



Andrzej Szymonik

# International logistics

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## Introduction

The *International logistics* monograph is the answer to the demand of students of logistics and managers dealing with the logistics processes in the company, which are the links in the supply chain.

The presented material is related to logistics implemented within global economy, with particular attention paid to European requirements and conditions. Today, leading economists come to a conclusion that the efficiency of economy and the well-being of the society are first and foremost dependent on the condition of companies, which in turn is influenced by the service level of processes carried out within international logistics that is closely linked with global business.

The volatility of economic conditions (such as the legal ones on the national, European and global level, environmental protection, trade connections, the structure of production, technical and technological progress, the pursuit of modernity) leads to systematic improvement of the management function as regards the movement of goods, services and information between particular links of the supply chain, on international scale, but not only.

The above-mentioned problems have been described in the below-mentioned chapters, where theory has been backed up with practical application.

1. Globalization vs. international logistics
2. Management methods in international logistics
3. Logistics centers
4. Transport for international logistics
5. Documents in national and international transport
6. Transport in foreign trade
7. Automatic identification in global transport processes
8. IT systems for international logistics
9. Security in international logistics

The content of the chapters and the sub-chapters has been selected in such a way that a student of logistics would be able to:

- define the basic concepts related to international logistics;
- describe the most frequently used management methods and tools applied in the creation and functioning of international logistics;
- explain the principles by which particular kinds of transport function on the global scale and measure its significance for the creation of logistic channels of a single transport area;
- describe the operation principles of logistics distribution centers;

- identify information technologies favorable for improvement of logistics processes within the confines of international logistics;
- work out tools that guarantee operation security within international logistics.

I would like to express my sincere gratitude to the reviewers, Assoc. Prof. Wojciech Nyszk, the Head of the AON Logistics Institute in Warsaw and Assoc. Prof. Ewa Kulińska, the Head of the Chair of Marketing and Logistics in Opole for all their involvement and care for the best possible shape of this monograph.

Their remarks and suggestions took into consideration the latest solutions as regards the subject of the hereby work and thus they helped to improve the quality of the final version of this monograph, both in terms of content and methodology.

# 1. Globalization and international logistics

## 1.1. Conditions of functioning and development of logistics in the global scale

Social, economic, technical and political-legislative forces of globalization influence on all fields of enterprise functions, including the growth in the complexity of managing the supply chain.

Globalization is (among other things)<sup>1</sup>:

- contrast, meaning – on one hand – the desire to integrate, on the other – to the differentiate (integration manifests itself in merging, collaboration and cooperation of various economic entities, differentiation is mainly the diversified economic development of respective countries);
- selectiveness manifesting itself in the fact that mainly the developed countries are involved in globalization, and some with middle GDP income;
- polarization – visible in the division of the world into the rich and developed part, and the predominant part that is poor and not much developed;
- development and liberalization of international trade;
- marketing of the economies, the liberalization and privatization;
- freedom of capital flow;
- integration of financial markets;
- standardization and internationalization of production, services and finance;
- the increasing role of international organizations and groups.

Globalization and internationalization are now such common phenomena that increasingly more often, when using the notion of a *market*, we mean the entire world, not just one particular economy. Today, the real test of company management efficiency, for many businesses, is the ability to develop and implement an effective global strategy. Many factors push companies around the world towards globalization, understood as expansion into foreign markets<sup>2</sup>. At the time when the company is transformed successively from the local (national) into an international one, and then a global one, it begins for instance, to import materials and components from around the world, manufactures its products in

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<sup>1</sup> B. Kaczmarek, *Zarządzanie międzynarodowe – wybrane problemy*, [in:] *Osiągnięcia i perspektywy nauk o zarządzaniu*, S. Lachiewicz, B. Nogalski (eds.), Wolters Kluwer Business, Warsaw 2010, pp. 529-539.

<sup>2</sup> G.S. Yip, *Strategia globalna*, PWE, Warsaw 1996, p. 21.



any country, and sells them on many markets, making certain amendments where necessary, to match the product to the local requirements.

The period of globalization, which began to grow in strength in the second half of the twentieth century, characterized by the largest wave of mergers and takeovers, strategic alliances and the growth of partner business network that included international organizations. The synergy of joint companies led to improved business outcome, the example of which can be the combination of the reputation of the German group Volkswagen and the brand of Skoda in the Czech Republic, which had a positive impact on the latter. Similarly, the use of knowledge, skills and technology has enabled Volkswagen to raise productivity and improve product quality. In the markets of Europe (including Poland<sup>3</sup>), China, India, the best-selling cars in the past few years are those produced in the Czech brand Skoda<sup>4</sup>.

Thus, we may say that globalization of a given enterprise means the integration of operations that are internationally dispersed and the units that represent them; this becomes an implication for partnerships, including those regarding logistics activity in the global supply chain<sup>5</sup>.

The global supply chain management is about combining all operations performed by all the links in order to transform raw materials and semi-finished goods into finished products, delivering them to the customers worldwide, along with appropriate service<sup>6</sup>.

The logistic processes carried out within the supply chain show a common tendency to cross national borders, which entails significant modifications of the relationships that occur within, e.g.<sup>7</sup>:

- expansion of mutual relations via tighter links within the information systems used by consignors and carriers of goods, customs offices and agencies;

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<sup>3</sup> <https://www.google.pl/search?q=pozycja+skody+czeskiej+w+europie&ie>, 22-08.2013.

<sup>4</sup> wyborcza.biz/biznes/1,101562,11527953,Rekordowa\_sprzedaz\_Skody\_\_12\_proc\_\_wyzsza 22.08.2013

<sup>5</sup> Cf. M. Antoniak, A. Szudrowicz, *Logistyka a internacjonalizacja i globalizacja*, [in:] *Logistyka we współczesnym zarządzaniu*, Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań 2003, p. 189.

<sup>6</sup> E. Gołemska, M. Szymczak, *Logistyka międzynarodowa*, Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań 2000, p. 33.

<sup>7</sup> D. Kisperska-Moroń, *Wpływ tendencji integracyjnych na rozwój zarządzania logistycznego*, Wydawnictwo Akademii Ekonomicznej w Katowicach, Katowice 2000, p. 114.

- increasing emphasis on the need for constant monitoring of international flows of products in order to secure import supplies;
- increasing the efficiency requirements for the links in order to provide deliveries for the markets located in the remote parts of the world.

The global economy leaders are those companies which are targeted at the needs of their “global” clients. For these customers, the goal of purchase are the products which seem ideal in terms of their quality, technology or functionality, and which may be acquired at the lowest possible prices at the most convenient place and time.

These needs are to be met by the strategies of the global companies that design and later produce global products, using the achievements of interdisciplinary technologies, i.e. communication, automation, robotics, flexible manufacturing systems, material engineering (especially using nanomaterials), micro-electronics, information technology. Corporate companies reach their potential customers all over the world with information on their products or services, via global promotion actions; they build worldwide networks of production and distribution, as well as logistics systems allowing for these products to physically reach their consumers and users in every corner of the world.

## 1.2. Theoretical foundations of international logistics

If we treat logistics as a method of managing the flow of goods and information, then a very particular case of logistic management will be international logistics. *If we consider the four areas of logistic management within the company: operational, financial (closely related to logistic costs) marketing and informational one, then such system of linked companies, located all over the world, where at least one of them is shared, will be called international logistics<sup>8</sup>.*

**Operational** cooperation in international logistics is expressed by activities such as:

- implementation of the same (or similar) concepts (rules) of management by the participants, the companies being the supply chain links on the European scale (e.g. LM – *Lean Management*, AM- *Agile Management*, TBM – *Time-Based Management*);

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<sup>8</sup> Cf. A. Szymonik, *Eurologistyka Teoria i Praktyka*, Difin, Warsaw 2014, p. 21.

- using one *Shared Service Center*, the objective of which will be to strengthen and facilitate functions in such areas as human resources management, IT support, logistics, operations between the customers and the supplier etc. (shared services make it possible to perform business processes in line with unified norms, with lowered risk and costs);
- building and use of partner undertakings with logistic companies, suppliers, recipients of the components and products;
- application of the same or similar concepts of inventory management (e.g. CMI, *Co-Managed Inventory*, CPFR – *Collaborative Planning Forecasting and Replenishment*), VMI – *Vendor Managed Inventory*);
- using the same or similar methods of goods flow management in companies that are participants of the supply chain on the European scale, and not only (e.g. Just-in-Time, Kanban);
- implementation of the latest transport technologies (e.g. transport navigation systems, warning systems, tracking systems, high-speed trains, trucks of maximum transport efficiency, that reach the lowest running costs in the industry with optimal performance of the vehicle, fuel-efficient engines, aerodynamic bodylines, modern and spacious inside of the vehicle, safe and economic aircraft);
- implementing the latest warehousing techniques – modern systems, machines, devices (e.g. automatic identification, the “goods to man” systems, automatic monitoring, machine vision, automated high-bay warehouses, the WMS information systems- a programme for management of goods movement in warehouses, unmanned trolleys, robots, automatic machines);
- implementation of uniform measures to assess the logistic supply chain on its entire length;
- implementation of logistic packaging chains;
- construction of vast computer networks;
- implementation of modern communication systems, e.g. videoconferences, the Internet;
- standardization of production and inventory control methods and logistic processes;
- implementation of e-logistics (electronic stock exchange, electronic catalogues, freight exchange, electronic logistic platforms, corporation portals);
- standardization of operational costs balance in all supply chain participants;
- creating logistic centers.

Joint **financial management** related to international logistics costs, narrows down to monitoring and control:

- freezing of working capital in inventories – this constitutes the answer to a question of how much it costs all chain participants (companies) to freeze the capital in inventories, as opposed to the possibility to use it in any other, more efficient way – the cost of lost opportunities (only good production planning, based on the orders, or well-prepared forecasts, along with the right information exchange, ensures the minimization of stocks);
- the costs of physical flow in international logistic channels (including the costs of: depreciation of fixed assets involved in logistic activities, work, media and materials consumption, external transport services, taxes and transport insurance etc.);
- warehousing costs in international logistic channels (including costs of storage and manipulation);
- costs of stock depletion (including lost sales and delayed orders);
- costs of international logistic channel deficiencies and mistakes in customer service (these include penalties for the breach of supply conditions and all costs resulting from mistakes in service);
- the costs of information flow (the level of customer service is closely related to the quality of information along the entire depth and width of the international logistic channel);
- implementation of effective logistic activity crediting policy.

The identification of logistic costs for particular links of an international logistic channel is extremely troublesome and difficult. This is caused by the complexity of the problem resulting from the number of varying participants, different as regards their role and place within the channel. Defining and understanding all logistic costs of each link, especially when changes are introduced into one of them, requires carrying out a simulation and detailed system analysis within the entire international logistic channel. Helpful tools in defining logistic costs for all participants of logistic chains are:

- integrated management systems that support the ABC method – the balance of operational costs;
- an Excel spreadsheet that facilitates:
  - identification of all participants within both upper and lower part of the international logistic channel, along with the costs incurred by logistic operations;

- carrying out simulations of changes and responses of all the links of the chain;
- services provided by specialized units (e.g. consulting companies, Accounting Service Centers –ASC, or Global Shared Services in Finance-Accounting).

The **marketing** cooperation in international logistics is about accomplishing tasks such as:

- creating the image of the company and brand consolidation for products and services, e.g. by participation in different kinds of rankings;
- realization of unanimous policy regarding the target strategy of logistic services via;
- working out a long-term program, among all participants, i.e. manufacturing, transport and distribution companies, that would indicate the areas for change which might be necessary in the long run;
- joint cost-reduction programs;
- monitoring of external factors that have impact on the price, i.e. customers, competition, distribution channel participants, regulatory, ethical and legal matters.
- using the so-called price positioning affecting the creation of added value for all participants in the supply chain;
- using expert advisory services;
- **using integrated IT systems that support the decision making in the price policy area;**
- training relevant staff that would be able to maintain the price regime of logistic products.
- finding and exploitation of market niches – among other ways, this may be done by a detailed analysis of:
  - substitution industries – in the broader meaning, the companies compete not only within their own field (e.g. transport industry), but also with the companies that provide substitutes, which would mean companies such as those belonging to the TFL sector (one needs to answer a question, whether there is a place for a new brand product);
  - strategic groups – the term “strategic group” describes a set of companies belonging to one sector and pursuing a similar strategy (e.g. logistic distribution centers for companies such as Ikea, Jeronimo Martins, Netto);
  - supply chain – in the sale of a product, it is crucial to define all supply chain participants until the moment of obtaining the materials, by all

sub-contractors, to the final consumer (in this last case, one needs to answer the question, how deep the market is to be – the national, European or global one?);

- complementary products and services – it is very rare that the products as such have a value to the customer, most often their price depends on considering the entire set of products and services complementary to one another (it is not enough to deliver a product, it needs to be installed, ran, serviced and withdrawn from exploitation);
- functional and emotional preferences of the customers – in some industries the competition is based mainly on the price and the ratio of the price to the relevance of the product – such industries may be called oriented on the functional preferences of the customers;
- time – in order to create a new market space, it is not enough to passively adjust the company to the appearing market trends, one needs to foresee the future needs of the customer and assess, how the change in needs would influence the perception of products; this is particularly visible in the IT sector;
- systematic study of transfers of shares in the competitive environment (here one cannot forget to create the legislative possibility of moving the stock between pools offered for private and institutional investors as well as between domestic and foreign investors);
- periodic analysis of the size and structure of demand for logistics – the following types of analyses are usually carried out:
  - market absorption;
  - segmentation and selectiveness;
  - market capacity;
  - market development trends, with particular attention paid to e-commerce,
  - sustainability and flexibility.
- the use of “mix” promotion strategy, depending on the phase of product lifecycle;
- marketing research on chosen European and non-European markets, which **would inter alia answer the following questions:**
  - how does the logistic potential shape on the new markets in the European region, including Middle-Eastern Europe?
  - how to build a comparative analysis of a logistic company and the products or services it provides on several markets?

