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BENEFITS AND COSTS OF CONNECTING LOGISTICS ENTERPRISES TO DIGITAL LOGISTICS PLATFORMS. THE PERSPECTIVE OF TRANSACTION COSTS THEORY

KORZYŚCI I KOSZTY ZMIANY ZWIĄZANEJ Z WCHODZENIEM PRZEDSIĘBIORSTWA LOGISTYCZNEGO DO CYFROWYCH PLATFORM TECHNOLOGICZNYCH. PERSPEKTYWA TEORII KOSZTÓW TRANSAKCYJNYCH

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Abstract: Objective. The research aims to verify the profitability of the change consisting in the transition of a logistics company from the structures of hierarchical solutions requiring the expansion of its own transport order collection system, to structures using a digital logistics platform delivered by a specialized company based on a specific contract.Within the conducted research, the authors used a critical review of the literature on the subject, realized desk research and case study analyses.The obtained results confirm the advantage of moving from hierarchical structures that require expanding one's own transport order collection system, to structures using a digital logistics platform of a specialized company, based on a periodic contract with network distinguishing characteristics. The obtained results will be used as the basis for further research on the possibilities of analysing organizational

management systems based on the contracting models of digital logistics platforms. The research results will broaden the knowledge on the interpretation of the advantages of digital logistics platforms from the perspective of the transaction costs theory.

Keywords: logistics, digital technology platforms, digital logistics platforms, transaction costs theory.

Streszczenie: Celem badań jest sprawdzenie korzystności zmiany polegającej na przejściu firmy logistycznej z rozwiązań hierarchicznych wymagających rozbudowy własnego systemu zbierania zleceń przewozowych do rozwiązań wykorzystujących na zasadzie kontraktu cyfrową platformę logistyczną specjalistycznej firmy. Autorzy dokonali krytycznego przeglądu literatury przedmiotu, przeprowadzili analizy desk research oraz analizę w postaci studium przypadku. Uzyskane wyniki potwierdzają korzystność przechodzenia z rozwiązań hierarchicznych wymagających rozbudowy własnego systemu zbierania zleceń przewozowych do rozwiązań wykorzystujących na zasadzie kontraktu okresowego o cechach sieci – cyfrową platformę logistyczną specjalistycznej firmy. Otrzymane rezultaty posłużą do dalszych badań możliwości analizy systemów zarządzania organizacjami z wykorzystaniem modeli kontraktowania cyfrowych platform logistycznych. Wyniki badań poszerzą wiedzę o interpretacji zalet cyfrowych platform logistycznych z perspektywy teorii kosztów transakcyjnych.

Słowa kluczowe: logistyka, platformy technologii cyfrowych, cyfrowe platformy logistyczne, teoria kosztów transakcyjnych.

1. Introduction

Poland is the second-largest market for transport companies in Europe, and the transport-shipping-logistics (TSL) industry employed around 300 thousand people in 2020. Despite the status of a European leader, the Polish TSL industry is struggling with numerous problems. The Polish transport sector is highly fragmented and dominated by small shipping companies, hence the difficulties in building solid organizations as players on international markets. Payment terms within this sector are on average 60 days, while the digitalization level is still deficient. Uber, which entered the Polish TSL sector with new technologies, took advantage of this situation.

For many years, Polish companies operating in the TSL sector have been looking for relevant solutions to effectively implement digitization technologies in this sector. Without these technologies, it is not possible to compete with, for example, the previously mentioned Uber company (UberFreight, 2019). An example of a good solution within the considered area is the logistic platform at trans.eu (Trans.eu Platform hereinafter abbreviated as: Platform). The main theoretical context referred to by trans.eu, but also by Uber, is the business model reformulation into the framework of a system using the contracting assumption, settled with minimal transaction costs, much below the costs that companies have so far incurred when creating their own systems of searching, signing, and tracking contracts in the transport-shipping-logistics sector.

The aim of the conducted research, the results of which are presented in this article, is to identify the benefits and costs resulting from the change consisting in the logistics company transition from hierarchical solutions, requiring the expansion of its own transport order collection system, to new solutions utilizing a network-specific periodic contract – a digital logistics platform of a specialized company. The authors carried out a critical review of the literature on the subject, conducted a desk research and case study. The obtained results will be used for further research on the possibilities of analysing organizational management systems based on contracting models using digital technology platforms (DTP). The research results are expected to expand knowledge on the interpretation of the advantages of the digital logistics platforms from the perspective of the transaction costs theory.

