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# E-LOGISTICS AND M-LOGISTICS IN INFORMATION ECONOMY

Volodymyr I. Skitsko

Kyiv National Economic University named after Vadym Hetman, Kyiv, **Ukraine**

**ABSTRACT**. **Background:** The purpose of this article is to study the concepts of electronic and mobile logistics as components of the information economy within which the effective management of relevant information flows can be performed today.
**Materials:** The article is based on the available recent scientific-theoretical and professional practical research and publications. Introduction to these studies and publications allowed to conclude the diversity, importance and relevance of the proposed in this work problem and the existence of the understudied aspects.
**Results:** This article proposes author definition of m-logistics as part of an information logistics, describes the aspects of its functioning and demonstrates its place in information economy.
**Conclusion**: This work may be a starting point for further research in the field of e-logistics and m-logistics. For example, there is a need for the development and introduction of modern economic and mathematical methods and models by which the effective information management in modern business environment can be performed.

**Key words:** e-logistics, m-logistics, information flow, information economy.

## INTRODUCTION

Today's global economy is called post-industrial or information, in particular due to its turning from simple data about something into full-value product which can bring additional revenue to the company (firm). Information economy is a type of economy where productivity and competitiveness of economic agents depend largely on their ability to generate, manage and effectively use the information based on knowledge [Malyk 2013]. The basis for the information economy can be considered information and communication technologies and tools, rapid development and availability of which led to the emergence of electronic (or digital) economy, in the context of which electronic business (or e-business) operates.

E-business includes: e-commerce, e-advertising, e-marketing, electronic banking, electronic auctions etc. In these types of business activity the adjective "electronic" indicates that these activities are carried out strictly in electronic (digital) form using the Internet, mobile connection etc. Previously, sites of enterprises (companies) were similar to business cards where one could read, for example, the history of the company, its management, contacts, activities, list of products which the company produced and sold. In site development more attention was paid to its design than to functional content. Today the websites of the companies in the sphere of e-business are much more complex, where the consumer can perform a number of actions without resorting to the company employees' assistance. For example, the consumer can fully independently order the products and pay for them on the company site

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with the help of Internet-banking - carry out a number of banking transactions without visiting the bank, etc.

Each year, mobile communication devices are becoming more powerful, which predetermines the use of complex software applications. As a result, the line between PC (laptop) and mobile device is erased - in particular, on a tablet (or smartphone) one can work with e-mail, take photos and videos, read and edit documents, create drawings, business presentations, etc. In addition, continuous improvement and development of mobile communication technologies allows one to be constantly connected to the Internet at high speed sufficient for performing actions described above. In this case we can talk about the mobile business (m-business), which includes m-commerce, m-banking etc.

The use of innovative devices and technologies in the analysis, processing, transmission of information facilitates simplification, accelerating and reducing the cost of traditional business processes. However, relevant remains the problem of information management the essence of which lies in active providing of full and reliable information in the right place at minimum cost for its receiving with the aim of taking the relevant sufficient decisions by the consumer or company management. When the company cooperates with partners (customers, suppliers, carriers, banks and others), between them there is an exchange of information, which is organized in the form of the respective flows. Managing such flows belongs to the sphere of logistics within which electronic and mobile logistics can be isolated.

The concepts of e-logistics and m-logistics are quite new. A great number of works of scientists and specialists are devoted to various aspects of functioning of e-logistics. But there are no systematic investigations about m-logistics. Therefore, there is a need to fill this gap.

## INFORMATION, ELECTRONIC AND MOBILE LOGISTICS: GENERAL ASPECTS OF FUNCTIONING

In "traditional" logistics the main is the material flow, others are accompanying it. According to the nature of information economy not only goods can be profitable, but also information. That is why, in our view, on the one hand we can talk about implementation of information as a good with material flow. On the other hand we can talk about the dyad of material and information flows which complement each other and become the main flows in the context of the information economy.