- how to find new channels and markets, including e-markets, for logistic services?
- what is most crucial in my logistic service from the perspective of the international market customer, with particular focus on e-logistics?
- what is the position of my product as compared to the competition in the logistics sector, what are its distinctive features, if any.

Cooperation regarding information sharing and exchange is particularly important in international logistic channels, where the links are logistic companies, of network or virtual type, or finally enterprises that own intelligent production systems, where a human is replaced by machine data processing (IT technologies of artificial intelligence). Cooperation in the field of information is related, among others, to the following:

- data exchange within all management functions (planning, organizing, motivating, controlling, decision-making and coordinating);
- creating one shared database within integrated management systems or in the Internet;
- data exchange in key functional areas of the company (e.g. sales, distribution, technical preparation of production, production planning and management, production and assembly of products; supplies, storage; tool and repair management);
- using professional logistics platforms;
- making use of the global standards;
- the use of the Global Data Synchronization Network (GDSN), i.e. compatible electronic catalogues storing data on products and producers, enabling secure and continuous data synchronization; this way all trading partners have consistent data in their systems, regarding a specific unit at the same time;
- exchange of information via EDI.

### **1.3. Networks and channels of international logistics**

International logistics consists of two basic elements<sup>9</sup>:

- configuration of the international logistic network (often referred to as international logistic systems);

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<sup>9</sup> Cf. E. Gołemska (ed.), *Kompendium wiedzy o logistyce*, PWN, Warsaw-Poznan 1999, p. 128.

- supply chains in international dimension, the so-called international logistics channels.

The international logistics network configuration is a **human-created system of basic, permanently located ones**:

- routes for all modes of transport (i.e. road, rail, air, inland waterway and sea transport);
- modal points<sup>10</sup> of the logistic network, oftentimes called transport points (e.g. warehouses, independent container points, airports, seaports, logistic centres etc.);
- ancillary equipment that facilitates the process of servicing roads and transport points;
- transmission media, through which the logistic points flow to the sources of raw materials extraction, to the place where these products are supplied.

This system can be seen as a closed set, with the following formula:

$$KSE = D \cap P \cup U \cap M \cap R$$

where KSE is Euro-logistic network configuration

D – roads;

P – modal points;

U – ancillary equipment;

M – transmission media;

R – interrelations between elements.

The configuration of an international logistic network is subject to constant change, which is evoked, first of all, by modernization and development of the transport and logistics infrastructure.

### **International logistic channel means:**

- optimal routes created purposefully and in a systematic way, most often within the confines of the already-existing international logistic networks (though in emergency logistics networks may be created individually, e.g. temporary landing sites or warehouses) to the recipient, along with accompanying information;

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<sup>10</sup> The name of modal (most likely) points of the logistics network refers to all places of stopovers for the products, i.e. warehouses, outlets and transport nodes and factories, distribution networks etc.



- the physical network which begins with the supplier and ends with the ultimate client and embraces aspects related to product development, purchase, manufacturing, physical distribution, after-sale service and the circulation of information.

The analysis of the professional literature content and the presented definitions, from the perspective of the product/service added value, makes it justified to form a range of judgments and demands<sup>11</sup>:

**Firstly:** in international logistic channels the subjects are linked by the physical movement of goods and sending information. A good example may be the Singer sewing machine. The basic components of these machines are produced on three continents: the housing – in the US, the drive shafts – in Italy, and the motors – in Brazil. The final product is assembled in Taiwan, while the customers are spread all over the world. The dispatch of supply, manufacturing and distribution-related functions between subjects located in various parts of the world is a huge challenge for logistics, which needs to unite and integrate the system<sup>12</sup>.

**Secondly:** International logistic channels a network of companies established to develop a new product, exchange resources, gain advantages through its size, reduce costs, increase a competitive advantage etc. They are divided into horizontal and vertical ones. The former ones are networks established by manufactures of similar or same goods. The latter are represented by a set of companies connected with one another in a ‘supplier – receiver’ relationship.

**Thirdly:** the subject structure of international logistic channels is created by mining companies, suppliers of materials and components, manufacturers, service providers, transport companies, warehouses and logistics centers, distributors and all the relationships between them.

**Fourthly:** An international logistic channel is a quick, flexible and interconnected system driven by the mechanism of the customers’ choice, aiming to achieve a high level of customer satisfaction, as well as, to gain the highest possible profit by the companies within this channel.

**Fifthly:** The international logistic channel can be described by means of the following characteristics: the process (the subject of the flow), the structure (the entity structure), and the objectives (the scope of action and the areas of cooperation of participating entities).

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<sup>11</sup> Conclusions are based on source materials listed above.

<sup>12</sup> K. Rutkowski, *Logistyczne wyzwania globalnej wioski*, <http://ceo.cxo.pl/artykuly/51999>, 02.12.2012.

**Sixthly:** the range of international logistics channel consists of raw materials, auxiliary materials and cooperating elements, purchased on the supply market according to the need, passed on to the production process and finished products submitted for sale and delivered to the customer<sup>13</sup>.

**Seventhly:** Depending on the configuration of the international logistic channel, its links may consist of different kinds of mining, processing, service and trading companies. Their position within the channel results from the division of work in the next stages of production and sales of goods. Because of their role as senders and receivers of loads, as well as, the accompanying information and finance streams, their basic role in the functioning of the international logistic channel is unquestionable. The service functions of a company are also important links in supply chains. These may include, among others:

- logistics, transport and shipping companies;
- information brokerage companies;
- reprocessing and waste storage plants.<sup>14</sup>

The international logistic channels, just like all other logistics systems relate to ensuring the usability and utility of time availability of goods and services. Their incorrect configuration leads to waste, generates unnecessary costs and lowers the level of customer service.

Continuous improvement of the configuration of international logistics channel is imposed by activeness of the competition, as well as by:

- the changing demands of customers in relation to logistics services (e.g. individual client, on-time delivery of production-related cargo, either JiT or 7R<sup>15</sup> – related, a wide range of after-sales service, including the withdrawal of products from operation);
- the emergence of new e-economy relations (B2B, B2C, C2C, B2A, where: B – business company C – retail customers, A – commercial administration authorities);
- demand for new types of services;
- adaptation to the requirements of information technology (e.g. the Internet, the Intranet, Internet portals, information systems supporting logistics, telematics, automatic identification);

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<sup>13</sup> Cf. M. Sołtysik, *Zarządzanie logistyczne*, Akademia Ekonomiczna, Katowice 2000, pp. 27-30.

<sup>14</sup> J. Witkowski, *Zarządzanie łańcuchem dostaw*, PWE, Warszawa 2003, p. 12.

<sup>15</sup> 7W – *right product, right quantity, right condition, right place, right time, right customer, right price.*

- adjustment to production systems based on flexible production systems and *Intelligent Manufacturing Systems* of the future (IMS);
- changes in the supply and sales markets, such as the emergence of a new form that is e-commerce and the expansion of Chinese products and services;
- high cost of logistics activity caused e.g. by rising fuel prices, fixed and variable charges, the hire logistics infrastructure in attractive locations.

In practice, we distinguish the following types of international logistics channels<sup>16</sup>:

- discontinuous;
- continuous;
- synchronous.

The type of the international logistic channel stems from the character of logistics tasks which are closely related to:

- type of production (individual, serial, mass);
- form of production (rhythmical, non-rhythmical);
- organization of production (group production type – technological specialisation, socket and linear type – subject-related specialisation);
- the degree of IT systems use.

If we deal with the conventional production systems and individual, small-lot, non-rhythmical production, then, depending on the advancement of IT systems into the manufacturing process, we have discontinuous and continuous channels. A high changeability of assortment or manufacturing programmes, along with irregularity of inflow of orders cause difficulties in developing schedules for production orders.

In case of rhythmical, mass production, coupled with a modern flexible manufacturing system (ESP) and computer-integrated manufacturing, the flow of goods and services is carried out in the framework of the continuous and synchronous channels (the latter are dominant). The presented production systems and channels are characterized by<sup>17</sup>:

- the possibility to create the so-called master schedules;
- the stabilized volume of on-going production;
- minimal interoperational resources;

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<sup>16</sup> Cf. *Kompendium wiedzy o logistyce*, E. Gołemska (ed.), PWN, Warsaw 2001, pp. 270-272.

<sup>17</sup> G. Stonehouse, J. Hamill, D. Campbell, T. Purdie, *Globalizacja. Strategia i zarządzanie [Globalisation. Strategy and management]*, Felberg SJA, Warsaw 2001, p. 270.

- multi-assortment potential;
- the ability to adapt to manufacturing of new products with in any order of their manufacture;
- responsiveness to change, i.e. the delivery time is calculated from the moment of its foundation until his execution.

The configurations of international logistic channels are created within the confines of different relationships and economic dependencies, within integrative and partnership undertakings. In practice, it they are realized via:

- fusions (two companies voluntarily move their assets to a new entity);
- takeovers (agreed and hostile);
- strategic alliances;
- partnership undertakings – they are voluntary, varied in form, from highly formalized long-term agreements to short-term ones.

## 2. Management methods in international logistics

### 2.1. Tools facilitating international logistics management

International logistics may function effectively and efficiently, if we effectively manage all participants and processes that constitute logistic channels.

Modern logistics management is defined as *a decision - making process related to the synchronizing of the physical, informational and financial supply and demand streams flowing between its participants so as they would gain competitive advantage and creating added value with benefit for all its elements, customers and other stakeholders*<sup>18</sup>.

Logistics Management concerns<sup>19</sup>:

- joint planning, forecasting, supplementation of stocks, monitoring and controlling the interrelated processes;
- configuration of the product and the network, which means making key decisions concerning offered products and services, the structure of entities and the bonds occurring between the structure;
- designing products with the use of the suppliers knowledge;
- forming production network, aiming to select and define the tasks of production, production sites and inventory maintenance, which, according to the idea of postponing, may relate not only to industrial companies, but also the trade and logistics ones;
- unification and optimization of processes taking place in the supply chain, that are connected with the physical flow of goods and the accompanying flow of information and financial resources;
- clarity of identification of a product, load or location of a partner on the world scale;
- continuous analysis and monitoring (same for all participants) of the indicators and efficiency measures for business parameters.

While determining the basic principles of international logistics management, one may apply the approach used by an organization dealing with knowledge - improvement and advisory in the area of company management, APICS (*American Production and Inventory Control Society*, an organization

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<sup>18</sup>Cf. J. Witkowski, *Zarządzanie łańcuchem dostaw Koncepcje>Procedury>Doświadczenia*, second improved edition, PWE, Warsaw 2010, p. 36.

<sup>19</sup>Ibid., p. 32.

currently referred to as *Educational Resources Management Association*). Basing on this approach, we can distinguish<sup>20</sup>:

- speed – concerning the tasks carried out since the receipt of the order to obtaining financial means for delivering the goods to customers, which is associated primarily with the provision of adequate infrastructure;
- harmonization of subsequent links within the chain – connected with the differentiation of time necessary to perform tasks by particular units of the chain, which enables inventory level reduction, thus lowering the costs;
- ensuring information flow between the cooperating units, in the proper form, time and place; especially concerning the demand for finished goods, reported by the customers, providing adequate inventory level of materials or intermediates in particular units, determining the required contract realization period, providing the flow of financial resources needed for ensuring inventories in particular units;
- knowledge and understanding of the expected results of cooperation – connected primarily with the agreement between the partners as to the expected results in the entire international logistics channel and the use of appropriate performance indications;
- creating value for the stakeholders – involving the need to recognize and take into account the expectations of all the stakeholders in the activity of the logistics channel.

In turn, the efficiency of international logistics channel management is determined by the degree of the following objectives<sup>21</sup>:

- minimization of the total cost of the product and information flow, while maintaining the quality level of supply service required by the client (the so-called savings logistics);
- ensuring the shortest possible time of contract realization and highest possible reliability, frequency and flexibility of supply with a certain estimated level of efficiency cost (the so-called efficiency logistics);
- optimization of the supply level on the scale of the international logistics channel, together with the flexible adjustment to the preferences as regards delivery service for particular areas of the market
- standardization of trade and logistics units identification, companies and other locations, sent and received shipments, returnable resources, individual resources, service relationships, documents;

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<sup>20</sup> [http://mfiles.pl/pl/index.php/%C5%81a%C5%84cuch\\_dostaw](http://mfiles.pl/pl/index.php/%C5%81a%C5%84cuch_dostaw), 30.10.2013.

<sup>21</sup> Cf. J. Witkowski, *Zarządzanie łańcuchem dostaw...*, op. cit., p. 31.

- continuous improvement of management methods with the aim to achieve growing customer satisfaction.