2. Evolution of the value chain as a basic concept for logistics platforms

One of the most important reasons for the market success of enterprises is a well-formulated and implemented strategy. The final shape of the strategy is influenced by many factors, from the industry type, through the entity's financial situation, to the selected strategy type (Nowakowska-Grunt, 2011). In the case of companies operating in TSL, strategies, apart from the general dimension – referring to the classics proposed by Ansoff, Porter, and Drucker, often have a contextual dimension – indicating the specificity of the basic scheme of operation in these organizations, referring to the various elements connections and multiple processes occurring within and between companies. In logistics, this is especially true of value chain strategies.

It was the aforementioned Porter who firstly pointed to a new concept of organizational analysis related to the value chain (Porter & Millar, 1985). Over the years, this concept was not only frequently referred to by scientific literature, but also developed and contemporized by various authors. Thanks to the literature study on the subject conducted by Ricotti (2019), it is possible to determine the direction of the evolution of Porter's concept. The assumption of competitive advantage that a single enterprise can generate through the value chain has been developed and modernized in many publications, among others Ensign (2001), Fine et al. (Fine, Vardan, Pethick, & El-Hout, 2002), Shapiro et al. (Shapiro, Singhal, & Wagner, 1993), Simatupang et al. (Simatupang, Piboonrungroj, & Williams, 2017). The further development of the value chain concept was provided by the research on Virtual Value Chain (Rayport & Sviokla, 1995), Global Value Chain (Anderson, 2000), Added Value Chain (McPhee & Wheeler, 2006), Reverse Value Chain (Jayaraman & Luo, 2007), and Sustainable Value Chain (Fearne, Martinez, & Dent, 2012). The authors mentioned above extended the value chain concept to include Porter's concept of suppliers, channels, and buyers. According to the initial assumptions of the value chain, linear and sequential logic lead to increasing value. The publication of Value Network (Peppard & Rylander,

2006) led to creating a theory about the value network formed by various external organizations (Normann & Ramirez, 1993). Therefore, today's competition does not occur between particular entities, but rather between networks of interconnected organizations (Allee, 2000). The emergence of the network theory and the increased openness in building relationships between entities have changed the framework for the value chain management.

Ricotti, in the article entitled "From value chain to value network: a systematic literature", systematized the value chain concepts to show its evolution clearly, but he was not the only author to take up this issue. It is worth noting that other reviews of Porter's concept of the value chain, slightly different from Ricotti's vision, have also appeared in the literature such as Offshore Value Chain (Schmeisser, 2013), a review of the value chain literature (Kodó & Hahn, 2017), a comparative review of value chain development (Donovan, Franzel, Cunha, Gyau, & Mithöfer, 2015), a review of sustainable chain management (Bush, Oosterveer, Bailey, & Mol, 2015) and a critical review of network capabilities (Äyväri & Möller, 2008). A new impetus for the development of these concepts was recently provided by Industry 4.0 solutions, which often changed the way of implementing these concepts based on ground-breaking innovations. Looking from the perspective of the value chain evolving towards network solutions and enriched with 4.0 technologies, resulted in the emergence and the exceptionally dynamic development of various technological platforms. These platforms, enriched with the adjective 'digital', have fundamentally changed the image of the modern transport-shipping-logistics (TSL) sector. Primarily, the theoretical foundations implying the platform concept emergence should be sought in the area of transaction costs.

3. Transaction costs theory. Implications in contracting activities

One way to explain the reasons for the appearance of contracts in management and quality sciences is to refer to the transaction costs theory (Coase, 1993; Williamson, 1979)[1] and the property rights theory (Schmitz, 2006). In these theories, contracting is the transfer of property rights between the parties to the contract and, by its nature, is associated with bearing the certain costs of concluding a transaction. It is an effective management method, but only in a situation where the opposing hierarchical solutions are associated with incurring the higher costs of the hierarchy. In the previous century, hierarchical solutions were more competitive than contractual solutions. This situation changed when the costs of concluding contracts began to drop significantly, mainly due to the implementation of IT solutions facilitating the

[1] The agency theory also contributed to the development of the network theory, referring, like the transaction costs theory, not only to the asymmetry of information, limited rationality, but also the phenomenon of opportunism (Niemczyk, 1995).