Material flow management is carried out within various types of logistics: purchasing, warehousing, marketing etc. And information flow management is made within information logistics. There are different interpretations of information logistics, after examination of which the following conclusion can be drawn. Some authors refer to the sphere of influence of information logistics only information systems of the company and everything connected with their functioning, others - managing information (information flows accompanying material flows). Let us assume that the information logistics of the company is a subsystem of the company management that organizes information flows affecting the results of the company logistics operations [Skitsko 2014].

Information logistics occurred before the information economy, not alongside with it. Information logistics appeared together with the concept of logistics, because the need for information support of processes in moving the material flow has always existed. In our opinion, now information logistics is one of the main types of logistics and perhaps the main one. In particular, due to the fact that with the development of information and communication tools and technologies and increasing importance of information there are constant changes in information logistics to a greater extent than in other types of logistics. And these changes predetermine changes in other traditional forms of logistics (e.g. purchase, storage, sale, etc.) and the emergence of new types of logistics. With

the development of internet and spread of the use of electronic presentation of information within information logistics e-logistics occurred.

Now there is no universally accepted (defined by regulatory documents) definition of e-logistics notion. Various scientists offer their own definition in their research practices. However, the common feature of these definitions is that almost in all of them the word "Internet" can be found. In particular, e-logistics is called Internet-Enabled Logistics [Gunasekaran, Ngai, Cheng 2007]. However, the use of the Internet itself in logistics processes does not mean that logistics becomes electronic. E-logistics is essentially a complex entity (system), which includes manufacturers (distributors), logistics centers, resellers, carriers, consumers among which there is an electronic exchange of data via the Internet with the help of mobile (wireless) and wired communication technologies with the aim to, in particular, reduce data errors, improve efficiency in decision-making and more.

Electronic logistics (e-logistics) is a management subsystem for forecasting, planning, decision making, coordination and control of electronic information flows through information and communication systems and technologies with application of mathematical methods and models (in agreement with material, service, financial flows and the flow of intellectual manpower) at the macro-, meso-, microeconomic levels [Skitsko 2014].

To the functions of e-logistics we can refer, in particular, the following [Skitsko 2014]:

- formation of information environment in which interact the participants of the logistics chain of goods supply;
- definition of characteristics of electronic information flows;
- formation of requirements and needs to the companies which provide information and communication services and corresponding connection;
- organization of the use of international standards of products identification;
- maintenance of correct and reliable operation, development of information system of the company;
- collection, analysis, storage, transformation and organization of information transfer in electronic form;
- selection of the necessary data for management decision making.

Methodical basis of electronic logistics is its international standards, development of which is currently carried out in the following areas [Bukreev, 2006, Barcik, Jakubiec, 2012]: barcoding of products; Electronic Data Interchange - EDI; Global Data Synchronization Network - GDSN; Electronic Product Code - EPC. In addition, it is necessary to maintain and develop (constantly update) hardware and software of electronic logistics system participants in order to improve their competitiveness by improving quality of service and reduce the cost of logistics processes etc.

Mobile tools and technology are innovations the use of which on one side has become commonplace in business and everyday life, on the other hand - they are constantly evolving, requiring corresponding changes in building business processes, new knowledge and skills of people, hardware and software upgrade and so on. Today people use smartphones or tablets not only for communication (mobile connection, email, social networks, etc.), entertainment (online games, television, etc.) and receiving information available on the Internet, but also for buying goods in online stores or through auctions, ordering and purchasing air, train or bus tickets, tickets to concerts or theater, performing banking operations and more. The penetration of mobile devices and technologies in business processes and everyday life of people will only increase each year. In particular, in press release [World's largest online…, June 08, 2015] showed a clear dependence of the increase of online purchases on increasing the spread of smartphones and tablets. Besides, today in Britain 59% of online purchases are made through mobile devices, in the US - 45%, in Germany - 24% [World's largest online…, June 08, 2015].