Depending on the development, width and length of the international logistics channel, the cooperating companies (e.g. those that constitute corporation, a consortium, fusion, alliances and takeovers) may:

- sell their products in Europe or beyond its borders; still, they concentrate their manufacturing and supplies in one region;
- concentrate their production in one region, but collect materials and components from different countries;
- use the strategy of postponing, i.e. starting their production only right after the demand appears for the manufactured products.

In supply international logistic chain management, many methods<sup>22</sup> and devices<sup>23</sup> are used, which have been and still are applied in effective economic systems management. To this group, we may include<sup>24</sup>:

- LM – *Lean Management*;
- AM – *Agile Management*;
- QR – *Quick Response*;
- TQM – *Total Quality Management*;
- BBR – *Business – Based Reengineering*;
- Theory of constraints and queues;
- TBM – *Time – Based Management*
- JiT – *Just in Time*;
- ECR – *Efficient Consumer Response*;
- SCOR – *Supply Chain Operation Reference Model*;
- VMI – *Vendor Managed Inventory*;

The mentioned concepts may be applied and implemented as long as information technologies are used simultaneously, which not only support the decision-making, but also provide valuable useful information, necessary for the international logistic chain management.

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<sup>22</sup>Def. *A method is a consciously applied proceeding, aiming to achieve the desired goal; according to Słownik języka polskiego* <http://sjp.pwn.pl>, 30.10.2010.

<sup>23</sup>Def. *Tool 1. A person executing someone else's will 2. abt. ath. used for a particular purpose, according to Słownik języka polskiego* [http://sjp.pwn.pl/szu\\_mkaj/metoda](http://sjp.pwn.pl/szu_mkaj/metoda), 30.10.2010.

<sup>24</sup>Cf. *Instrumenty zarządzania łańcuchem dostaw*, M. Ciesielski (ed.), PWE, Warsaw 2009, p. 25; M. Ciesielski, *Logistyka – problemy rozwoju dyscypliny praktycznej*, [in:] *Osiągnięcia i perspektywy nauk o zarządzaniu*, Oficyna a Wolters Kluwer business, Warsaw 2010, p. 516.

The supply the process effectiveness in international logistic chain management requires the development of three main dimensions of electronic economy, which are the following kinds of communication<sup>25</sup>:

- internal – between the company staff, with the use of the Internet network and the computer team work support systems;
- of the company – with the chosen economic organizations, thanks to the extranet;
- of the company – with the unlimited number of present and potential clients or partners, with the use of the widely accessible Internet network.

## 2.2. LM – Lean Management

This concept is about the elimination of all actions that do not create added value, i.e. such actions, for which the customer would not pay.

The world *lean* goes with:

- Lean Management;
- Lean Production (*Lean Manufacturing*).

*Lean Management* is described as:

- *the simplification of all processes (flows), to avoid errors, waste and situations of missed opportunities*<sup>26</sup>;
- *the concept of enterprise management, which involves adaptation to the economic conditions prevailing in the market through organizational and functional transformation; It is a slow and continuous process of rationalization of the entire organization and its relationship with the environment by introducing a number of changes in the business, assets structure and management methods, but also in the field of vocational training and attitudes of employees; making the company more slim, more lean*<sup>27</sup>.

The general principle of Lean Management is integrated comprehensive orientation, which extends onto the entire value chain, including external linkages with suppliers and customers in international logistic channels.

The basic elements of this concept include<sup>28</sup>:

- reduction of complexity – this is a simplification of all processes and flows in order to avoid errors and waste of unused capacity or situation (the result

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<sup>25</sup>Cf. J. Witkowski, *Zarządzanie łańcuchem dostaw...*, op. cit., pp. 103-104.

<sup>26</sup> [www.me.put.poznan.pl/materialy](http://www.me.put.poznan.pl/materialy), 01.11.2013.

<sup>27</sup> [http://mfiles.pl/pl/index.php/Lean\\_management](http://mfiles.pl/pl/index.php/Lean_management), 05.07.2013.

<sup>28</sup>Cf. P. Blaik, *Logistyka*, PWE, Warsaw 2001, p. 230-231.



of these activities is, for example: change of organizations, structures, the way the tasks are carried out);

- communication – intensive information exchange in all areas within the companies – participants of the supply chain and between these spheres, taking into account all the supplier-customer relationships (information exchange takes place with the use of modern information technologies, on the basis of partnership, trust, sharing the risks and benefits);
- comprehensive quality – it is the pressure to constantly strive for improvement, not only of a product or a service, but also all logistics processes involved in the supplier-customer relationship;
- co-operation – refers to both customers and suppliers, as well as to the employees of the company, under the assumption that long-term partnership should bring certain benefits to all participants.

*Lean Management* concentrates on four interrelated objectives, which are<sup>29</sup>:

- short production cycle, high integration of production process;
- on-time delivery, partnership with suppliers;
- minimum stocks;
- maximum use of production capacity.

Restructuring, according to the idea of *Lean Management*, means also changes in the mindset of the employees and managers. Teamwork is postulated, along with shared decision-making, full involvement in work and constant qualifications improvement. The priority in *Lean Management* is information and direct access to it for all employees.

*Lean Management* puts significant emphasis on shaping long-term direct contacts with suppliers and customers; then the *Just in Time* method may be applied.

International logistics, basing its functioning on the above – described management concepts, uses outsourcing, which simplifies and facilitates the management system by having some functions performed outside. In the efforts to optimize the supplier-customer contacts, also controlling is used.

### **2.3. AM – Agile Management**

*Agile Management*, in contrast to *Lean Management* takes place under conditions of constant and unpredictable changes within the supply chain, i.e. in conditions that cannot be foreseen (burdened with risk, poorly structured). Such

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<sup>29</sup>Cf. [http://mfiles.pl/pl/index.php/Lean\\_management](http://mfiles.pl/pl/index.php/Lean_management), 01.11.2013.

cases may be evoked with emergency situations (a temporarily organized supply chain in case of fires, floods, technical disasters etc.) or unplanned or individual customer's order.

This kind of management requires the following to be at one's disposal<sup>30</sup>:

- employees exchanging knowledge and participating in the supplier-customer relations management processes;
- participants, organizations (supply chain links) that learn, base their actions on constant innovation processes;
- a flexible and intelligent technology.

Moreover, it is necessary to integrate all organizations, people and technology throughout the supply chain and constant improvement of processes carried out, as well as focus on the added value as the most essential element of joint business.

The concept of Agile Management emphasizes the importance of knowledge and intellectual capital in the process of targeting. It is suitable where one needs a "quick" product along with full after-sales service (delivery, assembling, commissioning, service, repair, disposal, training), which a properly managed supply chain is supposed to cope with.

The presentations of LM and AM concepts show that both have many common objectives and features such as speed of delivery and creating the added value. These concepts permeate and complement each other. Instruments used in LM form a strong foundation for the implementation and effective use of AM.

A lean international logistic channel will certainly be more flexible than a structured, complex one, entangled in the number of factors. Taking into account only one parameter, which is the number of suppliers, it is easy to imagine that discussing changes with one supplier is easier and takes less time than with a few<sup>31</sup>.

## 2.4. TQM – Total Quality Management

*The American Society for Quality* has defined quality in the form of interdependent dimensions, as<sup>32</sup>:

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<sup>30</sup>[http://www.ptzp.org.pl/files/konferencje/kzz/artyk\\_pdf\\_2009/076\\_Lenart\\_a2.pdf](http://www.ptzp.org.pl/files/konferencje/kzz/artyk_pdf_2009/076_Lenart_a2.pdf), 01.11.2013.

<sup>31</sup>*Instrumenty zarządzania łańcuchami dostaw*, M. Ciesielski (eds.), PWE, Warsaw 2009, p. 29.

<sup>32</sup>C.B. Bozarth, R.B. Handfield, *Wprowadzenie do zarządzania operacjami i łańcuchem dostaw*, Helion, Gliwice 2007, p. 115.

- the characteristic features of a product or service that have impact on its ability to satisfy directly expressed or implicit needs (value approach);
  - product or service free of defects (compatibility approach);
- Evaluation of actions occurring within a supply chain in the dimension of value may include:
- compatibility – whether the product supplied and the after-sales service are compatible with the specification;
  - performance – what are the basic characteristics of the processes taking place between the suppliers and the customers;
  - durability – the effectiveness and timeliness of logistics operations in space and time;
  - reliability – whether the product will be delivered in the designated place, time, quantity and quality to the specified receiver;
  - aesthetics – whether the delivered product or service impacts positively on the customer.

In turn, the compliance assessment is about evaluation whether the actions and processes taking place within the supply chain are performed as initially intended (agreed between the participants of the supplier-receiver relationship).

Both value and compatibility approach should provide answers as to how the supply chain should be organized so as to deliver the product with the greatest added value.

The participants of the supplier-customer relationship should<sup>33</sup>:

- understand which dimensions of value are most crucial for all;
- design, prepare and methodologically implement the qualities:
  - of a product implying particular components for its manufacturing;
  - of the flow of goods, information exchange or the level of customer service;
- motivate, monitor, control whether the implemented processes allow the satisfaction of participants' expectations along the entire supply chain.

The synergic actions of the manufacturers and service – providers who cooperate in order to process and move goods – from the raw material phase to the end user level, are possible, as long as the understanding of quality is unanimous and the model described as the TQM (*Total Quality Management*) model is implemented.

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<sup>33</sup>Cf. *ibid*, p. 116.

Although no single definition of TQM exists, we may assume it is a comprehensive and systematic approach to the supply chain management, based on constant improvement of the quality of the products and services, as seen from the client's perspective.

TQM is dependent on the quality of raw – and other materials, components, logistics infrastructure, products, service and on the efficiency of suppliers, producers, whole sellers and retailers, and the effectiveness of their management.

The impact of TQM on the international logistic channel functioning is manifested in its various dimensions. The most important of them include four components<sup>34</sup>:

- architecture and integration (e.g. supply chain designing, developing relationships in proximal and distal environment, shaping and performing transactions, process project and change management, integration of services, systems and information);
- controlling (e.g. using experienced logistics personnel, decision - making support systems, management service providers, such as 3PL and 4PL, systematic use of reengineering, continuous improvement of processes and results);
- information and communication (e.g. applying integrated information management systems, i.e. ERO class, the realization of information processes, i.e. obtaining, analyzing, gathering and sharing data, using one shared base for data gathering and subsequently transforming it into the information and knowledge needed, using automatic identification by e.g. applying bar codes and readers, common use of navigation);
- sharing resources (e.g. transport, warehouses along with all activities performed there, new innovative solutions of logistics processes, information and knowledge, information systems, procurement and sales markets).

## 2.5. Efficient Consumer Response – ECR

**ECR** – (*Efficient Consumer Response*) is a supply chain, including the Euro - logistic one, that is customer - oriented. ECR is a modern strategy the foundation of which lies in the partnership of its participants – a synchronized supply management, with application of technologies that support the flow

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<sup>34</sup>Cf. <http://progressmakers.pl/page.php/1/show/1667>, 02.11.2013.

of products, information and financial resources, with the aim to raise the competitiveness of the Euro - logistic channel and the maximization of benefits of all participants, with simultaneous increase in satisfaction of the final consumer<sup>35</sup>.

The joint effort to maximize the Euro - logistic channel efficiency, instead of traditional concentration on the effectiveness of its particular links leads to the reduction of the total costs of the system, inventory level and the capital involved, while increasing the value for the end customer.

The ECR strategy is based on the following basic processes adding value to the supply chain, including the international logistic channels<sup>36</sup>:

- efficient replenishment focused on the most effective way of delivering the right product, minding the quantity, time and place;
- efficient management of the shop assortment aimed at the right amount of goods being available in a particular assortment to meet the consumer's demand, with simultaneous optimization of the storage capacity;
- efficient promotions, reducing the trade and market promotion costs, without downgrading their natural function of attracting the consumer or weakening the distributor's market position.
- efficient offer of new products intended to maintain the adequate level of attractiveness of the particular range of products and increase their sales.

The ECR strategy is applied in four areas<sup>37</sup>.

**The first one – demand management** – tackles the problems of understanding and managing the demand for products and services:

- the implementation of pilot projects – the best way of the customization of the ECR concept to the needs and possibilities of business partners;
- streamlining the assortment – leads to a significant improvement in the consumers' satisfaction, reflected in the performance of companies;
- promotion optimization – usually increases the productivity of promotion, especially the efficiency of processes, and cuts the time of consumers reaction and feedback;
- launching new products – the most challenging area of cooperation, yet promising –generates decent profits when barriers have been overcome.

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<sup>35</sup> A. Baraniecka, *ECR Efficient Customer Response. Łańcuch dostaw zorientowany na klienta*, IiM, Poznan 2004, p. 22.

<sup>36</sup> Logistyka *dystrybucji*, K. Rutkowski (ed.) Difin, Warsaw 2001, p. 198.

<sup>37</sup> ECR Polska, 28.08.2013.

**The application of the system brings the following profits:**

- immediate and direct influence on the consumers' satisfaction, ensuring increase in the sales and market share;
- leads to significant changes in the cooperation of the enterprises – to serve the consumer better and more effectively;
- a number of former projects resulted in excellent plans, nonetheless, without bringing about effects or long term relations.

**The second – supply management** – the supply aspect of ECR is focused on the integrated set of the concepts for improvement, each being an answer to the need of quick and effective way of replenishment along the supply chain.