search for contractors, the conclusion of contracts, and monitoring them. This also resulted from introducing process and design solutions, which made the contractors' inclusion into the activities of the organization simpler and cheaper. "In such a situation, transaction costs did not completely »reset«, but fell to the level provided by the hierarchy, however without the costs of the hierarchy" (Niemczyk, 2013). The organizational counterpart of such solutions has become networks that do not possess most of the hierarchy's disadvantages. The network concept was adopted by digital technology platforms, which, thanks to the communication system and the linking of contractors with periodic contracts, filled the gap between the abovementioned hierarchy and an entirely contractual organization. In such a situation the company external to the platform faces the dilemma of whether to expand its organization, examining the costs of the hierarchy to be able to implement activities effectively, or instead to use the assumption of contracting, signing contracts with organizations that are able to realize the considered activities based on the network idea. Therefore, the issue to be analysed is the relation between the benefits and costs of contracting based on digital technology platforms, compared to those within a hierarchical organization. This decision is primarily influenced by the transaction costs and the benefits and costs of the change itself.

"Transaction costs include the costs of making decisions, planning, organizing, and negotiating the actions to be taken and the terms of the exchange, the costs of changing plans, renegotiating terms and resolving disputes depending on changing circumstances, and the costs of ensuring that the parties act as agreed. Transaction costs also include any losses resulting from ineffective group decisions, plans, arrangements or contracts, ineffective responses to changing circumstances and imperfect contract enforcement" (Milgrom & Roberts, 1990). In practice, ex ante and ex post transaction costs are distinguished. In the context of contracting, the former include the costs of the overall contract preparation, including the costs of collecting information, the costs of the decision-making process related to the contract conclusion, the negotiating costs, the costs of signing and implementing the contract, the costs of formal and legal changes, the costs of changing organizational documentation, advertising, and announcements, and finally the costs of obtaining the necessary permits. On the other hand, ex post costs include the costs of tracking the contract implementation process, possible annexation, also the costs of temporary weakening of the institution (costs of running in the management system, costs of acquiring new qualifications and experience, costs of changing communication patterns, costs of changing the organizational culture), costs of achieving pre-operational efficiency before the change, costs of stabilizing and increasing efficiency (costs of improving the mechanisms of exercising power). In the context of specific contracting, the catalogue of the listed costs may change.

The purpose of effective contracting from the transaction costs perspective should be to achieve a state in which the benefits of the organization's functioning after the change will exceed the benefits of the previous system, or the losses

arising from the new system functioning, will turn out to be lower than the losses achieved before the change, taking into account the transaction costs of creating a new system (contract). The inequality below shows the relations between these quantities.

$$benefits\ ci_{t+1} - benefits\ ci_t > transaction\ costs_{t\to t+1} - alternative\ costs$$

$$benefits\ ci_t = useful\ result\ before\ the\ change - costs\ incurred\ before\ the\ change^*$$

** if the difference is negative, there will be losses instead of benefits*

$$benefits\ ci_{t+1} = useful\ result\ after\ the\ change - costs\ incurred\ after\ the\ change^*$$

** if the difference is negative, there will be losses instead of benefits*

$$transaction\ costs_{t\to t+1} = costs\ of\ realizing\ the\ change$$

$$alternative\ costs = costs\ that\ could\ have\ arisen, in\ case\ the\ change\ has\ not\ been\ decided$$ (Niemczyk, 1995).

The transaction costs theory is not only a set of catalogued costs, but also a concept pointing to a new direction of changes in the management of organizations. Contracting under the conditions of an IT-based economy becomes, as already emphasized, requires less effort and is cheaper. As a result, contracting will increasingly replace hierarchical solutions. The benefits of contracting are mainly related to increasing the market sensitivity of contractors considering hierarchical solutions, increasing the flexibility of the arrangement (the possibility of exiting and entering contracts), increasing the autonomy of contractors, and increasing the involvement related to the so-called entrepreneurial rent (Niemczyk, 2013), as well as the possible benefits of coopetition, when the contractor possesses the characteristics of a coopetitor. Yet the weaknesses of contracting, in addition to the transaction costs mentioned above, are the costs of operating in conditions of more significant uncertainty, costs of excessive autonomy, and costs related to the limited resource rent obtained from the contractor's knowledge resources.

In the case analysed in the article, the benefits and costs resulting from the contractor's inclusion in the digital technology platform, instead of building the potential to perform specific tasks on the market without participating in the network, was investigated.

