Intensifying Cross-border Logistics Collaboration Opportunities Using a Virtual Logistics Center

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Authors’ contributions
This work was carried out in collaboration among all authors. Author PT elaborated the operational concept of the VLC. Author BI finalized the concept of the VLC. Author UA formulated the possible advantages of the VLC. Author TB clarified and finalized the range of services. Author ABT examined and specified the operation mechanism of basic services. All authors read and approved the final manuscript.

Article Information
DOI: 10.9734/JERR/2020/v13i317100
Editors:
(1) Dr. Tian-Quan Yun, South China University of Technology, China.
(2) Ali Shakir Mahmood, Mustansiriyah University, Iraq.
(1) Ali Shakir Mahmood, Mustansiriyah University, Iraq.
(2) Nurul Farihan Mohamed, Universiti Sains Islam Malaysia, Malaysia.
Complete Peer review History: http://www.sdiarticle4.com/review-history/57947

Received 28 March 2020
Accepted 04 June 2020
Published 09 June 2020

ABSTRACT
There are a number of untapped opportunities for cross-border logistics cooperation, one of which is the operation of virtual logistics centers. The Institute of Logistics of the University of Miskolc researched the possibilities of establishing and operating Virtual Logistics Centers in many fields (e.g. automotive industry, maintenance systems, etc.). The paper describes a proposed concept for the operation of virtual logistics centers for cross-border cooperation, as well as explores the possible benefits of the application. The proposed concept can provide a good basis for the development of a virtual logistics center in the border regions of Miskolc (Hungary) - Košice (Slovakia), and also in the border regions of Bishkek (Kyrgyzstan) - Almaty (Kazakhstan).

Keywords: Cross-border cooperation; logistics service; virtual logistics center; process improvement; competitiveness.

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1. INTRODUCTION

As a result of the spread of digitalization, the creation of virtual logistics centers (VLCs) in order to improve the competitiveness of cross-border small and medium-sized enterprises (SMEs) is becoming increasingly important [1,2]. By tracking logistics objects and recording the needs of service users and providers, new logistics services that do not yet exist can be created [3]. In the dissertation we have developed the concept of a VLC that can provide a number of logistics services using a so-called Web interface. By using these services, it may be possible for SMEs in the studied regions to reduce logistics costs and / or increase the quality of logistics services. In our experience, when designing a VLC, we need to think in several time horizons and define a development concept.

Needless to say, the concept of using e-commerce and “virtual value chains” for the organization of logistics and other activities has been a major topic since at least two decades by now, thanks to the widespread adoption of the Internet and the World Wide Web starting from the early 1990s [4]. Of course, electronic marketplaces were naturally one of the first embodiments of this concept and by the late 1990s, they were already established in multiple areas of the industry [5], resulting in an especially significant influence on supply-chain management [6]. The latter impact was so large that by today, it is evident that e-commerce became a fundamental part of the economy, giving rise to various well-developed and very successful e-commerce based logistics models [7].

In parallel to the emergence of e-marketplaces, the concept of the virtual enterprise was also developed. The difference between the two models is that the e-marketplace mainly focuses on connecting the supply side with the demand side. On the other hand, according to [8], “the virtual enterprise is based on the ability to create temporary co-operations and to realize the value of a short business opportunity that the partners cannot (or can, but only to lesser extent) capture on their own." Of course, it is not uncommon that e-marketplaces play an important role in the implementation of virtual enterprises [9,10]. However, an e-marketplace alone is rarely designated as a virtual enterprise.

Today, we can see various examples for the implementation of virtual enterprises in the different fields of logistics [11,12,13]. However, one area that is not yet examined according to our knowledge is the implementation of a virtual enterprise for the exact purpose of intensifying cross-border logistics collaboration. On the other hand, this type of application can be important in multiple regions of the world where a regional logistics ecosystem can span over multiple states, such as in the case of Central-Eastern Europe or Central Asia. For this reason, our concept provides a model of implementation specifically designed for the previously defined purpose.

Regarding the concept we have developed, it is recommended to formulate short-term (1-3 years) and long-term (3-year) development objectives:

- With regard to the short-term goal, the basic task of the VLC is to be able to provide demand for logistics services on the part of production and service companies and price offers on the web interface in a predefined way (for basic logistics services such as transport, warehousing). In addition, the system should be able to provide a quality assessment of the services already provided. This makes it possible to compare the received offers according to cost and service level (based on the quality indicators of previously performed tasks), as well as to select the appropriate logistics service provider. The selection of the service provider is not based on automatisms, but on the client. This web service is mostly considered to be an electronic marketplace service [14,15].