The most important tasks embrace:

- operational perfection – a basis for improvement in business partners relations;
- reactive stocks refilling – moves stocks from preparation stage, which allows reacting to changes in consumers' purchase – related habits;
- integrated deliveries reliant upon demand (depending on company's efficiency) – a contribution to a very quick reaction of the logistic channel, as in principle it is a more flexible production management, dependent on the real demand.

**The realization of this area requires considering the following:**

- it is often the basic source of cost reduction, which is of special meaning in a situation when the profit growth or price reduction are of key importance.
- the influence on sales and market share is less direct than the one the demand side has, yet products must be secured to be delivered on time to a specified place;
- cooperation among different companies belonging to a given supply chain is easier, when compared to the one that occurs between the retailer and the consumer;

**The third – supporting technologies** whose aim is to develop product's identity, manage data and ensure communication and goods traffic among partners within the Eurologistic channel. The above area requires:

- EDI which facilitates and automates communication, orders, deliveries, invoices and payments within the company or among partners;
- data warehousing which is one of key factors when it comes to rising supply and demand;
- Activity Based Costing method which is the command of cost sources and possible influence on decision making, a basic tool to manage supply and demand;

The natural evolution of supporting technologies like standardization of EDI reports, bar codes or product numbers is a prerequisite for many innovations connected with the ECR. Current possibilities determine the effectiveness of the ECR processes and the pace at which those solutions will be introduced. (as shown by the effects of the pilot programs).

**The fourth** – integrates actions where two concepts meet. The first is *cooperation* in planning and restocking, a drive for reactive replenishing stocks within the chain. The other is the e-B2B – a portal enabling people to do business by using common, standard infrastructure. At first the two concepts seem independent of each other, but when implemented, they get integrated and become a hybrid solution.

The most significant tasks in this area include:

- revealing and sharing the arcana of company management leading to the improvement of its operation;
- creating an electronic market available to all parties concerned;
- creating a widely accessible IT support system: sales and purchase, forecasting, planning and supplies replenishment.

Integrated actions will exert a considerable impact on the whole business environment, as they contribute to:

- accelerated development and product delivery;
- extension of geographical range;
- greater efficiency and effectiveness of actions;
- products and services adjustment;
- better use of information in more flexible structures and models of enterprises.

In order to achieve success it is essential to identify and take advantage of various opportunities instead of relying solely on the latest technology advances.

The implementation of the ECR strategy should provide clear and notable benefits, among which we include<sup>38</sup>:

- for the consumer:
  - a wider range of goods and comfort shopping;
  - less frequent supply shortages;
  - fresh and cheap products;
- for the broker:

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<sup>38</sup>*Logistyka dystrybucji...*, op. cit., p. 233.

- greater consumer loyalty;
- better market orientation;
- supplier relationship improvement;
- for the supplier:
  - streamline production synchronization;
  - supply shortage reduction;
  - strengthening brand position;
  - long - lasting trade relations.

## 2.6. SCOR – the Supply Chain Operation Reference model

In 1966, the SCC (*Supply Chain Council*)<sup>39</sup>, the organization standardizing supply support systems published the **Supply Chain Operation Reference model** (SCOR), which is used for description and comprehensive analysis of the supply chain<sup>40</sup>. This model is continuously updated; the latest version of SCOR bears number 9, was published 2 May 2008 and has been successfully applied in Euro-logistics.

The SCC's SCOR model is defined as a comparison of standard supply chain processes with best practice estimated on the basis of corporate companies such as BAYER, IBM, DHL, GS1, Hewlett Packard, IKEA, Boeing, Cisco Systems and others.<sup>41</sup>

This model is designed to<sup>42</sup>:

- facilitate efficient communication for the managers;
- make comparisons, drawing knowledge from competitors and other companies, within the industry and beyond;
- perform assessments of one's own supply chains, including the Euro-channels;
- perform measurements of particular logistics processes in the Euro-channels;
- mixing the elements of business process engineering, benchmarking and the SCM leaders.

In the SCOR<sup>43</sup> model, all logistics processes are divided into 6 types<sup>44</sup>:

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<sup>39</sup>SCC *Supply – Chain Council* supports best practices implementation in logistics management, by defining organizational models that optimize goods and information flow processes in complex organizations.

<sup>40</sup>Systemy, 15.11.2013.

<sup>41</sup>Cf. *Instrumenty zarządzania łańcuchami dostaw*, M. Ciesielski (ed.), PWE, Warsaw 2009, p. 167.

<sup>42</sup>Ibid., p. 168.



- planning – concerns such areas as e.g.: demand, Euro - logistic channel performance, the size of inventories, database creation;
- acquisition – in these area such things are agreed on as: transport, the manner of sending and reception, shipping insurance conditions, manner of strategic purchasing implementation etc.;
- manufacturing – this area includes production planning, packaging, reporting demand for materials, storage and issue of manufactured goods;
- delivery – includes the management of: orders, inventory of finished products, transport, transaction documentation etc.;
- returns – concerns the returns of finished products, made for different reasons, as well as the returns of components and raw materials purchased for production and no longer needed;
- enabling – creating the right atmosphere, for example by shaping the desired level of trust, or partnership between the Euro-logistic channel participants.  
The SCOR model includes three levels of processes:
  - types – presented in the above outline;
  - categories, e.g. supply chain planning, supply planning, production planning;
  - elements, e.g. for supply: ordering, delivery, acceptance, dispatching of goods etc.
 Supply chain planning involves:
  - identification, prioritizing and aggregating demand in the supply chain;
  - identification, assessment and aggregating of the supply chain resources;
  - balancing of supply chain resources with supply needs;
  - setting and communicating supply chain plans.

## 2.7. VMI – Vendor – Managed Inventory

Cost-reduction, shortening the time of reaction to the customer's needs and the optimization of inventory level in the supplier-customer relation are the main areas of interest and management in Euro-logistic channels.

The objectives of inventory management include<sup>45</sup>:

- ensuring appropriate customer service level, both internal and external, with attention paid to quality and to the approach to all realized orders;

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<sup>43</sup>The SCOR model does not include such elements as: sales administration, technological development, designing, after-sales service.

<sup>44</sup>[http://technologie.nf.pl/Artykul/8256/Str\\_5/Przeklad-Lancucha](http://technologie.nf.pl/Artykul/8256/Str_5/Przeklad-Lancucha), 15.11.2013.

<sup>45</sup>Cf. [http://mfiles.pl/pl/index.php/Zarz%C4%85dzanie\\_zapasami](http://mfiles.pl/pl/index.php/Zarz%C4%85dzanie_zapasami), 16.11.2012.

- observation of the current and future demand for all the goods necessary to avoid surpluses and shortages in production.
- minimizing the costs by reducing the diversity of inventories, establishing economical sizes of particular orders and analyzing the costs of inventory creation and maintenance.

Companies have a wide range of inventory management methods at their disposal<sup>46</sup>. The basic traditional methods used in inventory management include ABC, XYZ, the Economic Order Quantity model (EOQ), the inventory control models, the investment approach, the MRP (Materials, Requirements Planning) systems, the DRP (Distribution Requirements Planning) system, the JiT (Just in Time) system.

Other models of inventory management on the strategic and operational level include:<sup>47</sup>

- co-managed Inventory (CMI) – the supplier and the customer jointly carry out activities aimed at reducing inventory levels; they jointly shape the availability of products within a supply chain (they exchange information on sales forecasts, promotional actions etc.)
- *Collaborative Planning, Forecasting and Replenishment* (CPFR) – is a strategy developed on the basis of ECR. It involves the co-management of the planning processes, forecasting, and replenishment of inventories both by the supplier and the receiver of the goods, and it requires full information exchange on the key data, as well as joint explanation of any alterations from the objectives assumed);
- *Vendor – Managed Inventory* – here, the supplier is responsible for maintaining appropriate inventory levels at the customer's. Also, often (but not always) the given supply – until the moment it is taken – is owned by the vendor (consignment inventory); requires full exchange of key information and access to it.

Professor K. Rutkowski provides several definitions of VMI<sup>48</sup>:

- a process within which the vendor generates orders for their customers, basing on information sent by the customer themselves (in this process, the

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<sup>46</sup>Cf. chapters 4 & 5 A. Szymonik, *Logistyka i zarządzanie łańcuchem dostaw*, Difin, Warsaw 2010.

<sup>47</sup>Cf. <http://twojbiznes.infor.pl/index.php/dzialy/praktyka/artykul - 984456.html>, 16.11.2012.

<sup>48</sup>[http://www12.sap.com/poland/solutions/business-suite/scm/events/logistyka\\_03/presentations/](http://www12.sap.com/poland/solutions/business-suite/scm/events/logistyka_03/presentations/), 15.11.2013.

vendor is guided by jointly established objectives concerning inventory level, order realization and transaction costs indices);

- a means to optimize effects within the supply chain, assuming the responsibility of the manufacturer for keeping appropriate inventory levels at their customer's (the producer has access to the customer's data concerning inventories and is responsible for generating the customer's orders);
- the planning and management system which is not directly linked with inventory ownership (in this system, instead of monitoring the sales and inventories, in order to generate orders for replenishment by the customer themselves, the vendor takes over the responsibility for them).

Starting cooperation according to the VMI principles must be done with mutual consent of both parties. However, very often either the vendor or the receiver imposes this form on the other, as a condition necessary for cooperation. This may stem from both the tender forces or the information and technological requirements the imposing party may have.

Benefits and facilitations drawn from VMI may concern:

- both parties – error reduction in the data and the operations performed, improvement in the speed of the process, involvement in raising standards of final customer service, cooperation enhancement, reduction of required working capital, time compression, reducing the number of returns and emergency supplies;
- manufacturer or distributor – reduction of inventory shortage and their general level, lowering the planning and ordering costs, customer service level improvement, transferring the responsibility for inventory maintenance onto the supplier, simplification of administrative procedures, securing the enterprise against bad situation on the markets of supplied materials and components, involvement necessary only in case of problems;
- supplier – minimizing errors in forecasting, the impact of promotion is easy to include in inventory planning, reduction of errors in orders, the knowledge of inventory status allows to use priorities in the realization of supplies, anticipating the needs before their actual occurrence, optimization of production, reduction of errors in forecasting, stability of relationship with the customer;

- all participants – higher customer retention<sup>49</sup>, lessening insecurity as to the amount of demand, lower inventories required for particular parts of the supply chain.

The implementation of VMI brings about additional costs both on the side of the customer and the supplier – mainly the supplier. Professional inventory management methods and tools usually effortlessly bring the lowering of inventories, while the program itself, through natural imposition of data exchange regularity, stabilizes the supply plans and allows to and makes it possible to include the VMI customers in delivery schedules and transport routes. It is the stability, enabling the cost reduction as regards manufacturing and/or distribution, may be the biggest immediate benefit for the supplier.

Other benefits for suppliers include<sup>50</sup>:

- access to information about the actual end demand;
- stabilization of demand by preventing excessive or too small shipments at the end of the month, associated with the desire of the *customer* to reduce the accounting inventory at the end of the month;
- building relationships with *customers*, also on the operational level, not just concerning sales;
- creating opportunities for informal communication with the *customer*, concerning the products, quality service, competitive activities, special needs of the customer etc.;
- motivation of employees who, working in VMI, deliver an inventory management service that is still unique in Polish reality;
- creating a competitive barrier, by enriching one's goods with real added value for the *customer*, connected with taking over the activity regarding inventory management;
- the possibility to prevent a fall in sales through early detection of declining consumption at the *customer*, and consequently, the ability to search for the root cause of such decline.

From the perspective of the *supplier*, one must always balance the VMI program implementation and maintenance costs with potential benefits.

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<sup>49</sup>Retention – *Holding up, legally justified detention of someone else's property, or the right to keep the belongings of the debtor, which the creditor has under particular circumstances, as per Słownik języka polskiego (Polish Language Dictionary) online.*

<sup>50</sup><http://www.mpm24.com/strony/2/i/106.php>, 15.04.2013.

### 3. Logistics centers

#### 3.1. Definition and functions of logistics centers

One of the conditions for the efficient movement of products in Euro-logistics is to create nodal points of modal logistics network, which in practice, depending on the time of formation, classification, purpose and strategy would be called:

- storage building (object);
- storage center;
- logistic services center;
- distribution center;
- logistics park;
- logistics center;
- logistics hub<sup>51</sup>.

Apart from the above-mentioned, network nodes include also seaports, airports, inland ports, package sorting places, intermodal freight terminals.

In practice, the most commonly used name is logistics center, distribution center, storage center, warehouse.

In foreign literature, different names are used to describe the logistics center: *plater-formes multimodales* (French), *freight villages* (English), *Guterverkehrszentrum* (German) and *interporto* (Italian)<sup>52</sup>.

The type of node we deal with is dependent on the range of services it provides. And so, the most common example are:

- warehouse – for cross docking, freight forwarders, customs clearance, warehousing, sorting;
- storage center – apart from those mentioned for the Warehouse, provides telecommunications services;
- logistics center – performs operations as a warehouse or a storage center; besides, provides financial and insurance services, packaging, maintenance and repair of vehicles and transport equipment, fuel sales, social services - welfare, medical assistance.

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<sup>51</sup> hub – the main transshipment point (node) of the network based on hubs and terminals, connected to one another by public road, rail, sea or air; Hubs may be connected to other hubs or terminals, while the terminals are connected only to hubs, studio.s306.w.interia.pl/sped/pliki/leksykon%20spedytora, 22.07.2013.