The development of online trading leads to the development of other areas, including logistics, banking, and so on. As an example, let us consider the development of cooperation

of express delivery and its clients. Previously, the sender and recipient could learn about the movement of the parcels only by telephone. Later the companies began offering the service of SMS notification as for location of the parcel on its way to final destination. Then there appeared the opportunity to track the parcel by its unique number on the company site. Only computer (a laptop) and Internet connection were needed for this. Then the connection was only wired. Now there is opportunity to track the parcel in a mobile app which is installed on a smartphone or tablet with the use of wireless mobile technology. The use of such innovations predetermines the following: the communication of logistics services consumer (recipient of the parcel) and the company staff is minimized; comprehensive and timely information as for the parcel location allows the recipient to plan their daily schedule more rationally etc. In addition, information asymmetry in the processes of delivery is reduced due to the opportunity of almost equal access to information by all participants of the logistic chain.

Wide spread of mobile devices and technologies requires accurate information flows management. Such management can be carried out within the e-logistics, but according to the modern trends of technologies development it would be more appropriate to talk about the emergence of the concept of mobile logistics.

In our opinion, m-logistics is a subsystem of e-logistics as for forecasting, planning, decision making, coordination and control of electronic information flows that occur and are formed with the use of mobile devices (smartphones, tablets, etc.). On a mobile device one can work with information via SMS, special mobile application and / or using optimized "traditional" (full) website.

Special mobile application requires its installation on user's device. It should also be easy and simple, should not require many actions from the consumer for getting the necessary information, use the least possible RAM volume (this affects the speed of both the application and the mobile device as a whole). Mobile apps actually replace the common website providing additional functions unavailable from the computer or laptop. For example, the mobile application can store the barcode of the loyalty card, so the customer does not have to carry a number of plastic cards - he only needs to launch the app on a smartphone. On the other hand it is not necessary to create a mobile application the development of which may be very expensive. It is enough to optimize the common web site for work on a mobile device, which primarily lies in simplification of visual presentation of information (pictures, videos, additional effects and features, etc.). The requirements to mobile applications can be applied to a simplified version of the web site.

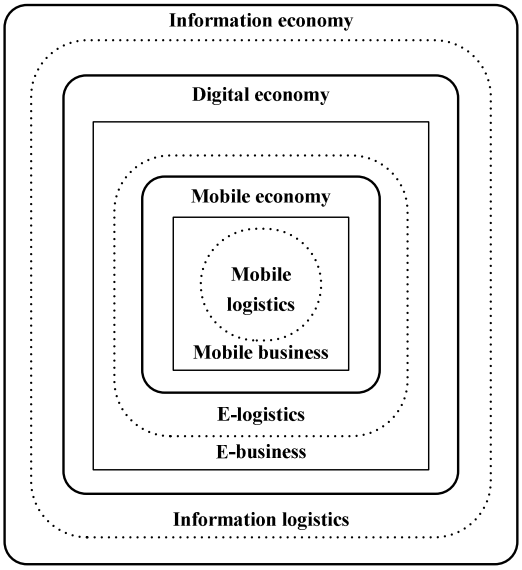
Methodical basis for mobile logistics can be methodological basis of electronic logistics (see above), where the main place is occupied by bar coding and electronic data exchange. Currently when purchasing electronic tickets to the cinema or theater a consumer receives a unique linear bar code that is read at the entrance to the hall with special devices from smartphone or tablet screen. Besides, transport tickets can contain two-dimensional bar code, which is also read from device screen. In these cases, there is no need to print tickets. In our view, barcoding any information through mobile applications is quite prospective. For example, while making order in a mobile internet-store the client may get a corresponding bar code of the order so not to remember the information about the order needed while receiving the goods at pickup point or automated parcel terminal. The client may just provide the bar code (which will be scanned by a special device) for confirmation. In addition, such coding should reduce the number of possible errors in the data exchange and time of receiving the order.