4. Basic types of digital technology platforms in logistics

There are many definitions of digital technology platforms (DTP) in the literature on the subject. The term DTP itself is not widely used today (Bartczak, 2019), and terms

such as digital platforms (De Reuver, Sørensen, & Basole, 2018), digital platforms, or digital industry platforms (Corin Stig, 2015) are much more common. There is also a platform category reserved for the logistics industry, referred to in the literature as logistics and transport platforms (Hofmann & Osterwalder, 2017) or digital logistics platforms (Banker, 2019) – also included in Polish publications, DTP is a concept very widely interpreted in various disciplines of science. In management and quality sciences, DTP is defined as digital tools that contain functions that enable relations between organizations, which carry a specific value (Constantinides, Henfridsson, & Parker, 2018). DTP also includes activities carried out by the entity, translated into functions aimed at supporting, optimizing, and implementing the entity's internal processes (Corin Stig, 2015). In turn, in terms of technology, DTP has been defined by the literature as a technical team consisting of software, hardware, computer, and all the organizational procedures and activities related to it (De Reuver et al., 2018). DTP is also a set of services that allow the creation of applications (Lorong, Howard, Gaughan, & Logan, 2016) or a codebase that can be expanded with functionalities and modules (De Reuver et al., 2018).

The scientific literature also refers to the concept of **digital logistics platforms** (DLP), which can then be interpreted as: electronic notice boards that enable the exchange of services or information between contractors; electronic results; networks of dependencies between logistics, transport, and ICT; place of co-use of entities from the logistics industry with means of transport or terminals; a system of modules aimed at communication within the supply chain (Gajšek, Lipičnik, & Šimenc, 2012).

Leal defines digital logistics platforms (DLP) as functional systems that perform a coordination and integration task in relation to specific activities aimed at the implementation of logistics processes in an automated manner and closely related to the IT infrastructure (Leal, 2011). According to Sułkowski and Morawski, electronic logistics platforms (EPL) provide an environment for cooperation and supply chain management, operating on the Internet. This enables integration between individual components of the supply chain, such as suppliers, manufacturers, logistics operators, and recipients, and facilitates operational activities within logistics processes (Sułkowski & Morawski, 2012). The multitude of definitions and names suggests an inconsistent picture of the digital logistics platforms (DLP) issue, which in turn distorts the possibility of the correct classification of the phenomenon, and makes it challenging to define a coherent essence of the DLP. It is also worth noting that some definitions and terminology have been assigned only to technological platforms operating in specific industries, extending the discussed area with new elements and features. Following numerous definitions of DLP, many authors have developed appropriate classifications due to the adopted perspective of the issue. The most basic division was designed by Gawer, and presented in the table below.

According to another division prepared by the consulting company PWC, DLP includes systems such as cloud platforms and digital freight exchanges. The latter

bring together entities that want to use free cargo or storage space and those that offer such space (Baron, Zintel, Zieris, & Mikulla, 2017).

Table 1. Types of digital logistics platforms (DLP)

The criterion for distinguishing the type of platforms	Specification		
manner of platform functioning	internal platforms	supply chain platforms	industry platforms
architecture	modular	core along with additives	
level of innovation	large	within the supply chain	unlimited
level of exploitation	enterprise	supply chain members	industrial ecosystems
type of interface	closed (available only to platform users)	selectively open (available to supply chain members)	open to everyone
manner of coordination	strictly defined management hierarchy	based on contractual relationships along the supply chain	ecosystem management
entities organizing the platform	enterprise and its subcontractors	supply chain members	platform leader along with contractors

Source: own elaboration based on (Gawer, 2014).

Digital freight exchanges can be additionally divided due to the scope of applied IT solutions. Considering the large variety of the discussed platforms group, only examples of such solution types are listed below:

- SaaS (Software as a Service) enables the use of selected software components,
- PaaS (Platform as a Service) includes the sale of all software only,
- IaaS (Infrastructure as a Service) is the entire IT infrastructure, including computer hardware and service (Antonowicz et al., 2017).

The above classification can be further developed with additional suggestions:

- FaaS (Framework as a Service) – a service consisting in the development of applications available on the market,
- BpaaS (Business Process as a Service) – a platform in which the service provider also controls part of the entity's business processes,
- CaaS (Communication as a Service) – a platform with functions dedicated to communication,
- DaaS (Data as a Service) – a platform for data analysis,
- IpaaS (Integration Platform as a Service) – a platform allowing to manage data located in the cloud,
- XaaS (Anything as a Service) – a classic cloud platform (Malinowska & Rzeczycki, 2016).