<sup>52</sup> A. Montwiłł, *Zasady działania i organizacja centrów logistycznych*, [in:] *The Logistyka Magazine* 5/2012, p. 16.

The scope of operations performed by a warehouse, a storage center or a logistics center is related to the number of buildings, the space, the degree of mechanization and automation, the number of employed staff and investors (storage centers – in most cases one investor – developer, logistics centers – many investors).

In professional literature, one may come across different definitions of the above-presented node modal points, which are the elements of the European logistic network. And thus:

- A logistics center is a spatial object with appropriate organization and infrastructure that enables various independent companies to perform operations on the goods in connection with their storage and movement between the sender and the recipient, including support for intermodal transport and providing users with a variety of additional services<sup>53</sup>;
- A distribution center – is an organizational unit dedicated to the storage of goods owned suppliers and their allocation to recipients according to specific features of the owner of the goods<sup>54</sup>;
- A storage center – a spatial object with appropriate organization and infrastructure for different independent enterprises performing operations on the goods in connection with the storage and movement between the sender and the receiver<sup>55</sup>;
- A warehouse – a functional and organizational unit, designed for storing inventory in especially adapted space (storage buildings), basing of established technology, using technical equipment and means, manager knowledge and a team of people with appropriate skills<sup>56</sup>.

The basic and main task performed in logistics centers is the transshipment of intermodal transport units (containers, swap bodies and semi-trailers), additionally providing services that are not directly linked with logistics.

Within the activity of logistics centers, we distinguish three kinds of functions:

- logistics – related:
  - transport,
  - storage,
  - inventory management,

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<sup>53</sup> Cf. *System logistyczny Polski*, M. Jacyna (ed.), Warsaw University of Technology, Warsaw 2013, p. 87.

<sup>54</sup> *Słownik terminologii logistycznej*, M. Fertsch (ed.), ILiM, Poznan 2006, p. 27.

<sup>55</sup> Cf. *System logistyczny Polski ...*, op. cit., p. 86.

<sup>56</sup> <http://www.abc-ekonomii.net.pl/s/magazyn.html>, 05.05.2013.

- order management,
- transshipment on container terminals,
- packaging,
- completion;
- auxiliary:
  - forwarding,
  - customs service,
  - insurance,
  - rotation system collecting reusable transport packaging,
  - rental of containers, pallets and other transport packaging,
  - Information and IT services,
  - promotion and marketing;
- additional:
  - technical maintenance of vehicles,
  - sale of fuels, oils and accessories,
  - repair of containers and other transport packaging,
  - hospitality services,
  - catering services,
  - banking services,
  - financial and accounting services,
  - telecommunications services,
  - parking services.

Logistics centers services are often used by manufacturing companies; there, they perform processes related to supplies, assembly and distribution. In such case, the functions performed by the producer include the following spheres<sup>57</sup>:

- supply – the reception and storage of goods for production, supply consolidation of supply for the production, assembling assembly kits, delivery of goods to manufacturing companies, including sequential supply of production lines;
- production – subassembly (e.g. welding the sheets of metal car body) and installation teams away from the primary manufacturing site;
- expertise – services requiring compliance e.g. with EU HACCP requirements for transport (refrigerated trucks), storage (temperature, humidity), distribution of food;

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<sup>57</sup> [http://www.google.pl/#hl=pl&gs\\_rm=12&gs\\_ri=psy-](http://www.google.pl/#hl=pl&gs_rm=12&gs_ri=psy-), 05.05.2013.

- coordination – action between the sphere of production and the sphere of services-packaging products, co-manufacturing<sup>58</sup>;
- distribution – final assembly, packaging, delivery.

### 3.2. Classification of logistics centers

Economic growth is closely related to the development of logistics, which needs to meet customer's expectations and bring profits. The main kinds of inspiration for establishing logistics centers are:

- the increase in meaning customer service quality;
- compression of time;
- cost reduction;
- globalisation;
- organizational integration.

In professional literature, one may come across a multi-aspect approach to the division and classification of logistics centers. Below, there are some of them:

Due to integrity<sup>59</sup>:

- focused – infrastructure and buildings owned by the logistics center or individual users are located in one area subject to the rules set by the management board;
- modular – logistics center within the area defining its boundaries is functionally divided into separate units subordinated to the common rules of operation set by the operation purpose of the logistics center, but whose ownership structure, organization and governance can be varied;
- dispersed – organizationally uniform but divided into parts; spatially separated for various reasons: the availability of real estate, infrastructure, planning or economic conditions, local economic or planning policy objectives, etc.

Due to ownership:

- public-private – logistics centers usually initiated by the public sector, where its investment contribution has the form of legal and administrative measures to enable (facilitate) the realization of the investment, real estate, financial and tax decisions (planning fee, local taxes, etc.) and investment in the development of local infrastructure, including transportation infrastructure

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<sup>58</sup> *Co-manufacturing* means assembling products out of parts sent by different producers, precisely in response to a given order from the customer.

<sup>59</sup> Cf. *Logistyka*, D. Kisperska-Moroń, S. Krzyżaniak (eds.), Biblioteka Logistyka, Poznan 2009, pp. 287-290.



etc., while the private sector is involved in capital investment, implements and finances infrastructure and facilities for their own use and usually performs management functions in the logistic center after it is set up.

- private – built with the investor’s own resources; with functional and infrastructural orientation on the market-related goals

Due to the type of handled goods:

- universal – providing the possibility of stockpiling without restrictions as to their nature and physical form;
- industry – limiting the type of collected inventory to specific ranges, which stems more from the concentration of a particular production type in its environment (e.g. industry cluster solutions) than from self - restraint or either administrative or legal factors.
- specialist – specialization may result from the specific characteristics of a given product or the required additional credentials to perform the usual operational activities – for example, chemical products requiring specific procedures related to the need to provide special safety requirements for storage and transport.

Due to the extent of the impact and type<sup>60</sup>:

- international – 500-800 km radius of impact the highest degree of expansion of the organizational and functional management area 100-150 ha – developed logistics infrastructure, full IT system and extensive logistics services provided;
- regional – 50-80 km radius of influence; an indirect link in the logistics channels, with well-developed logistics infrastructure and information system;
- local – radius of influence, the lowest level in the system of logistics centers, with limited logistics infrastructure.

The important division of logistics centers seems to be the one in terms of function (purpose) that they play in the economic system of the country. In this respect, we should distinguish three types of logistics centers:

- The logistics centers that constitute the public national infrastructure, including<sup>61</sup>:
  - logistics centers for harmonized service of the urban and industrial agglomerations – the so-called *city-logistic* (the purpose is to reduce traffic in city centers, at the same time preserving the same level of supplies);

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<sup>60</sup> W. Piekarski, S. Juściński, *Centra logistyczne w Polsce po wejściu do unii europejskiej*, [in:] *Eksploatacja i niezawodność* nr 4/2005, s. 46.

<sup>61</sup> Por. W. Paprocki, J. Pieriegud, *Rozwój centrów logistycznych*, <http://www.google.pl>, 06.05.2013.

- logistics centers as international trade points (this function is performed by the logistic centers in sea ports and on the premises of the so-called dry ports, located within the land border crossings).
- Logistics centers that fulfill own needs of economic entities:
 

In case when industrial or trade entities, thanks to the implementation of the logistics management concept (SCM – Supply Chain Management), are able to define their logistics processes and assess the costs of particular phases of these processes, appropriate conditions occur for the verification of placing, structure and organization-related decisions.
- Logistics centers as a service commissioned by logistics operators – the so-called 3PL (third party logistics). Operators can own logistics infrastructure points, use it on lease or rent or provide services on the premises owned by industry and trade companies.

### **3.3. Equipment and infrastructure of a logistics center**

The purpose of a logistic center is first and foremost<sup>62</sup>:

- a 24/7 comprehensive servicing of the flow of material and goods together with the provision of all welfare services to the drivers and other employees;
- provision of a comprehensive storage service;
- provision of all handling-related works, such as loading, transshipment and unloading of products.

For appropriate realization of these tasks, the company running a logistics center must have appropriate facilities and infrastructure for the creation and management of supply chains. They include:

- administrative buildings (e.g. management and administration office, foreman and team leader office, information traffic management office);
- storage buildings and structures, allowing storage and protection of inventory;
- storage equipment (shelves, the means for moving products, measurement and control equipment, fire protection equipment etc.);
- means of transport for the movement of products both within the enterprise and between suppliers and customers;
- equipment for loading and unloading;
- internal roads and access roads, mainly for cars, but also for the wagons;

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<sup>62</sup> I. Pisz, T. Sęk, W. Zielecki, *Logistyka w przedsiębiorstwie*, PWE, Warsaw 2013, p. 275.

- packaging that fulfill protective, storage, transport, handling, information and advertising functions;
- reusable loading units, such as pallets or containers;
- buildings and offices related to the functions of auxiliaries and additives (e.g., service stations, petrol stations, social and living rooms, banking services, insurance );
- equipment and safety-related measures such as ESFR<sup>63</sup> sprinklers, vents, emergency exits, emergency power-battery room, fire and smoke detectors, 24/7 security-monitoring.

Taking into consideration the scale and complexity of the processes carried out in a logistics center, such objects constitute the key link of a supply chain. However, a big scale of the undertaking or even significant operational space make the realization of the requirements to be a huge design and operational challenge. The growing customer demands, mainly as regards the speed of service and flawless competence of the orders, as well as the need to minimize operational costs of company functioning, underlie the tendency do the widest possible automation and computerization of logistics processes. Automation includes the processes of physical handling of the cargo, while the information systems take over the management functions (inventory, equipment automation and operational data) and the operational service for logistics processes.

Among the processes of physical cargo handling that undergo extensive automation, we may distinguish, among other things:

- storage – the main components of automated high-bay warehouses are specialized rack systems, automatic stacker cranes, material handling equipment and control systems, information systems, adequately standardized loads, e.g. Euro pallets;
- internal transport – the use of automatic self-steering trucks (AGV), overhead cranes, solid conveyors, cranes, rack stackers and rail trolleys allows for the elimination of human labor;
- order picking, sorting, expedition – it would not be possible to improve these processes without automatic identification using a variety of instruments and tools which include:
  - light download signaling,

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<sup>63</sup> ESFR – *Early Suppression Fast Response*.

- RFID (*Radio-frequency identification*) – a technique that uses radio waves to transmit electronic data and power to an electronic circuit being the label of the object, to identify it by means of a reader,
- voice systems – the use of voice technology provides an easy, two-way means of communication between the computer system, such as WMS<sup>64</sup> and the user, e.g. a warehouse worker,
- a barcode reader, commonly called a scanner, is a device that converts light reflected from the bar code to an electronic signal, understandable for a cashpoint or a computer,
- RF Terminals – wireless exchange of information via radio on-line; such terminals are often equipped with a barcode scanner,
- computers mounted in vehicles and portable computers – have an advantage over handheld devices; equipped with user-friendly interface.

An essential component of the technological equipment in a modern logistics center are, next to the automation systems, integrated IT systems.

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<sup>64</sup> WMS (*Warehouse Management System*) – warehouse management supporting system, supervising the rational distribution of stocks, using ADC techniques.

## 4. Transport for the needs of international logistics

### 4.1. Transport classification by EU standards

**On the basis** of the Regulation of the Cabinet of 24 December 2007 on the Polish Classification of Activities (Polska Klasyfikacja Działalności, PKD) a system was created that describes the type of economic activity run by all kinds of economic entities.

PKD was based on the statistical classification of economic activity NACE<sup>65</sup> rEV2, implemented with Regulation (EC) No 1893/2006 of the European Parliament and of the Council of 20 December 2006 establishing the statistical classification of economic activities NACE Revision 2 and amending Council Regulation (EEC) No 3037 / 90 as well as certain EC Regulations on specific statistical domains (Official Journal of the European Communities L 393/1 of 30.12.2006).

In the PKD classification, transport activity is included in “Section<sup>66</sup> H” – Transport and storage economy in four sections – Appendix 2.1<sup>67</sup>:

- 49 – land transport and transport via pipelines;
- 50 – water transport;
- 51 – air transport;
- 52 – storage and support activities for transportation.

**Section H – *Transportation and storage*** includes:

- activities related to the transport of persons or goods carried out by rail, pipeline, road, water or air;
- transportation assistance activities provided by the stations, airports, railway stations, bus stations, etc., the terminals in the control of movement, passenger service, baggage and cargo control;
- renting of transport equipment with driver or crew;
- postal and courier activities.

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<sup>65</sup> NACE is an acronym of a French – *Nomenclature statistique des Activités économiques dans la Communauté*

<sup>66</sup> Section is marked by a single letter; it divides the total of 21 activities, which include activities related to each other as seen from the perspective of traditionally shaped, general division of labor <http://www.epodatnik.pl/index.php/pkd/138-pkd-objasnienia/543-pkd-zasady-budowy-klasyfikacji>, 12.05.2012.

<sup>67</sup> Department – is marked with two-digit numerical code, divides the total of the 88 grouped kinds of economic activity, which include some operations with features which are essential both for calculating the degree of similarity, as well as are useful when considering the relationships in the national economy (e.g. input-output tables), *ibid*.