In our opinion, the mobile logistics should perform the following functions:

- to facilitate the forming of general information environment in which interact the participants of the logistics system with the aim of receiving information in any part of Earth where there is mobile connection and Internet;
- to specify characteristics of electronic information flows;

- to state the requirements which are included in the TT (technical task) on development of mobile apps with the help of which the participants of the logistics system communicate;
- to state the requirements as for optimization of the "traditional" web site for its fast view on mobile devices;
- to select data and forms of their representation in mobile apps and on the optimized web site for management decisions making;
- to constantly monitor the development of mobile tools and technology and adapt the used mobile apps to the current customers' needs etc.

Specifying mobile logistics as a separate sphere of economic activity predetermines the necessity to determine its place in the information economy (see Fig. 1). Mobile logistics on the one hand is part of e-logistics, on the other - of m-business. M-business functions within the mobile economy, by which we can understand the following. Mobile economy is part of the information economy, in which economic activity is carried out only by mobile means and technology. Mobile economy is part of the e-economy, within which operates the e-business, which includes e-logistics. E-economy functions not only within the information economy, but within information logistics as well, and mobile economy - within e- economy and e-logistics.




Source: own study

Fig. 1. Conceptual model of the information economy
Rys. 1. Model koncepcyjny ekonomii informacji

## INFORMATION FLOWS AS THE MAIN CONSTITUENT OF E-LOGISTICS AND M-LOGISTICS: THE ESSENCE, PROBLEMS OF MANAGEMENT AND MODELING

The peculiarity of the current stage of economic development in business is the coexistence and development of the traditional production (physical production of goods consumed by us in the real physical world and which can be touched by hand, performing physical works or services - repair, cleaning, hairdressing, etc.) and innovations, related primarily to the process of generating, sharing, storage, destruction of information as well as analysis, management and information flow modeling. All the more information in business has electronic (digital) form replacing paper media. Due to this almost immediate exchange of considerable volume of information is possible among companies via Internet and mobile networks in modern business. This stipulates the reduction of time on performing some business processes and final result may

