

## THE CONCEPT A LOGISTIC NETWORK ORGANIZATION LVIV-RZESZOW

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**Purpose:** This publication focuses on issues related to logistics management. The aim of this publication is to show the possibility of creating a logistics center within logistic networks.

**Design/methodology/approach:** This publication uses a conceptual method based on observations, sales forecasts and distance analysis of logistics centers.

**Findings:** The analysis of the collected and presented data as part of the concept of creating a logistics center Lviv-Rzeszów shows that such an action is justified, in particular in economic terms. The study shows that the optimization of processes as part of the implementation of the concept would allow for many benefits for the economy and regional development, as well as for the transport and logistics industry itself.

**Research Limitation/implication:** During the study, there were limitations related to obtaining empirical data. The most important implication of the study is the statement that the planned investment will bring significant benefits to entrepreneurs and other market stakeholders.

**Originality/Value of paper:** The publication showed the possibilities of using the new logistics center Lviv-Rzeszów and its impact regional and business development.

**Category of the paper:** Research paper.

**Keywords:** supply chain, process optimization, logistics, industry 4.0.

### 1. Indroduce

Dynamic development of economies, IT, growing competitiveness, e-commers, Industry 4.0. etc. causes the intensification of unfavorable phenomena in land transport. The development of infrastructure, in particular logistic centers, based on the use of intelligent systems, allows to increase the possibilities of operation of all market stakeholders. Logistics activities aimed at optimization of processes and directly incurred costs allow, within the

framework of logistics networks, among other things, to improve the provision of services and increase the level of quality and customer satisfaction.

The aim of the article is to show the possibility of creating a logistics center Lviv-Rzeszów, which, from the point of view of logistics management, will increase the possibilities of product transfer and increase the benefits to market stakeholders.

## 2. Literature review

A major focus of corporate logistics management is the distribution network for goods, which forms the core of the process, offering a high level of service at the lowest cost possible (Rodrigues et al., 2021, p. 525). The decision of where to locate the various supply chain elements is very important, especially in the case of a distribution center (DC), because it is responsible for consolidating and distributing the goods, for regulating the number of vehicles to be used, and for redirecting the goods received from different locations. They also help optimize transportation logistics operations because they redistribute large volumes of cargo based on certain variables, such as distance, load size, and product type, among others (Castañeda Sivincha, 2018). The logistics center performs a connecting function, ensuring the delivery of goods from the sender to the recipient, as well as providing high-quality information support for the goods (Mandra, 2016). The modern logistics center is characterized by the provision of additional transport services: cargo handling, storage in comfortable conditions, forwarding, agency, customs clearance, etc. (Zagorodnia, 2017). The main task of the multifunctional transport and logistics center is to ensure the provision of transport and logistics services for minimum costs for logistics services and logistics infrastructure through cooperation of transport and logistics companies that provide a specialized range of logistics services (Mashkantseva, 2019). Development and implementation of a modern project of a multimodal transport and logistics complex requires a professional approach and use of the principles of project management, theories of systems analysis, business planning and management decisions (Solidor, 2021).

In most of the studies in the hub location mainly focus on two aspects: one is the location and optimization of hub nodes (Alumur, Kara, & Karasan, 2012; Gelareh & Nickel, 2011); the other is the design and optimization of logistics networks (Bowen, 2012; MingJun & Yan-Ling, 2012), it mainly includes a multimodal transport logistics network (Meng & Wang, 2011), postal logistics network (Lee & Moon, 2014), and port logistics network (Dai, Yang, & Li, 2018; Nguyen & Zhang, 2017). However, there is very little research on mixed central logistics networks. Most research on the focal logistics network is qualitative research and very few studies use mathematical models to study the selection of central nodes. A complex logistics network is considered resilient when it can maintain a near-peak performance while facing