### **The section on land and pipeline transport includes:**

- passenger rail interurban transport, where the subclass<sup>68</sup> includes:
  - nation-wide passenger transport, performed via magisterial networks all over the country,
  - intercity passenger rail,
  - sleeping and restaurant cars provided within the rail company,
- rail transport of goods – including:
  - rail transport of goods, both on magisterial and local networks;
- land passenger transport, urban and suburban – including:
  - urban or suburban passenger transport, carried out with the means of inland transport, such as busses, trams, trolley buses, aboveground or underground rail etc., on established routes, basing on an itinerary that includes letting the passengers in and out at fixed stops.
  - passenger transport on routes between an airport or railway station and the city center,
  - the activity of aboveground cable rail, cable cars etc., provided that they belong to the urban or suburban communication system.
- the activity of passenger taxis – this subclass includes:
  - transporting individual passengers to places specified by them,
  - renting passenger cars and vans ( $\leq 3,5$  t) with the driver;
- road transport of goods – this subclass includes the transportation of goods, performed with road transport modes, adapted to carry:
  - logs,
  - livestock,
  - frozen or refrigerated goods,
  - heavy goods,
  - bulk commodities, including milk tanker transport from the farm,
  - cars,
  - waste and recycled materials, with the exception of their collection and disposal,
  - car with driver hire,
  - transportation of cargo using vehicles propelled by force of human or drawn by animals.

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<sup>68</sup> Division – it was introduced in order to identify specific activities for the Polish economy that are subject to statistical observation. If at the national level has not been further divided on the sub-class level as related to the international level (class = subclass), such subclass is designated with letter Z, *ibid.*

### **The water transport section includes:**

- sea and coastal passenger transport – this subclass includes:
  - passenger transport on the high seas and coastal waters, scheduled or unscheduled,
  - activity of excursion boats and other vessels,
  - activity of ferries, water taxis, etc.,
  - boat and coastal shipping and crew rental for recreational purposes (e.g. for fishing cruises);
- sea and coastal freight of goods – including:
  - transport of goods on the high seas and coastal waters, scheduled or non-scheduled,
  - towing and pushing of barges, oil rigs etc.,
  - sea and coastal water transport rental for transportation of goods, with a crew;
- inland waterway freight – including:
  - passenger transport on inland water routes; rivers, canals, lakes as well as inside ports, bays and in docks,
  - inland waterway transport boats hire with a crew, for recreational purposes;
- inland water transport of goods – including:
  - transportation of goods on water inland routes; rivers, canals, lakes, inside ports, bays and in docks,
  - cargo water transport vessels hire with crew included;

### **The air transport section includes:**

- passenger aircraft transport – including:
  - passenger aircraft on fixed routes and according to the established timetable,
  - charter flights,
  - scenic and cruise flights,
  - air passenger transport hire, with crew,
  - general aviation-related activity, such as passenger transport organized by aero clubs for training or pleasure;
- air transportation of goods – this subclass includes:
  - air freight services on fixed routes and according to the established itinerary,
  - air transport of goods not covered by the itinerary,

- aircraft and crew hire for transportation of goods;
- space transport – including:
  - sending satellites and vehicles to space,
  - space transport of passengers and goods.

**The warehousing and transportation supporting activities section includes:**

- warehousing and storage of gaseous fuels – including:
  - activities related to warehousing and storage of gaseous fuels, excluding this part of the installation that is used for production and the installations used for performing tasks of the gas fuels transfer system.
- warehousing and storage of other goods – this position includes:
  - warehousing and storage of all kinds of goods (excluding gaseous fuels) in grain silos, general purpose cargo warehouses, cold storage, warehouse tanks etc.
  - storage of goods in in duty-free zones;
  - freezing of goods;
- service activities supporting land transportation – this subclass includes:
  - activity related to the land transport of passengers, animals and goods, the activity of terminals such as railway and bus stations, stations for cargo, activity related to rail infrastructure, activity related to bridges, tunnels, car and bike parks, garages and storage spaces for storing caravans in the time of winter,
  - railway shunting works,
  - towing and roadside assistance,
  - condensation of gas for further transport;
- support activities for transportation by sea – the subclass includes support activities for sea transport of passengers, animals and goods, such as:
  - port terminal operations,
  - activity connected with navigation, pilotage and berth places,
  - lightering (re-loading part of cargo to other vessel to reduce the draft),
  - marine rescue operations,
  - lighthouses;
- service activity supporting inland waterway transportation – this includes service activity supporting inland waterway transportation of passengers, animals and goods, such as:
  - harbor terminals activity,
  - waterway locks,



- activities related to navigation, pilotage and berth place,
- lightering (reloading of the cargo to another vessel in order to reduce the draft of the vessel);
- service activities supporting air transportation – this subclass includes the activity supporting air transport of passengers, animals and goods, such as:
  - the activity of terminals, such as: airport stations and harbors etc.,
  - air traffic control,
  - land aircraft handling etc.,
  - fire-fighting and fire protection services at airports;
- handling of goods in seaports – the subclass includes:
  - loading, unloading and handling of cargo and luggage of passengers in seaports.

## 4.2. Intermodal transport

Fulfilling the expectations contained in the White Paper, published in May 2011, entitled: *Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System*, means, first of all the implementation and development the so-called intermodal transport in freight transportation.

In subject-related literature, intermodal transport is defined as:

- type of transport involving shipment of cargo with transport means belonging to different transport modes (meaning that in order to transport the cargo, more than one transport mode is used, where at the same time only one type of unit load – e.g. container – is applied along the whole transportation route)<sup>69</sup>;
- transportation of goods in one and the same unit load (transport vessel), known as ITU – *Intermodal Transport Unit* – without reloading the goods themselves in the changing transport modes<sup>70</sup>;
- transportation of cargo in unit loads with the use of transport means from at least two different transport modes, based on unified conditions resulting from the intermodal transport agreement, concluded between the client and the operator of intermodal transport<sup>71</sup>.

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<sup>69</sup> [http://mfiles.pl/pl/index.php/Transport\\_intermodalny](http://mfiles.pl/pl/index.php/Transport_intermodalny), 12.07.2012.

<sup>70</sup> <http://www.cargosped.pl>, 12.07.2012.

<sup>71</sup> J. Najder, *Transport międzynarodowy* [International Transport], PWE, Warsaw 2012, pp. 112, 113.

In practice, intermodal transport is often described as<sup>72</sup>:

- combined – intermodal transport where the main part of shipment is carried out by rail, inland waterway or sea route, and only the short initial and/or final part is carried out by road transport, or
- multimodal – transportation with at least two different transport modes.

The analysis of the above definitions allows to conclude that wherever we deal with unit loads, it is permissible to use the "combined" and "intermodal" notions interchangeably (using the term "multimodal" in this context is incorrect).

Intermodal transport is characterized by:

- the use of at least two transport modes;
- increasing the number of possible transport options (especially significant in international and intercontinental transport);
- presence of only one single transport agreement;
- reduction of goods damage risk;
- the necessity of there being only one supplier responsible for the entire course of delivery;
- one pricing rate for transport covering the whole route;
- goods are subject to trans-shipment along with the entire unit load (e.g. a container, transport facility or transport means);
- multimodal transport division;
- with regards to range – transportation:
  - nation-wide,
  - international,
  - continental,
  - intercontinental;
- with regards to the type of the unit loads used – transportation of:
  - containers,
  - trailers,
  - swap-over carriage,
  - trucks,
  - specialized containers;
- with regards to the type of the transport means used – transportation type:
  - rail-road,
  - rail-road-sea,

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<sup>72</sup> Ibid., p. 10.

- rail-road-air,
- rail-road-river;
- with regards to the manner and nature of organization – transportation:
  - conventional,
  - modern (operator) – with full appliance of logistics services.

In Poland, the intermodal transport share on the rail transportation market – according to the statistics of the Rail Transport office – by the end of 2012 was 3.48% by mass and 6.12% by the transport work performed. In Poland, intermodal transport accounts for ca. 4.5% of all rail transportation. In Germany, similar to the Netherlands, the figure is 30%, while in Norway – 60%. Also in the countries of our region, the Czech Republic or in Hungary, the meaning of intermodal transport is bigger than here. The European Union average is (15-17)%<sup>73</sup>.

In the opinion of Polish shippers, the barriers of intermodal transport may include<sup>74</sup>:

- high fees for access to the railway infrastructure – 98.3%;
- lack of co-funding of intermodal transport by the State – 93.3%;
- poor quality railway infrastructure, low commercial speed – 96.7%;
- high costs of terminal investments – 76.7%;
- small number of terminals and transfer points – 71.1%;
- lack of specialized rolling stock – 61.7%;
- difficulties in access to the point infrastructure – 58.3%;
- the level of competition in the market for rail intermodal transport – 51.7%.

### **4.3. Companies of transport and logistics services area**

According to the analyzes contained in the White Paper, in the nearest years we will witness the significant increase in road freight of goods in the EU countries. The European experts predict that the value of these operations, which in 1990 amounted to 118 billion tkm will in 2020 reach the level of 320 billion tkm. On the territory of the 28 Member States, within these 30 years, the share of car transportation will rise from 60% in 1990 to 75% in 2020<sup>75</sup>.

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<sup>73</sup> F. Nietz, *Czas dogonić intermodal*, [in:] TSL biznes, 5/2013, p. 24.

<sup>74</sup> Ibid, p. 26.

<sup>75</sup> M. Kadłubek, *Wybrane prognozy rozwoju sektora zarobkowego transportu samochodowego ładunków w Polsce*, [in:] *The Logistyka Magazine*, 4/2010, CD 1.

As the figures reveal, the number of shippers in Europe will not decrease, because the number of transported goods will be growing. On the European market, there are very many companies operating on the TFL market, As per 2001, the leaders, according to the ranking developed by Armstrong and Associates<sup>76</sup>, include<sup>77</sup>:

- DHL, operating in over 220 countries and regions, which makes it the most international company in the world. Employing over 285 000 people, they provide solutions for an almost infinite number of logistics needs. DHL is a part of a leading company in the field of postal and logistics – Deutsche Post DHL and consists of the following divisions: DHL Express (Shipping urgent documents and goods from the sender to the recipient in more than 220 countries and regions, using the widest global express transportation network), DHL Global Forwarding Freight (caters for the diverse logistic needs of customers – from standard logistics and multimodal transport solutions to individual industrial projects; the annual goods transportation amounts to 2.7 million TEUs<sup>78</sup> and 2 cubic millions of small cargo; 2 million shipments are handled per year). DHL Supply Chain (market leader in contract logistics – income in 2011, \$ 4.1 billion, providing storage for 456 warehouses of 10 mln square meter area, transport and enriched services; it also offers solutions regarding information management and intercompany communication). DHL Global Mail (DHL global specialist in the provision of services tailored to customer needs in the field of B2C mail forwarding, featuring the largest network provider on five continents)<sup>79</sup>.
- Kuehne + Nagel was founded in 1890 in Bremen, Germany. A traditional international freight forwarding company, Kuehne + Nagel has evolved into a leading logistics provider on a global scale. Headquartered in Schindellegii in Switzerland, the company employs 55 000 employees in 900 locations in more than 100 countries. The strong position of the Group lies within maritime, air and road transportation, as well as contract logistics realized with the support of modern integrated IT solutions. The logistic network, modern IT solutions, and the highest level of the services provided allow to

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<sup>76</sup> Armstrong & Associates, Inc – in business since 1980, is a well-known leader in the field of supply chain research and advisory services on the market. The company develops data on 3PL companies.

<sup>77</sup> [http://www.3plogistics.com/Top\\_25\\_Global\\_FF.htm](http://www.3plogistics.com/Top_25_Global_FF.htm), 14.08.2013.

<sup>78</sup> TEU – *twenty-feet equivalent unit* – volume unit often used in relation to ports and ships; It is equivalent to the volume of the container with a length of 20 feet.

<sup>79</sup> See. <http://www.dhl.com.pl>, 11.08.2013.

continuously improve the range of services within transport, freight and logistics area. Kuehne + Nagel is also one of the leading logistics companies present on the Polish market since 1991. The company offers its services in twelve cities, in ten offices and eleven logistic center, with the total area of 175,000 m<sup>2</sup>. 1500 qualified employees provide support to customers, both Polish and international corporations. The company also owns 50 customs agencies<sup>80</sup>.

In Poland, in recent years, we observe development in transport, freight and logistics industry. This has been caused by:

- increasingly better point and line infrastructure;
- inflow of financial assistance of the European Union for investment and modernization of transport infrastructure;
- constant development of the cargo handling capacity of seaports, especially in handling containerized cargo and an increase in the number of container terminals “in the backup area” – that is deep in the country.

Comparing the transport work-related data, performed by the two main modes of transport in Poland to the results of the other 26 EU countries, one sees that Poland is in the second place in the group, behind Germany and ahead of France, Great Britain, Italy and Spain<sup>81</sup>.

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<sup>80</sup> <http://www.biurokarier.ue.wroc.pl/firma/1104/>, 20.08.2013.

<sup>81</sup> <http://www.outsourcingportal.pl/pl/outsourcing/artykuly/rynek-uslug-tsl-w-polsce.html>, 10.08.2013.

## **5. Documents in foreign and domestic transport**

### **5.1. Consignments**

The bill of lading is one of the key documents in transport services, both domestic and international.

It is a document that specifies the terms of the contract of carriage of goods. Typically, the shipper and the carrier construct it together, which states on the reception of the consignment for transport, and then give the sender a copy of this letter. Most often, it would be drawn up in four copies:

- original – for the carrier to be issued to the recipient;
- ridge – for the carrier, remains in the forwarding station;
- quotation – for the carrier, used for confirmation of receipt;
- repeater – for the sender.