- With regard to the long-term goal, the tasks of the VLC will be supplemented in such a way that, if necessary, the optimized allocation of available service needs and free logistics resources will be realized (preferred areas: transportation, warehousing). By implementing the binding in this way, for example more efficient vehicle utilization, more efficient warehouse utilization, etc. can be realized which can further increase the competitiveness of SMEs in the designated region. Furthermore, the task of the VLC should also be the implementation of specific functions such as lean process development [16], quality management [17], financial and other consultancy opportunities for SMEs in the designated region.
2. THE FUNCTION OF THE VIRTUAL LOGISTICS CENTER

According to our concept, VLC’s web-based software will only be available to production and service companies that require logistics services located within the designated region. It should be noted, however, that the application will be available to any logistics service provider, thus ensuring increased competition between service providers. In the developed model, the research and development institutions, the VLC, and the companies using the application together form a Virtual Logistics Company [3,1].

The role of these actors (see Fig. 1) is to:

- The task of the research and development institutions is to continuously develop the knowledge base of the VLC.
- The task of the virtual logistics center is to allow / refuse the connection of SMEs, to maintain their data, to operate the web-based system to be created, to formulate development needs for the development center, to carry out marketing activities and to perform the financial and management tasks of the Virtual Logistics Company.
- The companies joining the Virtual Logistics Company can basically use the required services on a web interface after filling in the user and data protection statement and concluding the service contract.

3. SERVICES OF THE VIRTUÁL LOGISTICS CENTER

The range of services to be provided by the VLC can be divided into two groups, basic and additional services [3].

Basic services are used to facilitate transactions between sellers and buyers in the field of basic logistics services, like transport and warehousing (can be called as an electronic marketplace service). These services can be implemented in the short term in a time horizon of 1-3 years.

VLC’s additional services are aimed at satisfying more complex logistics system optimization as well as special service needs (primary goal: to achieve the benefits available to large companies, i.e. the benefits of economies of scale for SMEs). This type of service involves a development, testing and implementation process of at least 3 years.

![Fig. 1. Participants of the Virtual Logistics Company (Made by Péter Tamás)](image-url)
Recommended basic services which can be sold in the framework of an electronic marketplace service are transport and warehousing. Suggested additional services:

- Joint procurement of materials and components for several SMEs,
- Optimized demand-resource allocation in the field of transport and storage,
- Marketing activities,
- Process development consulting.

4. OPERATING MECHANISM OF THE BASIC SERVICES OF THE VIRTUAL LOGISTICS CENTER

An application that also includes the business logic of the VLC should be designed according to the client-server concept. Thus, partners joining the VLC can use the services in a web interface. It is necessary to develop a server program (application), which must be installed on a central computer, the task of which must be to ensure the displayability and maintainability of the data required for the use of the services provided by the VLC. According to the VLC’s short-term development concept, the basic task of this application is to provide an interface where the needs for and prices for logistics services can be specified as required, and the appropriate service providers for the price and registered quality indicators (data obtained by evaluating performed logistics tasks) can be selected. The steps required to perform this task are described below [3].

4.1 Registration, Contracting

As a first step, companies requesting / providing logistics services must register on a web interface and then approve the data protection and operational regulations sent by the system operator. This is followed by the conclusion of a service contract, which includes, as more important information, the requested service, its remuneration and the possible duration of use. Finally, a username and password will be sent (e-mail) to use the service.

4.2 Login

By entering the received username and password (on the web interface), the functions specified in the service contract can be used.

4.3 Selection of the Logistics Service(S) to Be Performed

From the services required in the contract, the user must select the logistics service he needs in the client program.

4.4 Formulation of the Task to Be Performed

If the user requesting the service wants to look for a logistics service provider to perform his tasks, he can formulate the task to be performed by filling in a predefined electronic form.

4.5 Defining the Range of Logistics Service Providers

After defining the logistics task to be performed, the person requesting the service must select the
range of logistics service providers from whom he would like to request a price offer.

4.6 Sending a Request for Quotation

After defining the task to be performed and selecting the range of logistics service providers, the service requests will be “sent” to the designated logistics service providers.