disruptions. The network complexity stems from the size of the logistics arm and the intensity in which it coordinates with its partners while disruptions caused by the demand side is dependent on the performance of the e-commerce player. Supply chain management covers numerous processes and operations that transform raw materials into products and distribute them through retail sales. Consequently, the supply chain involves numerous parties, including suppliers, manufacturers, distributors, retailers, and customers, to improve coordination and collaboration between the parts of the chain (Christopher, 2016). In the transportation sector, there is a robust location-routing approach that considers simultaneous decisions on vehicle routes and the location of loading stations to design strategic networks of logistics fleets. To this effect, (Schiffer, and Walter, 2018, pp. 31-42) assess the problem with different levels of uncertainty by creating an algorithm; based on the results, they analyze the benefits of a robust planning approach regarding operational feasibility and overall costs savings for the planning problem. Organizational networks make it possible to join forces in joint initiatives and innovation activities, to use various unique skills as well as the creation of specialized configurations of competencies spread across multiple organizations participating in the network. They are supported by information technologies, especially the Internet, changing the relationship between organizations and their partners. These phenomena lead to new business models based on networks between organizations, including alliances and partnerships, among others. It has become common knowledge that the arising digital technologies could improve the efficiency of the operations of supply chains (SCs) worldwide (Govindan et al., 2018; Dubey et al., 2019). Both academia and practitioners have widely reported the potential benefits of the integration of digital technologies and SC management (Kamble et al., 2020). Implementing these novel technologies can help SCs to perform more efficiently (Chiappetta Jabbour et al., 2020). The operations and SC management could be restructured through Industry 4.0 (I4.0), named after the 4th industrial revolution. The name refers to the prevailing trend of exchange of data and automation in manufacturing technologies, like the Internet of Things (IoT), cyber-physical systems, and cloud computing, which could lead to forming smart factories (Govindan et al., 2018; Koot et al., 2021). There are the following problems in creating logistics networks (Table 1).

**Table 1.**  
*Selected problems of creating a logistic supply network*

No.	Information on challenges	
	category	description
1.	Financial constraints (Theorin et al., 2017; Ghadge et al., 2020)	Financial restraints are considered a significant challenge among organizations that intend to develop their abilities regarding advanced machines and equipment, and sustainable process innovations in I4.0
2.	Meagre digital operations vision and strategy (Erol et al., 2016; Saatçioğlu et al., 2019)	The digital transformation of organizations is a significant part of I4.0 adoption, which is achieved with the help of a clear digital operations vision and mission. The vision and strategy for adopting I4.0 should be specified before the start of the transportation process. Developing an SSC requires an efficient transformation of the visionary ideas of I4.0 to a missionary level, which is struggling for organizations

Cont. table 1.

3.	Lack of competency to adopt/implement new business models (Khan et al., 2017; Saucedo-Martínez et al., 2018)	Flexibility and customised systems are the requirements of competing in the global environment for contemporary industrial systems. Industries and organizations require the adoption of new business models to reach these goals. The analytics of big data from industries boosted the productivity of manufacturers. A solid base for planning new projects was presented due to predictions of new events based on big data. All the novel insights will not be functional, and just some cases are interesting out of millions. Hence exploring them would be challenging for data scientists to develop proper algorithms addressing novel business models
4.	Problem in integration of technology platforms (Zhou et al., 2016; Gajšek and Sternad, 2020)	The integration of technology platforms is a critical step toward efficient productivity and communication. Industries face challenges in outlining a flexible interface for integrating independent elements. I4.0 systems have many distinct parts that should be connected and supported for efficient analysis and data transfer. Hence, it is essential to develop and devise a platform for integrating technologies and efficient I4.0 driven SSC.
5.	Legal matters (Müller et al., 2017; Karabegović et al., 2020)	I4.0 works with real-time exchange of data between a networks of robots, computers, sensors, and humans interlinked to each other within the internet. The operation of this network might cause some intricate legal matters. Adoption of I4.0 in a sustainable environment should be secured regarding legal issues in the operations of organizations
6.	Lack of governmental policies and support (Raut et al., 2019)	Governmental policies and regulations are critical for developing an SSC through I4.0. There is a lack of clear governmental guidelines and regulations on I4.0 in most developing countries. Moreover, governments are uncertain of the probable outcomes of I4.0. As a result, government parties and policy analysts have not unveiled the roadmap to reach smarter and more sustainable business functions.
7.	Problem of coordination and collaboration (Pfohl et al., 2017; Luthra et al., 2020)	Collaboration and transparency between members of an SC are essential for understanding the organizational policies of adopting I4.0 and enhancing sustainability. Facilities should have efficient coordination and collaboration with each other for more reliable interaction. Their communications should have high adaptability issues of software and hardware, standardized interfaces, and synchronized data for practical synchronization
8.	Security concerns (Wang et al., 2016; da Silva and Barriga, 2020)	One of the I4.0 traits is creating a connection across manufacturing environments and making SCs more productive and, conversely, making the SC vulnerable to intruders. One of these vulnerable places is the supplier, which can be attacked by phishing intrusions and stealing privileged credentials, causing a vast data leak. The primary vulnerability of an SC is at its top, causing an exposure in other processes through their interactive elements. Security is the principal requisite for transforming a company or SC into a smarter one.