Another type of DLP is the cargo space sparing platform. Its role is to utilize unused cargo and storage spaces, i.e. loading vehicles with identified goods that would otherwise run empty. A subtype of cargo space sparing platforms is the C2C transport platform targeted at individuals (Hofmann & Osterwalder, 2017; Kawa, 2014). In the literature on the subject, one can also find other types of DLP dedicated to logistics, such as co-modal logistics platforms operating in co-modal transport, based on various branches of the economy (Leal, 2011), and digital brokerage platforms which find application in freight brokerage by connecting different segments of the supply chain (Auvinen, 2018).

The presented types of DLP are characterized by many technologically distinguished proposals due to the way they are organized or intended. As in the case of the DLP definition, the classification of logistics platforms can be elaborated from a general perspective and taking into account a specific industry – in this case the transport-shipping-logistics (TSL) industry. One should also note that the breakdowns given are only examples, and the concept under discussion is a much broader issue.

5. Methodology – case study method

The conducted literature research was the basis to find an answer to the question posed as the research objective in the introduction of this paper's thesis, namely to identify the benefits resulting from the change consisting in the logistics company's transition from hierarchical solutions requiring the expansion of its own transport order collection system, to new solutions utilizing a network-specific periodic contract – a digital logistics platform of a specialized company. The method proposed in the research is based on a case study analysis, therefore the results obtained can be generalized only in selected cases of a similar type. The subject of the study is to analyse the benefits of a specific organizational choice, also considering the features of the strategic choice. This refers to the analysis of the benefits and costs of the change derived from the transaction costs theory and the property rights theory.

In the conducted case study, the primary data sources were the organization's internal documentation, the expert knowledge of the research co-author employed in operating the tested platform, and two interviews with persons who work managing the Trans.eu Platform. In the preparation of the study, special care was focused on ensuring that the obtained results meet the principles of accuracy and reliability. The case study included:

- preparation of a general description of the case,
- defining the data collection procedure,
- development of questions asked at the stage of data collection,
- development of research results.

6. Case study of the Trans.eu Platform

6.1. General characteristics of the Trans.eu Platform

The analysis of the Trans.eu Platform began with a short presentation from the perspective of this digital platform's technological and logistic features.

The TSL industry in Poland is a strong, but also a very scattered and poorly digitized branch of the economy. Although Polish transport currently takes the position of European leader, it is not free from problems related to the growing competition, the increasing complexity of supply chains, and the digital gap. The solution to these difficulties could be the introduction of new technologies. One such solution is the Trans.eu Platform implemented by Trans.eu Group S.A., and officially presented at the Transport & Logistics Trade Fair in Munich (Messe München GmbH) in June 2019. The platform replaced an older, web-based platform for simple one-way communication with companies seeking orders in the TSL area.

The platform was adapted to the activities of three types of entities appearing in TSL: shippers, forwarders, and carriers. Such a solution enables the cooperation of interested institutions from the entire industry, except for a closed group of regular contractors. Due to the product's personalization, three specific tools were created on the Platform: Trans for Carriers, Trans for Forwarders, and Trans for Shippers. Each of them includes an integrated freight exchange that enables users to collaborate. Table 2 presents in detail the functionalities of the Trans. eu Platform.

Table 2. Functionalities of the Trans.eu Platform

Specification of functionalities	Remarks
1	2
2FA. A security module in the form of a two-step login required for new devices. Following customer requests, the function has been expanded to include the selected device remembering option and the possibility of choosing the code receiving method (e-mail, SMS).	safety function
Communicator. The web application is divided into three modules: • recent calls (breakdown of calls according to the date – ordered from newest to oldest), • contexts (inquiries sent via the details of the selected offer are sorted according to the directions indicated in the given advertisement), • contacts (one can find here the created contact list, search and add more people to it). Communicator also includes the option of free SMS and search bars in contact lists.	function thanks to which Logitrans Sp. z o. o. took the leading position in its industry
Freight and vehicle exchange. A list of over 300 thousand offers published by users and visible in real-time. To facilitate the search among the mentioned offers, the tab has appropriate filters that adequately specify the results. General information about the chosen offer is dedicated to the initial selection of	basic function