Oftentimes, the bill of lading shall be the basis for customs control and toll collection for the transported goods.

The bill of lading the shipper shall include:

- the name and address of the sender, his signature and identification of the carrier facility that has the contract;
- the place of destination of the consignment and the name and address of the consignee;
- specification the item, weight, number of packages, the method of packaging and marking;
- other indications and statements required or authorized in accordance with the provisions due to the terms of the contract or billing method.

The sender attaches the documents required by the specific provisions to the consignment and, if unable to provide them he is to attach them later on at a pre-agreed place and time, then the consignment must include the appropriate reference of the before mentioned place. A properly drafted bill must include the physical list of the inventory, regardless if it is transmitted by air, land, water or multi-modal transport.

The bill of lading is evidence of transmission of the contracted goods to carrier by the exporter. The holder of the shipping documents has the right to dispose of the goods. It is not a contract of carriage, is only a confirmation of the contract of carriage.

Depending on the type of transport can distinguish, among others, the following types of international consignment documents:

- CMR, TIR Carnet – road transport;
- (CIM and SMGS) – railway transport;
- AWB, MAWB, HAWB – air transport;
- sea or river consignment.

**CMR** – an international consignment is the basic document on basis of which cargo is being transported (a document confirming the conclusion of the contract of carriage) in international communication. CRM is based on the Convention on the Contract in the International Carriage of goods *International Consignment Notes*.

CMR is issued in three copies, each of which has the same legal force. Freight does not sign the letter, because the job needs to be done by the sender, that is: it exposes the representative of the party who has the permit of transport, it also receives the first copy and the other is sent with the shipment, and the third retained by the carrier. Basic information in the list of CMR include: the sender, the carrier, the consignee of the goods, the date and place of origin, provided the place and approximate date of delivery, cost of transport, the instructions needed to take care of customs formalities and the list of documents handed to the driver. All parties have the opportunity to make changes in the bill of lading, and for damages and costs resulting from the administration of wrong or ambiguous data corresponds to the sender. CMR is populated in the language of the country of origin, is a personal document, not portable.

Across Europe, the adopted original consignment prints have the following colors<sup>82</sup>:

- the first copy to the sender in red;
- the second copy to the recipient in blue;
- the third copy to the carrier in green.

Each set also includes a consignment in white, which is not an original and is only intended to control (e.g. tariff).

In addition to the basic information of the sender, carrier and consignee the CMR should include information such as: the type of goods and the manner of its packaging, its weight, the cost of transport, the instructions necessary for the customs formalities, the statement that the carriage is subject to the provisions of the CMR. Parties may include other information that they deem necessary.

When the goods are accepted for the carriage convention imposes obligations on the carrier associated with:

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<sup>82</sup> <http://pkmc.ovh.org/index3.php?get=cmr>, 15.08.2013.

- checking the accuracy of the information with the number of the bill of lading, as well as their marks and numbers;
- statement of the apparent condition of the goods and their packaging.

In case of any inconsistency the carrier must make an entry in the consignment note. Otherwise, the presumption that the goods and packaging are in good condition and that the quantities involved, as well as the numbers were consistent. CMR Convention also regulates<sup>83</sup>:

- the duties and responsibilities of the sender to the carrier;
- duties of the carrier's documentation and responsibility for improper use;
- the sender's rights to handle the goods;
- the degree of recipient's rights to handle the goods;
- the conditions for the goods the consignee;
- the option that the receiver may not agree to receive the package;
- the procedure that the carrier needs to undergo with undelivered cargo;
- the liability of the carrier for cargo and exceptions releasing him;
- complaints or claims arising out of the carriage, and the mode of limitation;
- provide transportation successively by several carriers.

In order to improve the transmission of international waybill Economic Commission for Europe operating under the aegis of the United Nations is currently working on a protocol to the CMR, which is intended to harmonize certain rules relating to the electronic bill of lading. According to the draft of the European Economic Commission, there will be a possibility to issue a CMR waybill in a non-physical form, provided with a secure electronic signature. Such document in an electronic form will consist of only one "copy", located on the PC connected to the network. The transport process participants will have different access keys to the letter, Thanks to the electronic bill of lading, the carriers and their customers will have the 24/7 access to its content. There will be no doubt as to when and who made an entry<sup>84</sup>.

**The TIR carnet** (*Transport International Road*), an international customs convention of 14 November 1975 (as amended) concerning the carriage of goods by truck in international transport, allowing to simplify procedures at border crossings and customs offices, to greater efficiency in road transport.

A truck that runs on the TIR carnet while leaving a given country is – in accordance with the TIR Convention – checked and sealed at the border or at any customs office located in the middle of the country origin, and is unsealed

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<sup>83</sup> <http://www.espedytor.pl/news/166.php>, 11.09.2013.

<sup>84</sup> <http://www.espedytor.pl/news/166.php>, 11.09.2013.



and inspected only in the country of destination of the goods, at all the borders of transit it passes with the formalities limited to a minimum (for example, the transport of goods from Spain to Russia, the truck is sealed at the border of Spain and passes the borders of all countries without comprehensive control, while the seal is opened only in Russia). Truck carrying goods under cover of TIR Carnet shall bear should be a blue plate with a white letter abbreviation TIR – hence they are commonly called TIRs<sup>85</sup>.

**CIM or SMGS** – in rail transport they are waybills and provide a document confirming the signing of the carriage contract with the rail company. The execution of the agreement (the signing) occurs when the rail receives the package and stamps it at the forwarding station (the date is put on the consignment). Rights and obligations of the parties are governed by the provisions of an international convention on the carriage of goods by rail (COTIF).

The CIM consignment note shall be made in five copies in the country of origin and a translation into one of three languages: English, French, German.

International Railway SMGS Consignment Note is used for transport from/to countries of the former Soviet Union, Mongolia and the Far East socialist countries. The complete letter includes: the original for the consignee, quotation for the destination station, repeater for the sender, a receipt for the customs office of the country of destination, the notice of arrival of the consignment to the consignee and an additional quotation. SMGS consignment note shall be in the language of the country of origin and the Chinese or Russian<sup>86</sup>.

**AWB** (*Air Way Bill*) is an air waybill stating the existence of a contract of carriage by air in international trade. It is also a confirmation that the goods were accepted for transport and includes terms and conditions of this service. It is completed only in English. In accordance with the provisions of IATA (International Air Transport Association) three originals are issued (one for the sender, the recipient and the carrier) and 6 copies of:

- the first original colored green is for the carrier;
- second pink for the recipient;
- the third blue for the sender (as evidence of the contract).

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<sup>85</sup> See [http://archiwum.zmpd.pl/aktualnosci\\_pliki/f-1833-2315.TIR\\_zalaczniki.pdf](http://archiwum.zmpd.pl/aktualnosci_pliki/f-1833-2315.TIR_zalaczniki.pdf) 20.10.2013.

<sup>86</sup> <http://www.betrans.com.pl/wymagana-dokumentacja-w-transporcie>, 15.08.2013.

Copies can serve as proof of receipt of delivery, customs clearance document and/or the billing document for the carriers (if there are several). The sender is responsible for the accuracy of the document. He is also liable for damages resulting from errors in the content of the consignment. The package is handled by the sender. This ceases to apply upon the arrival of the goods at destination, the declaration of the carrier that the shipment went missing and when the parcel is not received within a period of no fault of his own. Air Waybill as the previous is a personal document, non-transferable. The original is recognized by banks as sufficient transport document<sup>87</sup>.

**The air waybill MAWB** – forwarder, sending consignments of different customers in the same destination, prepares the MAWB. It indicates itself as the sender and the recipient – his partner in the port forwarding destination. MAWB is transferred to the carrier – the airline<sup>88</sup>.

**Shipping air waybill HAWB** – A list of individual items consolidated for transport, where the fare and rate offered to the customer by the shipper is specified. HAWB is a bill of lading, where the sender is the sender of the goods, and the recipient – the recipient of the goods. House Air Waybills shipping partner receives the paper directly at the destination and thus informs the consignee of its arrival<sup>89</sup>.

**Marine bill of lading** is evidence that the cargo is accepted to the ship for the carriage and is a document that allows handling the cargo and its delivery. It can be issued to the name of:

- a particular customer (personal bill of lading);
- by the order of the shipper or the person designated by him (bill of lading on behalf of);
- bearer.

If the bill of lading on behalf of the person contains no specific designated person, it is deemed to have been issued at the request of the shipper (owner of the vessel).

The bill of lading includes<sup>90</sup>:

- designation of the carrier;
- designation of the shipper;

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<sup>87</sup> <http://www.serwisprawa.pl/artykuly,37,2542,rodzaje-listow-przewozowych>, 15.08.2013.

<sup>88</sup> See M. Stajniak, M. Hajdul, M. Folyński, A. Krupa, *Transport i spedycja*, LliM, Poznan 2008, p. 122.

<sup>89</sup> Ibid.

<sup>90</sup> Act of September 18, 2001, the Maritime Code, OJ of 4 December 2001, Chapter 3.

- designation of the recipient, or that the bill of lading is issued on behalf of or to the bearer;
- the name of the vessel;
- determination of load indicating the type and – if appropriate – the measurement, volume, quantity, quantity or weight;
- determination of the external condition of the cargo and its packaging;
- main characters necessary to establish the identity of the cargo, provided by the shipper in writing before the cargo is loaded if they are printed or otherwise fixed to each piece of cargo or its packaging;
- designation of freight and other charges of the carrier or an indication that the payment in full has already occurred, or should occur, in accordance with the provisions contained in another document;
- the name of the place of loading;
- the name of the place of discharge or specific information as to when or where the landing place will be specified;
- the number of copies of the bill of lading issued;
- the date and place of issue of the bill of lading;
- the signature of the carrier or the captain of the ship or other representative of the carrier.

Consignment issued in accordance with the provisions of the Sea Code creates a presumption of sea boarding of the goods in such quantity and in such condition, as was shown in the document. It determines the content of the legal relationship between the carrier and the consignee of the goods, because the provisions of the contract of carriage bound in so far as it results from the explicit reference contained in the consignment.

In most cases three copies are issued. The issuer of the bill of lading is the carrier, but it is signed by the ship captain (it can also be done by the agent or marine broker). If the carrier is described inaccurately, or false, the owner of the vessel, which was loaded with the goods, is accountable to the recipient of the goods for resulting damage. Claims for transport will expire after two years from the date of maturity, and the bill of lading after one year from the date on which the issue occurred or was supposed to happen (unless the parties do not extend this period). Because of the complexity of the process, which is shipping by sea, several types of bills of lading can be named. There are bills of lading for the goods loaded (when the responsibility of the exporter is loading the goods on a ship) and bills of lading for the goods taken to load (when the loading of the goods to the vessel is the responsibility of the carrier). Transport documents in

maritime transport can be divided also clean bills of lading (those that do not contain clauses stating improper condition of the goods), and the unclean bills of lading (they contain a so called Restrictive clause, i.e., the carrier states that the condition of the cargo is not flawless)<sup>91</sup>.

**Inland bill of lading** and the loading document in inland waterway transport are basic essentials. International shipping waybill or bill of waterway lading is complete if it consists of an original, duplicate, and five copies. The original and two copies are given to the freight ship company. Additionally, one copy is given to the sender and the recipient of the shipment. In the case of inland bill of lading there is no legal basis to regulate the form of letter. This transport is called cabotage. The loading document is issued by name – with credentials of the Polish shipping company by its agent in the country of loading/unloading<sup>92</sup>.

## 5.2. Documentation on the road

One of the main factors that allow the implementation of transport processes, both in the country and abroad, is to have the necessary documents required by the relevant regulations. The vehicle should contain the following documents<sup>93</sup>:

- driver's license and vehicle registration, valid third party liability insurance;
- copy of the license;
- proof of payment of required fees for the use of toll roads;
- recorder automatically records the speed and driving time, mandatory breaks, downtime and recovery time;
- An EURO certificate confirming the level of safety and environmental requirements are met (especially in international transport);
- if dangerous goods are carried – the ADR certificate.

In the road passenger transport – if regular transportation is carried out, special regular services or occasional shuttle, a permit from the Bureau of International Transport Service is required along with the driving form.

In the road transport of goods:

- transport document that contains information about transported goods;
- appropriate authorization required in road transport;

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<sup>91</sup> <http://www.serwisprawa.pl/artykuly,37,2542,rodzaje-listow-przewozowych>, 15.08.2012.

<sup>92</sup> <http://www.betrans.com.pl/wymagana-dokumentacja-w-transportcie>, 15.08.2012.

<sup>93</sup> See M. Stajniak, M. Hajdul, M. Foltiński, A. Krupa, *Transport ...* op. cit., p. 126 et seq.

- documents required for the road transportation of dangerous goods;
- the certificate required under the contract for the international carriage of perishable foodstuffs and on the special equipment for them;
- permission to drive the vehicle in which information about the weight, axle load or dimensions exceeding the amount specified in separate regulations;
- an authorization to transport live animals.

### **5.3. Electronic pen and paper documentation**

Many formalities in business activities, including the transportation, requires the action of a paper for various reasons, which can include:

- legal requirements – signing the document on both sides;
- requirements for long-term storage of documents;
- customer habits of having a materialized form of confirmation;
- is a simple form of contract that is widely recognized.

To simplify and allow the automation of processes that require filling in a paper form, a digital pen is used – it can write on a paper while at the same time saving the entered data in electronic form.