Due to COVID-19 and war in Ukraine related restrictions, there have been many more disruptions, such as the break of network connectivity with lockdowns and entry restriction policy. Creating international hubs and logistics networks will allow for better movement of goods.

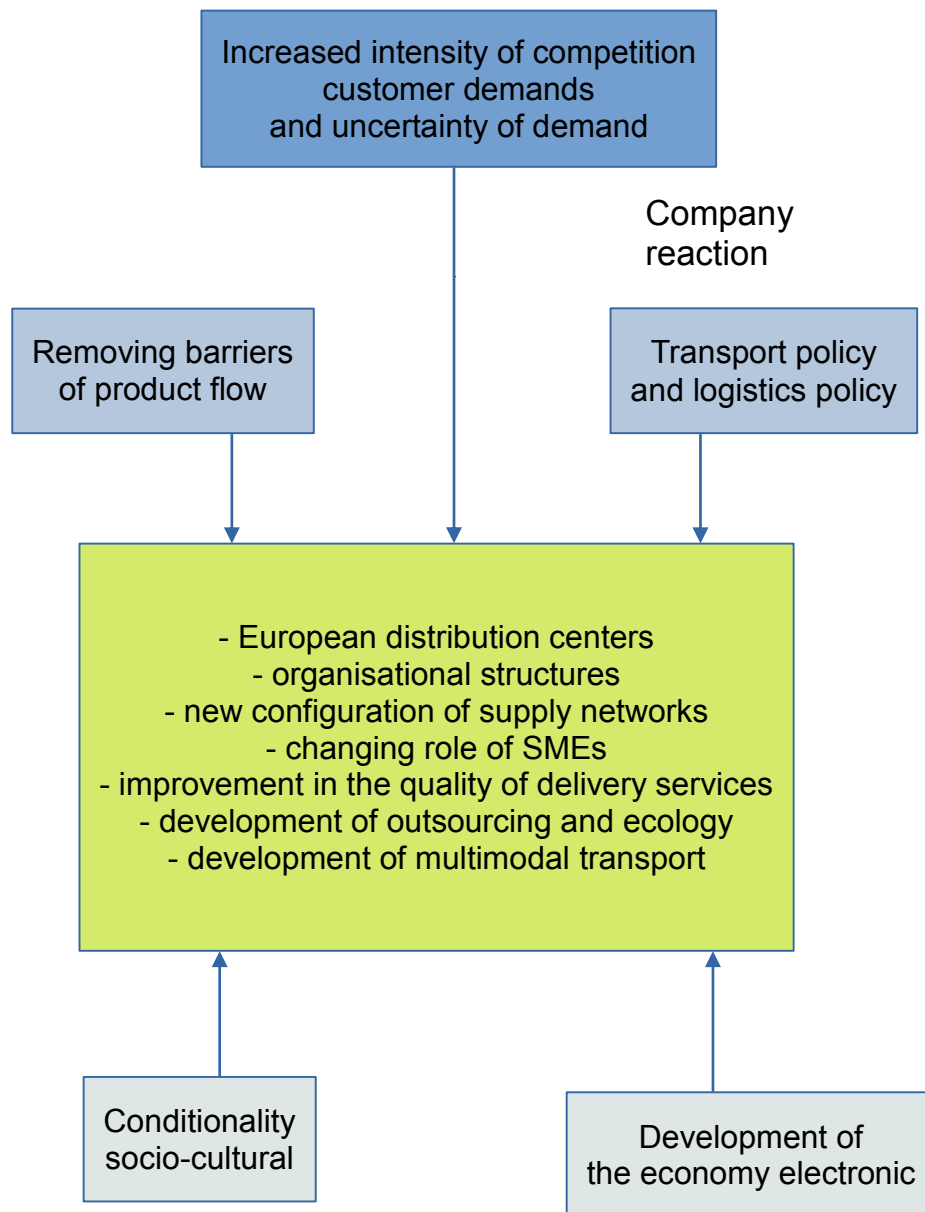
### **3. Methodology**

International logistics networks possess complex structure due to the size of stakeholders, infrastructures and the intermediary processes. A number of stakeholders and their transporting/warehousing departments are involved with the support of the transportation infrastructures and freight terminal, such as the railway, highway, warehouse and distribution centre. All the transiting facilities and terminal can be treated as nodes in the international logistics network, and the material flow between the nodes can be treated as edges. The design of regular hierarchical logistics networks with regard to the organization of The design of regular hierarchical logistics networks for the organization of logistics centers The design of regular hierarchical logistics networks for the organization of logistics centers is determined by the way in which the logistics service demand of the individual customers in the area is met. This means that it is necessary to identify