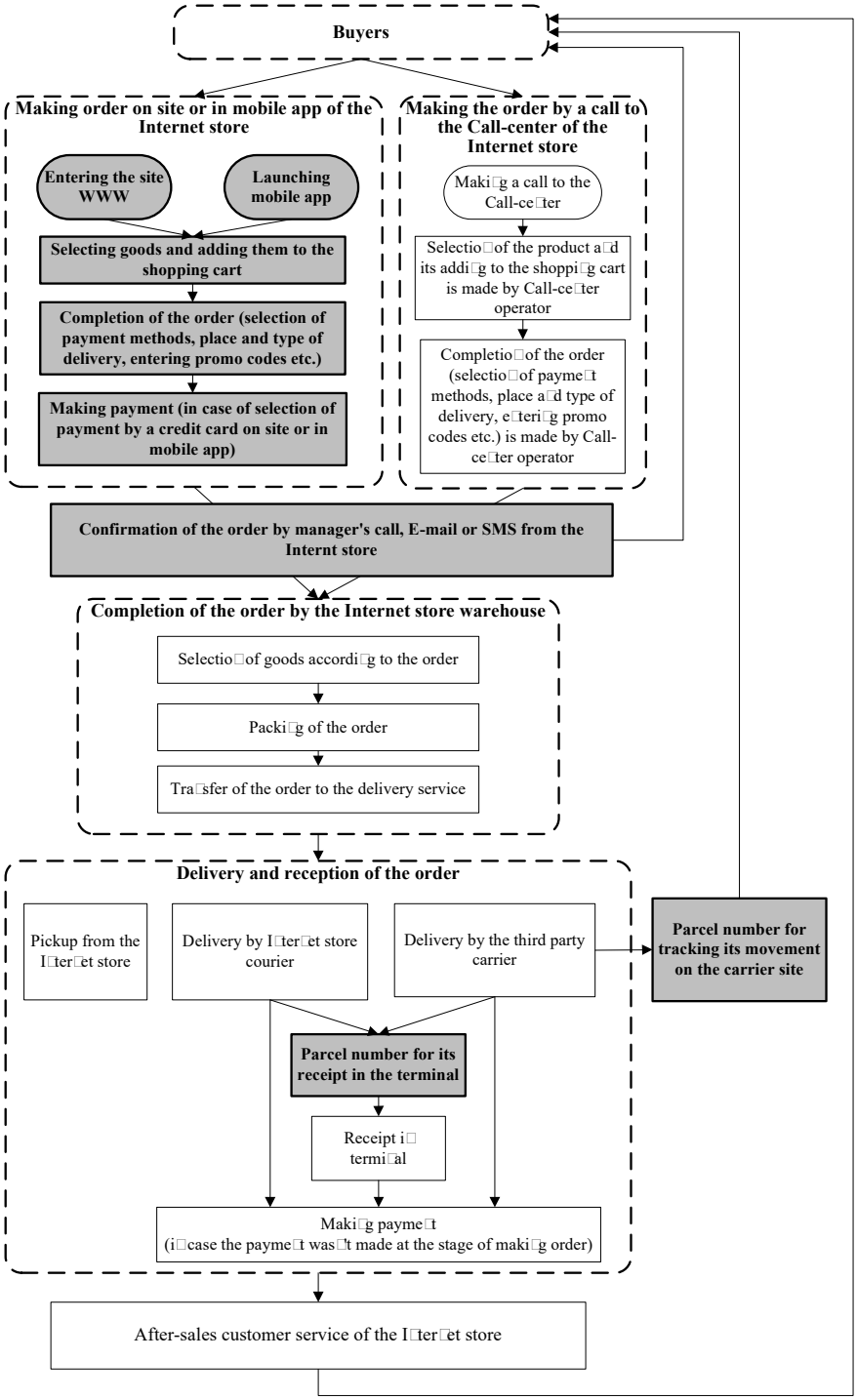
be achieved faster. The exchange of information in e-business may be performed in the context of the following forms (models) of interaction [Adamczewski, 2001, Barcik, Jakubiec, 2012, Shemet, 2012]:

- B2B (business-to-business). In this model there is interaction among the companies (enterprises, legal entities) with the aim to obtain various benefits. The final consumer (a physical person) of these companies is absent in this model, and the consumer of the products (goods, works or services) of one company is other company. Besides, in this model the exchange of information or selling information products is also carried out. Functioning of the B2B model today is performed with the help of various specialized trading platforms on the Internet.
- B2C (business-to-customer). In this model the company interacts with its end consumer. That is why the company (legal person) sells the goods, performs works or provides the services to a person (physical person). B2? models include Internet stores, Internet banking, selling transport, theatre or concert tickets etc. In our opinion, this model is most widely spread in e-commerce, therefore it requires most attention from the point of view of scientific theoretical and practical research of various aspects of its functioning.
- C2C (customer-to-customer). In this model people (physical persons) interact with each other with the help of various communication means and technology. The functioning of C2C model is currently performed through Internet auctions, classifieds etc., where such sites are the intermediaries between the buyers and sellers.
- C2B (customer-to-business). This model is relatively new. In this model opinions or ideas of the end consumers expressed by various means, in particular, on various Internet forums, social media, email etc. considerably influence the products making (their characteristics, features, price etc.) by the producer.
- B2G (business-to-government). In this model the company interacts with the state administrative organs. To this model of interaction may be referred in particular state procurement via Internet.
- C2G (customer-to-government). In this model there is interaction between a person and state administrative organs. To this model may be referred in particular the electronic submission of income declaration via the site of the tax service or email.
- G2B (government-to-business), G2C (government-to-customer). In these models state administrative organs provide the companies (enterprises) and physical persons with information services via Internet.