1	2
advertisements. More detailed information can be revealed in the 'drawer' after clicking on the selected ad. At this stage, it is possible to accept or negotiate the offer or send an inquiry to the offeror. The Stock module also includes buttons for adding new vehicles and freight offers.	
Freights. A section where the shipper can manage the offers issued, i.e. publish them, cancel publication, copy, move to the archive, confirm their validity (put the offer back to the top of the offer list), assign a responsible person. In the freight module, the employee can see all offers issued by all accounts assigned to a given ID.	–
Orders. Access to the transport order (contract) is generated automatically after mutual acceptance of the offer. The dataset included in the offer is automatically transferred. The shipper can edit the order by adding its conditions, and the carrier receives the option of accepting the contract to completely eliminate the need for an e-mail contact.	–
Ratings and references. The tab enables to rate the contractor, after the date of unloading, for 30 to 120 days, to track received ratings, and to issue and receive references, which significantly facilitates the registration of companies with a short market experience on the Platform.	–
Contractors. Search engine for companies that have an active account on the Trans.eu Platform enables to view detailed information about them, such as primary data, documents, employees, ratings and references, and fleet. The considered tab also possesses the function of creating user groups to publish offers within them.	–

Source: internal documentation of Trans.eu.

In the development of the Platform, Trans.eu focuses on developing carrier sourcing, i.e. the automation of carriers search and selection. Ordering loads can choose to work with groups of carriers tailored to the type of transport, conditions, and place of loading. The system supports them searching for a carrier by automatically providing them with a specific transport offer. However, thanks to the built-in online exchange module, users can find vehicle and cargo offers faster. Unique filters, an appropriate evaluation system, and easy access to current offers are meant to speed up the work of all the participants in the supply chain. The freight exchange is also a flexible solution for shippers when it comes to urgent transport organizing.

Table 3 presents the characteristics of this Platform based on the features of various platforms, including logistics, discussed in Part 3.

The Trans.eu platform is an Industry 4.0 tool connecting the community of the TSL sector in the transport industry. The logistics in 4.0 imposed on the Platform a new model of cooperation that connects the entire industry: no text messages, e-mails, or tables with data. Users who do not have an extensive IT infrastructure were given the opportunity to use state-of-the-art solutions that automate the processing of orders. The introduction of the Platform in mid-July 2019 initiated the replacement of the old, worn-out web exchange system. As a result, as already

Table 3. Characteristics of Trans.eu Platform considering features of other platforms' types

Type of platform	Characteristics of platform
Internal platforms	The platform has a high level of innovation and is available only to platform users (Gawer, 2014).
Digital freight exchanges	The platform brings together entities that want to use free cargo or storage space and those that offer such space (Baron et al., 2017).
Cloud	Classic cloud platform (Baron et al., 2017).
Paas	Only all-software sale (Aivazidou, Antoniou, Arvanitopoulos, & Toka, 2012).
Caas	Platform with functions for communication (Malinowska & Rzeczycki, 2012).
Cargo space sparing platforms	Platform assuming the use of unused cargo and storage spaces (Hofmann & Osterwalder, 2017).

Source: own elaboration.

mentioned, carriers, forwarders, and shippers received class 4.0 solutions tailored to their activities, together with the integrated freight exchange. Below is a comparison of the two versions: the desktop application (operated until 2019) and the Trans.eu Platform, operating since 2019.

Table 4. Comparison of the Trans.eu application: desktop and web

Area	Desktop application	Trans.eu Platform
1	2	3
Personalization	Boxed-product – the same for everyone.	Products containing tools dedicated to three groups: • shippers (TfS), • forwarders (TfF), • carriers (TfC).
Functionalities	The main products are freight and vehicle exchange, messenger. Side features are ratings, comments, trans risk, instant messaging archive, search tools and filters, and TransOrders.	Platform with tools dedicated to each of the target groups. The key functionalities are: • orders and freight, • publication of freight offers for groups of carriers, • automatic publication of offers to selected groups – advanced automation rules, • suggested price ranges for freight offers, • managing cooperation on fixed routes (the so-called contracts), • algorithms that match the carrier to the freight, • transport settlement and invoicing, • freight reports, • Freight Exchange, • order handling and monitoring module, • fleet module (TfC), • new functionalities of the exchange: faster downloading of offers, adding multi-stop and multi-body freight offers.