not only the sources and outlets of demand for logistics services in a given network, but also the intermediate nodes of this network, which are the logistics centers where the cargo streams and related information streams are transformed.

Thus, the entire distribution process may involve multiple intermediaries, depending on the nature and complexity of the services provided. To define a multi-level system in order to define a multi-level distribution system, it is necessary to determine the sources of In order to define a multi-level distribution system, it is necessary to determine the intermediate recipients and suppliers and final recipients of services.

### **4. Case study: Lviv-Rzeszow**

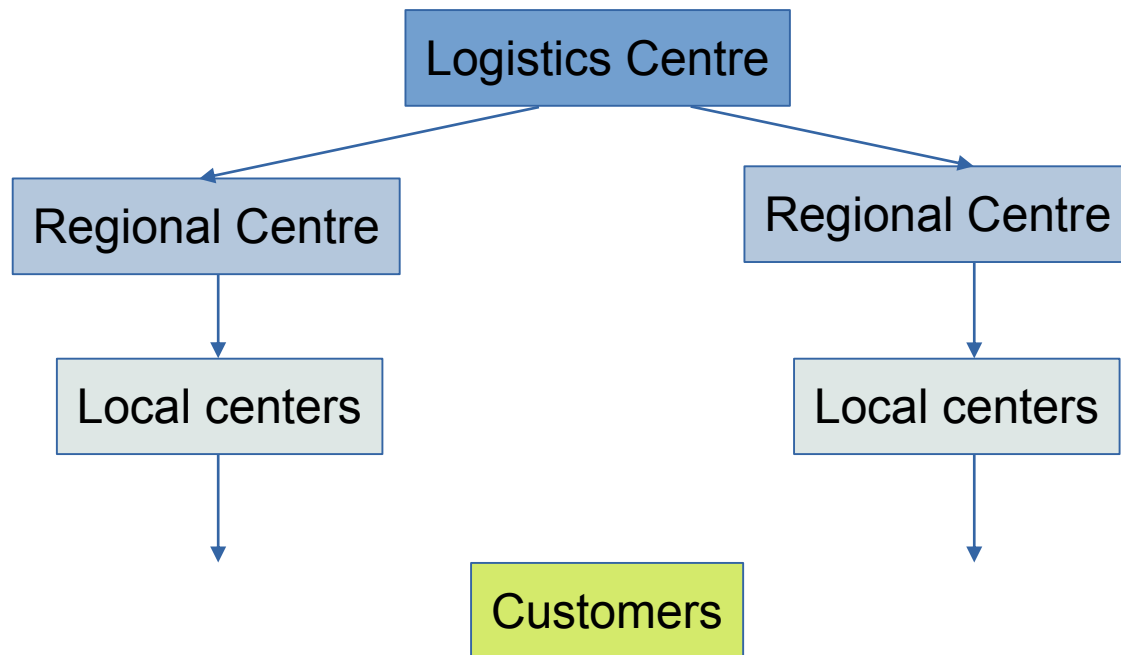
Designing logistic networks of enterprises is a complex decision-making problem. It results from the need to take into account both the specificity of enterprises' operations and the functional and spatial shape of storage facilities that are the elements of the designed network. The designed structure of logistic network influences the reduction of costs of material supplies delivery to enterprises or distribution of finished goods to customers. Main determinants and directions of development of the supply network of European enterprises (Figure 1).