In each of these models one of the main places is occupied by information. Information is not something that exists in isolation, by itself. Information is subjective [Aphanasenko, Borisova, 2012], it represents data about something. In e-business one can always find the source of information, outline the ways and means of its transfer, specify the persons it is meant for, i.e. the circle of its consumers. The growth of the importance of information for companies, consumers, state administrative organs will only grow every year. This is connected, for example, with the following [Bowersox, Closs, 1996]: the consumers recognized the usefulness and convenience of possession of relevant information concerning the current state of their order, presence of the remains in warehouses, delivery schedules and payments, etc. as part of logistic service; the managers of the companies paid attention to the fact that well organized exchange of information on the supply chain reduces the need for material and human resources; information increases flexibility in deciding on the effective use of enterprise resources and more.

As we said earlier, information management (management of information flows) in e-business is carried out within the e-logistics and m-logistics. In each of the above mentioned models of e-business the limits of e-logistics and m-logistics will be different. As an example, let us consider the operation of a typical Internet store as main representative of e-business (B2C model). The criterion of an effective online store is, of course, its profit, the presence and growth of which is impossible without the complete satisfaction of its (store) customers. However, stiff competition between online stores causes

extensive research of the buyers' actions, their preferences, selection criteria of both goods and shops and so on. In particular, the major factor for consumers in their choice of online store, except for the price and quality of goods, is fast and damageless delivery of the orders (which relates to traditional logistics sphere). In addition, we believe that buyer's choice of the online store is also significantly impacted by how easily it is possible to make an order on the site or in the mobile application and receive confirmation of its execution (within the scope of e-logistics and m-logistics).




Source: own study

Fig. 2. The conceptual block diagram of the interaction of buyers and Internet store
Rys. 2. Koncepcyjny schemat blokowy oddziaływań pomiędzy kupującymi i sklepem internetowym

Fig. 2 shows the actions of the buyer and units of the online store while the buyer is making purchases. The painted (gray) rectangles and ovals in this picture demonstrate the limits of e-logistics and m-logistics influence. In this case they are the same. This confirms the idea we expressed at the beginning of this article that the boundaries between computers (laptops) and mobile devices are erased. Some processes of executing the order by the warehouse of the online store and delivery which are not marked in the picture also refer to e-logistics and/or m-logistics. By making flowcharts of the actions of participants of other forms (models) of interaction in e-business we can make the corresponding conclusions.

The need for information flows (in particular, the electronic flows) management is due to the fact that their movement corresponds to the operation of actual business processes. On one hand business processes form the information flows, on the other - the effective functioning of business processes is difficult without a proper functioning of information flows. For management of information flows in e-logistics and m-logistics can be used various methods and models of analysis and design [Korablev, 2011, Rodkina, 2001]: graphic; network modeling; graphic analysis; method of functional-operational analysis; method of schemes of information connections; method of requisites and others. These models allow, in particular, to identify a number of irregularities in the traffic of information flows, which include [Milutina]: scattering, storage, rejection, source exhaustion, interruption of the flow of information or absence of the part of way for its traffic. Using models of information flows in the form of charts, graphs or networks we can determine structural (organizational) aspects of information flows. However, only with such models it is difficult to identify quantitative and qualitative characteristics of information flows and solve the problem of forecasting of information flows. In this case, one can use economic and mathematical models that are built, for example, on the basis of tools of theory of fuzzy sets and fuzzy logic, artificial neural networks, genetic algorithms, coevolution, synergy and so on.

## CONCLUSIONS

The rapid development of information and communication tools and technologies led to the emergence of companies of new generation that are pure innovational or combine tradition and innovation, and that carry out their activities on the Internet and mobile networks. One of the main components of such companies' activity is information that in the context of the information economy is a commodity that can be profitable. So it requires careful attention from the point of view of management and modeling which can be performed within e-logistics and m-logistics.