1	2	3
Application	Support for spot and ad hoc cooperation only. No tools for companies working with groups of subcontractors and on fixed routes.	Examples of tools to support the essential types of cooperation between shippers and carriers, and forwarders are: • fixed routes (contracts), • groups of carriers, • spot (Trans exchange).
Technology	The program is installed on a computer. Each functional change requires a new installation.	The app is available for any device, efficiently developed, and scalable.
User roles and permissions	One authorized user in the company with the highest access and employees with equal access to functionality.	More security and control. Many types of roles for people in the company who have assigned access to specific modules. Configuration tailored to the company's needs.
Automation of user processes	Classic content search engines.	Rules for publishing freight offers, creating groups of trusted companies, SmartMatch algorithm – automatic selection of a carrier or forwarder for freight according to the shipper's criteria, cars' monitoring on the map, and matching loads to them.
Analytics	No analytics or reports for the user.	Extensive report module for all users.
Archiving	Archive of conversations and transactions.	Archive of all activities: added freight, orders, concluded transactions, orders, talks, price negotiations.
Payment	The same subscription for everyone (discount when paying for a year in advance).	Subscription + micropayments for activities on the platform. The shipper or freight forwarder decides which side of the transaction will make the payment.
Stability and speed	High risk of failure and delays in operation.	A modern app, fast, safe, and stable.

Source: internal documentation of Trans.eu.

Unfortunately, the case study does not include data on the number of users and their structure in various cross-sections, including economic and financial data.

These data are related to shaping the company's competitive advantage and are considered sensitive in the surveyed organization.

6.2. Defining the data collection procedure and developing the questions posed in the data collection stage

The data necessary to analyse the profitability of the logistics company's transition from hierarchical solutions, to those using a digital logistics platform, were collected in January-March 2021. The research required:

- analysis of the Trans.eu Platform itself from the user's position, including analysis of available functionalities,
- analysis of the company's internal documents regarding the Trans.eu Platform provided by the management of the surveyed organization,
- interviewing two persons operating the Trans.eu Platform based on the questions presented below.

The basic questions asked in the information-gathering phase, both to the person analysing the documentation and to the respondents attending the interviews, concerned:

- benefits (useful results and costs) of the change achieved by the company joining the Platform,
- benefits (useful results and costs) achieved by the company joining the Platform before the change,
- transaction costs of implementing the change and alternative costs of the change.

6.3. Elaboration of research results

The basis for the analysis of the change benefits, namely to the transition of a logistics company from hierarchical solutions requiring the expansion of its own transport order collection system, to solutions based on a contract – a digital logistics platform of a specialized company – was the analysis of the inequality indicated in the second part of the paper.

The benefits associated with the entry of a company from the TSL sector to the Trans.eu Platform are the effect of comparing the beneficial result achieved thanks to the entry and the costs incurred for this access. The analysis of the information shows that on the side of the useful result , companies entering the Platform expect an increase in the number of contracts resulting from the usability of Platform's base. It is a database much richer in the number of offers compared to the possible effects of an independent search. Anyone with access to the Trans.eu 4.0 Platform can verify documents, history, contact details, employee lists, and opinions about the contractor. When creating documentation, the joining company may use recursive contracts contained in the system, and does not have to bear the costs of developing and negotiating contracts. Entering the Platform also means benefits

related to employees focusing on important matters, and not on documentation issues. Additionally, the modules introduced to the Platform replace systems and tools corresponding to, among other things: marketing, communication, transaction, and documentation support. This is a significant elimination of costs and, above all, gives access to a relatively higher substantive marketing service and a service that uses the economies of scale from the Platform's position. Another positive effect is a specific convergence resulting from adapting faster and more accurately to the changing TSL market. However, the most crucial effect for all companies is the ability to optimize their supply chain by eliminating empty fleet runs. According to Trans.eu data, in August 2019, customers who periodically logged in to the web application accounted for 6% of all Trans.eu subscribers. In August 2020, it was already 59% of all users. Currently, as many as 100% of migrated users of the previous solution periodically use the Platform's functionality, which proves the benefits of such a connection. The benefits of being on the Platform are also evidenced by comments posted by companies from the TSL industry; their analysis confirms the benefits mentioned above.

The user also bears the costs of handling the orders obtained in the Platform's system, thanks to the modules designed to support them, available as part of the only cost of entry to the Trans.eu 4.0 Platform, i.e. a monthly subscription. However, these costs are competitive compared to working without access to the Trans.eu Platform, hence the actual cost is a monthly subscription. A potential cost is also a possible lower level of trust in contracts with companies not so well known so far and acquired through the Platform. The Platform offers the possibility for verification of contractors, communication with them, risk minimization through recursive contracts, it often cooperates with previously unknown business partners. Therefore, there may be a phenomenon of unnecessary opportunism here.