**Figure 1.** Main determinants and directions of development of the supply network of European enterprises. Source: Authors' own materials.

The government has the task of separating the units responsible for logistics and management in the supply network in the organizational structures of the given network of enterprises and the origin of national and international structures managing processes between contractors to European structures.

There are two models: centralized and decentralized. For the needs of the distribution network Lviv-Rzeszow a decentralized model is proposed, where standard products are mass produced and then distributed using warehouses / distribution centers and intermediaries – maintaining stocks: to the final customers.



**Figure 2.** A model of a decentralized logistics network. Source: Authors' own materials.

The logistics center (CL) is identified in Medyka, as a location on the border. In this case the location of the railroad crossing is important. Regional centers (RC) are located in Rzeszow and Lviv. Table 2 identifies the distances from regional centers (RL) to local centers (LC).

**Table 2.**

*The distances from regional centers (RC) to local centers (LC)*

No.	Distances from RC (km)	
	RC-Rzeszow	RC-Lviv
1.	Krosno – 60 km	Drohobycz – 78 km
2.	Przemysl – 92 km	Czervonohrad – 72 km
3.	Tarnow – 87 km	Stryi – 72 km
4.	Tarnobrzeg – 75 km	Boryslav – 90 km
5.	Nowy Sacz – 148 km	Ivano-Frankivsk – 133 km

The selected local centers (LC) are evenly distributed in terms of distance, except for the intentionally selected ones in Nowy Sacz and Ivano-Frankivsk, which act as an integrator with other regional centers (RC). Table 3 presents the potentials of selected local centers (LCs).

**Table 3.**

*Industry of which manufacturing: the potential of local centers (LC) in 2018*

No.	Manufacturing company of the area LC	
	RC-Rzeszow – 5530	RC-Lviv – 10998
1.	Krosno – 3849	Drohobycz – 539
2.	Przemysl – 2196	Czervonohrad – 365
3.	Tarnow – 3654	Stryi – 339
4.	Tarnobrzeg – 5124	Boryslav – 195
5.	Nowy Sacz – 4057	Ivano-Frankivsk – 3893

Source: Authors' own materials based on statistical data (GUS, 2019; UKRSTAT, 2019).

The total number of entities in the industry as of 2020 in Podkarpackie voivodship is 16 696-49 764,2 sold in mln PLN. Regional center (RC) in Rzeszow would serve 24 410 manufacturing enterprises. Regional center (RC) in Lviv would serve 16 329 enterprises.

The main logistics center should solve the problem of strategic management of cargo flows in the directions and transport corridors, promptly coordinating the activities of regional logistics centers in cooperation with the central governing bodies of various modes of transport and the international logistics system. Regional logistics centers are responsible for operational management within their region in cooperation with adjacent local logistics centers.

The creation of the proposed logistics center will provide the following results:

- a significant increase in direct investment in the real sector of the economy, which will ensure the dynamic economic development of the region,
- increase in production of competitive goods,
- creation of new jobs, which will significantly increase the standard of living and social protection of the region's residents and reduce social tensions in it,
- introduction of modern technologies in the field of road construction,
- meeting consumer demand through the provision of quality logistics services
- increase in tax and social revenues to the budgets of all levels.

The potential analysis presented in the study suggests the possibility of a logistics center (LC) on the Polish-Ukrainian border in Medyka at the railroad crossing as the main mode of transport. Due to the high potential on the Ukrainian side the regional center (RC) in Rzeszow will at the same time be an intermediate logistic hub for the whole Poland. Regional Center (RC) in Lviv will act as logistic node for Medyka (LC) - Rzeszow(RC) and Poland as well as for western part of Ukraine.

## 5. Summary

The presented article is the basis for considering the necessity to modify and develop network logistics infrastructure. They confirm the necessity to use modern ICT solutions that allow to increase the attractiveness of both logistics and production companies. Optimizing logistics processes, among others thanks to the creation of a conceptual logistics center Lviv-Rzeszow, would bring significant benefits for entrepreneurs and other market stakeholders. This will be especially visible in production companies that have to build operating strategies based on processes, in particular logistics processes that must be repeatable.



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