż dominującego w branży TSL sektora usług transportowych.

**Słowa kluczowe:** usługi TSL - usługi branży transportu, spedycji, logistyki.

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