4.7 View Tasks that can be Performed

Logistics providers can view the “needs to be met” logistics needs sent to them.

4.8 Compilation of Quotations

The logistics service provider can prepare a quotation for the incoming needs by filling in a single electronic form for each service.

4.9 Sending a Price Offer to the Customer

The compiled offer will be sent to the customer.

4.10 Evaluation of the Tender(s)

In selecting the tenders received from the logistics service provider(s), in addition to the price, qualitative information can also be taken into account by means of a module for this purpose. The module contains quality information on logistics service providers based on the qualification of their previously performed tasks (these data are recorded by the customers served).

4.11 Selection of the Logistics Provider

After the evaluation of the tenders, the applicant selects the logistics provider who offers the most suitable tender.

4.12 Contacting, Making Consultations

The contracting company will discuss any issues related to the performance with the selected logistics service provider via the e-mail address or telephone number available for the received offer.

4.13 Selection of the Next Logistics Provider

In the event that a problem arises during the negotiations, as a result of which it is not possible to complete the task (e.g. liquidation of a carrier company, disagreement on details, etc.), negotiations can begin with the next most suitable bidder.

4.14 Execution of Activity

After the consultation, the logistics service company performs the undertaken logistics activity.

4.15 Invoicing

The logistics service provider sends an invoice to the ordering company after the performance of the undertaken service.

4.16 Payment for the Service

The client company pays for the service provided.

4.17 Evaluation of the Logistics Service Provider

One of the modules of the developed software provides an opportunity to evaluate the performed service. This data will help you to choose your logistics provider later on.

5. BENEFITS OF CREATING A VIRTUAL LOGISTICS CENTER

The benefits of the VLC to be set up can be divided into two parts, i.e. the benefits of basic services and ancillary services.

5.1 Benefits of Basic Services [3]

- Those who require a logistics service can choose from more offers than before, which can reduce logistics costs for SMEs in the selected region.

- Those requesting the logistics service can query the quality indicators of the previously performed tasks of the logistics service providers (service users can record this data), on the basis of which the quality aspects can also be taken into account when selecting the service provider. This can help increase the quality of logistics tasks in the designated Euroregion.

- The economic integration of designated border areas can be strengthened by
allowing those requiring logistics services to choose from the offers of logistics providers on both sides of the border.

- Data generated using the Virtual Logistics Company application can be used:
  - to develop the knowledge base related to virtual companies and clusters,
  - to analyze the logistical conditions of a designated region,
  - to prove the existence of a system of logistical conditions for industrial investments.

### 5.2 Benefits of Additional Services

- Several SMEs can procure the raw materials and components necessary for their operation together, thus reducing the specific costs of procurement.

- The assignment of transport and warehousing tasks to logistics resources, which arise in several SMEs, can be examined together according to defined objective functions, so the advantages arising from economies of scale can be exploited.

- With the help of the high-quality financial, interpreting, marketing, security management and legal advice to be provided by the VLC - specified in the field of logistics the competitiveness of companies in the region can increase.

### 6. CONCLUSION

The publication highlights the possibilities of cross-border logistics cooperation that can be established with the implementation of VLCs. The short- and long-term development concept of a VLC design was outlined. Among the services to be created, the operating mechanisms of the basic services are also described in detail. With the implementation of the presented concept, an additional logistics service can be made available to the companies of a selected region, which can significantly increase their competitiveness by reducing logistics costs and/or increasing the quality of logistics services. The unique nature of the paper is shown by the fact that the concept of the presented virtual logistics center is between the regions of different countries seeks to achieve economic cooperation through more efficient use of logistics resources.

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### ACKNOWLEDGEMENTS

The research was carried out as part of the Erasmus+CBHE 585967-EPP-1-2017-1-DE-EPPKA-CBHE-JP-PRODLOG project entitled “Development of a Bologna-based Master Curriculum in Resource Efficient Production Logistics/ProdLog”.

The research reported here was carried out as part of the EFOP-3.6.1-16-2016-00011 Younger and Renewing University –Innovative Knowledge City –Institutional development for the University of Miskolc aiming at intelligent specialization” project implemented in the framework of the Széchenyi 2020 program. The realization of this project is supported by the European Union, co-financed by the European Social Fund.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

### REFERENCES


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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/57947