In general, the valuable results achieved by the company entering the Platform (after the change), in the respondents' opinion, exceed the costs of operating on the Trans.eu Platform.

The amount of **benefits achieved before the change** (entering the Trans.eu Platform) is primarily influenced by the quality of the contracts obtained, related to the fact of obtaining them especially from trusted contractors. This is then associated with lower expenditure on tracking contracts and possible conflict resolution. The costs of working without the Platform are mainly: purchase of contract bases, one-off purchases of computer equipment, outlays on marketing, increasing employment costs related to winning contracts, and 'manual' contracts handling. The interviews clearly show that in this case, such dependence may be different. If the company operates on the market without the Platform and shows operating income, it should mean a surplus of the useful result over the operating cost. The key question is whether this benefit exceeds the benefit obtained by the company after the change.

Table 5 presents selected costs that can be reduced by entering the Trans.eu Platform.

Table 5. Costs of entering the Trans.eu Platform by a company from the TSL industry

Costs incurred by a company not using the Trans.eu Platform			Costs of entry and operation on the Trans.eu Platform
Type of purchase	average cost	category in which the given cost fits	
purchase of contractors database	PLN 1 for 1 record	overall contract preparation costs, including information gathering costs	the cost is a monthly subscription of PLN 345
purchase of a TMS license	PLN 399 per month	costs of changing organizational documentation	
purchase of a business phone	about PLN 1230	material costs	
purchase of a printer	from about PLN 200	material costs	
setting up GPS monitoring	from PLN 1 per month	costs of signing the contract and implementing the contract	
conducting marketing activities	from PLN 500 per month	advertising costs	

Source: internal documentation of Trans.eu.

The transaction costs of implementing a change include:

- costs of the decision-making process related to the conclusion of an 'entry' agreement to the Trans.eu Platform (creation of a contract, preparation of regulations excluding harmful legal provisions, contract approval process),
- costs of obtaining the necessary permits in the event of not having them (obtaining a licence for domestic/international transport of goods, a forwarding licence, or a certificate of professional competence),
- costs of the necessary formal and legal activities of the change,
- costs of conducting the necessary employee training,
- costs of internal changes in the connected company resulting from the need to adapt to new operating patterns.

The information obtained from the interviews and the analysis of the information in Table 5 shows that the transaction costs of implementing the change are low and insignificant when considering the benefits of the change itself.

There are also the **alternative costs of the change**. They are related to the potential risk of new solutions in the TSL sector emergence – in the area of contract search, also the emergence of competitive platforms offering new functionalities, further

with dependence on the Platform and the risk of losing one's market sensitivity and the Platform's mismatch with the revolution related to, e.g. autonomous cars. Since the indicated alternative costs apply equally to the entire TSL sector and not to this specific case of using a logistics platform, it can be assumed that they will similarly generate changes in the profitability of each sector entity.

In general, it should be recognized that the study clearly shows the advantage of moving a logistics company from hierarchical solutions to those using a digital logistic platform. This is mainly due to the company's benefit achieved after the change, after entering the Platform. With a low transaction cost and no risks associated with the occurrence of alternative costs, it should be expected that the benefits after the change will outweigh the benefits of the change.

7. Conclusions

The research aimed to check the profitability of the change consisting in the transition of a logistics company from hierarchical solutions requiring the expansion of its own transport order collection system, to solutions based on a contract – a digital logistics platform of a specialized company. The obtained results confirm the advantage of switching from the first set of mentioned circumstances to the second option. The research was conducted for a selected digital logistics platform (the Trans.eu Platform study), hence the results can only be generalized to the level of similar platforms. Despite such a restriction, the study's conclusions show that entering digital technology platforms (DTP), and especially digital logistics platforms (DLP), can realistically increase the profitability of the entering facility, significantly increase revenues, and rationalize the costs of the company concerned, with relatively low costs of the change itself and insignificant alternative costs. The obtained results can be utilized to research further the possibilities of analysing organizational management systems based on the contracting models of the digital logistics platforms.

Digital technology platforms (DTP) are presently in the first phase of development, thus the main reasons for their use and their popularity. Probably, with the technological development of platforms and the managerial and operational processes digitalization, its participants will have other reasons closer to the effects achieved in network management (network effect, convergence, acting within a network of values), but also in complexity management based on the behaviour described by non-linear equations. The platforms provide such an opportunity while indexing an exceptionally large number of records describing the transactions made there.

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