In this work the author definition of m-logistics as the constituent part of information logistics is given, its aspects of functioning are described and its place in information economy is shown. The concept of "m-logistics" is almost out of use now, but the need for its occurrence is obvious. In our view, the development of the concept of m-logistics and related areas of research should be of interest not only for Internet stores shopping, commercial banks, etc., but also for the companies in Multilevel marketing (MLM).

This work may be a starting point for further research in the field of e-logistics and m-logistics. For example, there is a need for the development and implementation of modern economic and mathematical methods and models by which one may perform the effective information management.

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World's largest online retail markets to double in size in the next three years [press release], June 08, 2015, http://www.occstrategy.co.uk/news-and-media/2015/06/google-paypal-research-press-release

# E-LOGISTYKA ORAZ M-LOGISTYKA W EKONOMII INFORMACJI

**STRESZCZENIE**. **Wstęp:** Celem pracy jest przeanalizowanie różnych koncepcji elektronicznej oraz mobilnej logistyki, jako części składowych ekonomii informacji, w obrębie, której mogą być realizowane efektywne zarządzanie przepływem informacji.
**Materiały:** Praca opiera sie na dostępnych ostatnio publikowanych pracach i publikacjach o charakterze zarówno teoretycznym jak i praktycznym. Wstęp do tych studiów pozwala na stwierdzić złożoność jak i istotność obranego do analizy tematu badawczego jak również małej ilości dotychczas przeprowadzonych prac w tym temacie.
**Wyniki:** Została zaproponowana autorska definicja m-logistyki, jako części logistyki informacji, opisane aspekty jej funkcjonowania oraz zaprezentowane jej miejsce w ekonomii informacji.
**Wnioski:** Praca ta może być punktem startu dalszych badań w obszarze e-logistyki oraz m-logistyki. Stwierdzono potrzebę opracowania i wdrożenia nowoczesnych metod i modeli ekonomicznych i matematycznych dla celów pomiaru efektywnego zarządzania informacją we współczesnym środowisku biznesowym.

**Słowa kluczowe:** e-logistyka, m-logistyka, przepływ informacji, ekonomia informacji

# E-LOGISTIK UND M-LOGISTIK IN DER INFORMATIONSÖKONOMIE

**ZUSAMMENFASSUNG. Einleitung:** Das Ziel der Arbeit ist Analyse unterschiedlicher Konzepte für elektronische und mobile Logistik (E- und M-Logistik) als relevante Bestandteile der Informationsökonomie, innerhalb deren das Management des Informationsflusses effektiv betrieben werden kann.
**Materialien**: Die Arbeit stützt sich auf die zugänglichen, letztens publizierten Forschungsarbeiten und Veröffentlichungen sowohl theoretischen als auch praktischen Charakters. Die Einleitungsbetrachtung lässt die Komplexität und die Relevanz des dieser Analyse unterzogenen Forschungsthemas sowie eines Mangels von dazu unternommenen Forschungsaktivitäten feststellen.
**Ergebnisse**: Es wurde eine Autorendefinition der M-Logistik als eines Bestandteiles der Informationslogistik vorgeschlagen, Aspekte deren Funktionsausübung beschrieben und ihr Rang innerhalb der Informationsökonomie projiziert.
**Fazit**: Die vorliegende Arbeit kann ein Ausgangspunkt für weitere Forschungen im Bereich der E-und M-Logistik werden. Es wurde Notwendigkeit der Bearbeitung und Einführung von modernen Methoden sowie mathematischen und ökonomischen Modellen zwecks der Bewertung eines effizienten Informationsmanagements innerhalb des gegenwärtigen Business-Umfeldes festgestellt.

**Codewörter:** E-Logistik, M-Logistik, Informationsfluss, Informationökonomie

Volodymyr I. Skitsko
Kyiv National Economic University named after Vadym Hetman
Faculty of Computer Science and Technology
Economic and Mathematical Modeling Department,
Lviv area (Lvivska ploscha), 14, Kyiv, 04053, **Ukraine**
Office Phone: +380445370736
e-mail: skitsko.kneu@gmail.com