The digital pen has<sup>94</sup>:

- built-in camera, that records what is written on paper;
- ram memory, which stores the data entered;
- bluetooth transmitter.

For this technology to be useful, it is necessary to modify the form with a special, pattern of dots that are almost invisible to the naked eye, by which the pen determines where the written text is located. The technology used in the digital pen allows to:

- populating the forms with the pen;
- sending the entries via bluetooth connection and a mobile phone (or a PC) to the server where the movements of the pen are converted to text and interpreted.

So the resulting data once verified and corrected on a mobile phone (or a PC) can be immediately transferred for further processing in the central system.

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<sup>94</sup> <http://www.impaqgroup.com/pl/polska/uslugi/country-specific-services/business-development>, 12.09.2013.

The solution is widely used wherever it is still required to fill out paper documentation, and the data recorded on the form should be included as soon as possible in a computer system in order to start the process of implementation of the provisions of the document.

“Electronic pen” allows to:

- improve the flow process and archiving of documents;
- shorten customer service while maintaining a high quality of service;
- allows to keep a paper document that is important to the business;
- to automate the process of entering data into enterprise information systems;
- automatically create a document repository scan without additional time required for the scan.

## 6. Transport in foreign trade

### 6.1. Transport Management

Transport Management means the laws and obligations concerning the organization of the transport of goods and paying the fare (bearing the costs related to transportation). Usually, transport Management is the result of a trade formula that has been adopted in the job contract. The contract signed by both parties should specify who chooses the transport mode, the route, the carrier, the shipper and what is the time limit for the receipt or delivery of the consignment. Besides, a trade agreement should include information on what route the given party has a transport management<sup>95</sup>.

The transport management decision is in the hands of the trade partners – the vendor and the buyer. **Transport Management may be mixed** – the vendor is responsible for the transportation of the cargo to the port for loading, and the remaining part belongs to the responsibilities of the buyer.

After the abolition of customs barriers, along with Poland's accession to the EU, the combined transport management is most frequent in sea transport. In road transport, it is customary that the transport management remains on the side of the vendor, which means that the goods are sold to the buyer along with the delivery. However, the decision as to which of the parties would organize the transport is often negotiated and specified in trade agreements.

In most countries, the entrepreneurs protect their own transport Management, thus supporting local carriers. For instance, in certain German lands, they have additional tax relief in this respect. In Poland, transport Management is most often given to the trade partner<sup>96</sup>.

In a situation when the supplier (vendor) offers their own transport solution, it has an influence on:

- export clearance;
- the place of loading;
- the mode of transport, the means of transport: rail, rail and road, air, inland waterway, sea, multimodal, intermodal, combined, special (track, pad transport);

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<sup>95</sup>See J. Najder, *Transport międzynarodowy* [International transport], PWE, Warsaw 2012, p. 281, by <http://www.betrans.com.pl/Management-transportowa-oraz-jej-zalety>, 02.08.2013.

<sup>96</sup>[logistyka.infor.pl/transport/artykuly/569582,co\\_to\\_jest\\_Management\\_transportowa.html](http://logistyka.infor.pl/transport/artykuly/569582,co_to_jest_Management_transportowa.html), 03.08.2013.

- the route;
- selection of subcontractors (shipper, ship owner, operator);
- organization of transport to the place indicated;
- the place of unloading;
- the date of delivery;
- cargo insurance.

The recipient who agrees to this kind of transport needs to take into consideration the difficulties to which we may include:

- lack of control over the cargo;
- all kinds of complications, damage, additional costs need to be reported to the sender;
- lack of direct control over the costs (any possible reloading, storage or retention costs);
- lack of possibility to choose an optimal means of transport.

In the situation when the receiver (the buyer) offers their own transport solution, they have an influence on:

- transport execution;
- establishing all costs prior to shipment;
- the proceedings of the sub-contractors;
- convenience in executing claims (“with the homecourt advantage”) in the event of any damage, shortages, delays;
- customs clearance;
- the selection of the optimal means of transport;
- the insurance of the cargo for transport;
- circulation of documents.

The disadvantage of this transport management is a huge workload and involvement of the employees, which obviously generates additional costs.

The choice made by one of the trade contract parties (the contractor) is not a guarantee that the logistic cargo will reach the destination as specified in the agreement, and therefore one should:

- check whether a given company is credible and how long it functions on the market;
- agree on the place of customs clearance;
- check with the customs office which documents are required for an efficient customs clearance, as every delay means costs for storage and delay in delivery;



- to establish a time reserve while planning delivery, as in the case of e.g. sea freight delays are quite frequent and usually difficult to foresee (moreover, with the first transports, the customs office may check the documents very thoroughly, which means another shift of delivery time).

## 6.2. Incoterms<sup>®</sup> 2010 delivery formulas

Incoterms (*International Commercial Terms*) a set of international rules that define the conditions of sale, the use of which has been widely adopted throughout the world. These rules share the costs and responsibilities between the buyer and the vendor, as well as reflect the kind of transport that had been agreed on. Incoterms refer to the UN Convention contracts for the International Sale of Goods. They were published in 1936 and regularly amended since then. The current version (as of 1 January 2011) is Incoterms<sup>®</sup> 2010 that has replaced Incoterms<sup>®</sup> 2000.

*Incoterms<sup>®</sup> 2010, while regulating the relationships between the vendor and the buyer does not specify the relationships of the contracting parties with the carriers, shippers and multimodal transport operators. Still, the knowledge of transport formula is necessary for the shipper for adequate transport organization, securing possible claims, assessing the customs value of the goods, customs clearance etc.*

*Incoterms<sup>®</sup> 2010 do not regulate the consequences of breach of contract and liability release as a result of certain events. These issues should be addressed by other provisions of the trade agreement, or by referring to the relevant regulations.*

*Incoterms<sup>®</sup> 2010 are applicable not only in foreign trade, but also in the EU or at the national level<sup>97</sup>.*

Incoterms<sup>®</sup> 2010 includes the interpretation of 11 commercial formulas, divided into four groups (E, F, C and D), each of which is marked with a three-letter abbreviation (the first letters of their English names). The formulas are grouped according to the criterion of increasing responsibility and risk of the vendor (from EXW to DDP). Each formula frames the responsibilities of the seller and the vendor in ten points corresponding with one another. The responsibilities of the vendor are numbered A1-A10, those of the buyer B1-B10.

In short, the major responsibilities and risk allocation are as follows<sup>98</sup>:  
(for all transport modes)

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<sup>97</sup> <http://www.google.pl/#hl=pl&client=psy-ab&q=formuly+incotermstp>, 08.08.2013.

<sup>98</sup> <http://www.helena-ts.pl/incoterms.php>, 08.08.2013.

1. EXW (*Ex Works*) – *from (enter the named place of delivery)*

The responsibility of the vendor is to place the goods at the disposal of the buyer at the point of release (e.g. the warehouse or the factory of the vendor). From this point, the buyer bears the risk and all costs and obligations, including loading the goods on the means of transport and executing the export customs formalities.

2. FCA (*Free Carrier*) – *delivered to the carrier (insert named place of delivery)*

The duty of the vendor to provide goods to the carrier (or to any other person, e.g. a forwarding agent) designated by the buyer, at the premises of the vendor (in such case they are obliged to load the cargo onto the means of transport) or at any other designated place (in such case they are obliged to deliver the goods, ready for landing, on the means of transport), as well as execute customs formalities for export. The responsibility of the buyer is to bear the risk, sign the contract of carriage to the designated place of delivery, as well as to inform the vendor about the name of the carrier, the loading date and the modes of transport.

3. CPT (*Carriage Paid to*) – *carriage paid to (insert named place of destination)*

The duty of the vendor is to provide goods to the carrier (from here the risk is borne by the buyer), sign the contract of carriage to a particular destination, and cover its costs. The buyer's responsibility is to incur all costs associated with the goods during transportation to the place of destination, except those charged to the seller under the contract of carriage.

4. CIP (*Carriage and Insurance Paid to*) - *carriage and insurance paid to (insert named place of destination)*

As compared to the CPT formula, the scope of the vendor's obligations shall be extended by insurance and its costs, with an obligation to provide proof of insurance to the buyer so that they might claim against the insurer – in case of damage or loss of the goods. Other obligations of the parties are the same as in CPT.

5. DAT (*Delivered at Terminal*) – *delivered to the terminal (terminal marked to enter a port or place of destination)*

The vendor is obliged to provide the goods and leave them to the disposal of the buyer after landing off the means of transport, in a particular terminal within the port or other designated destination. From this point, the costs and the risks are borne by the buyer.

6. DAP (*Delivered at Place*) – *delivered to the site (insert named place of destination)*

The vendor is obliged to provide the goods and leave them at the disposal of the buyer on the means of transport, ready for unloading. From this point, all costs and risks, including landing are to be covered by the buyer.

7. FAS (*Free Alongside Ship*) – *delivered alongside ship (insert named port of shipment)*

The vendor is obliged to provide the goods alongside the ship at the port of loading. From this point, the risks and costs involved belong to the buyer. The buyer is obliged to conclude a contract of carriage and to inform the vendor about the name of the vessel, the place of loading and the time of delivery to the port.

8. FOB (*Free on Board*) – *delivered to the ship (insert named port of shipment)*

The vendor is obliged to provide the goods to the ship at the port of loading. From this point, the risks and costs involved belong to the buyer. The buyer is obliged to conclude a contract of carriage and to inform the vendor about the name of the vessel, the place of loading and the time of delivery to the port.

9. CFR (*Cost and Freight*) – *Cost and Freight (insert the designated port of destination)*

The vendor is obliged to provide the goods to the ship at the port of loading. From this point, the risk passes to the buyer, but the vendor is still required to enter into a contract for carriage by sea, and to bear the costs of delivery to the port of destination.

10. CIF (*Cost, Insurance and Freight*) – *Cost, Insurance and Freight (insert the designated port of destination)*

As compared to the CFR formula, the scope of the vendor's obligations shall be extended only by insurance and its costs and provide proof of insurance to the buyer so that they were able to, in case of damage or loss of the goods, claim insurance. Other duties of the parties are the same as in the case of the CFR.

### **6.3. International transport insurance**

Insurance of goods in international transport is primarily intended for these businesses – manufacturers and retailers, including exporters and importers that within the confines of their activity also need to obtain or send different kinds of goods and this way are at risk of damage during transportation.

The insurance is directed both to those entrepreneurs who transport goods using their own means and to the companies that use the services of commercial carriers.

In an international cargo insurance, all phases of cargo transportation by land (car or train) are covered, as well as transportation by air, sea or inland waterway, including transshipment where necessary, and temporary storage of cargo during road transport. Protection may include loading and unloading operations.

Most insurers have three areas of protection to choose from.

- Basic, including damage caused by such events as fire, explosion, or an accident of the means of transport;
- Extended; in addition to the above-mentioned risks, includes other most common, as damage caused by e.g. washing off the deck, sea, lake or river water entering hold of the vessel, the container or storage space (consequently, this offer is addressed especially to importers and exporters using sea transport);
- Full, covering all kinds of risks.

According to the customer's wish, the agreement may be concluded for the duration of one transport, or for the duration of all transports executed while the contract is valid.

International shipments are insured in insurance companies based on standard ICC (*Institute Cargo Clause*)<sup>99</sup>, widely used both by insurers and by traders, exporters and importers around the world. Within ICC, there are three basic groups which differ with the extent of the insurance<sup>100</sup>:

- ICC (A) – Institute cargo clause A, formerly marked with the letters AR, covering “all risks”, a set of general clauses stating that the insurance covers “all kinds of risk” (i.e. accidents involving external force), resulting in loss or damage to the subject goods, except as expressly excluded in Clauses B and C; clause A does not include, apart from the listed exclusions, and those

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<sup>99</sup>ICC – Institute Cargo Clauses, developed by the Institute of London Underwriters, commonly used insurance terms and conditions of the property (goods) in international transport of sea, land and sometimes air transport that specify the scope of insurance coverage (and the risks excluded from protection) granted by the insurer on insurance of cargo in transport; there are three main clauses marked with the letters A, B and C that differ in the scope of insurance offered. In addition to three basic clauses, there are also a number of specialist insurance specifying the conditions specified mode of transport or certain goods, [http://www.broker-serwis.pl/slownik\\_i.html](http://www.broker-serwis.pl/slownik_i.html), 16.08.2013.

<sup>100</sup> [http://www.broker-serwis.pl/slownik\\_i.html](http://www.broker-serwis.pl/slownik_i.html), 16.08.2013.

exclusions that belong to clause B and C, the risk of war, strikes, social disturbances and terrorism – here, the insurance required are the special conditions of *Institute War Clauses* and *Institute Strikes Clauses*; commonly used by Polish insurers in the construction of insurance of property (cargo) in international transport;

- ICC (B) – Institute Cargo Clauses B, formerly marked the letters WA; Casuistic clauses, including insurance conditions and risk, in contrast to the *Ali risks* formula, applied in A clauses; it excludes from insurance some risk listed in A clause; commonly used by Polish insurers in the construction of the property (cargo) insurance in international transport;
- ICC (C) – Institute Cargo clauses C, formerly designated with the letters FPA; Casuistic clauses, including insurance conditions and risk, in contrast to the *Ali risks* formula, applied in A clauses; clause of the highest insurance range of the three basic ICC clauses; commonly used by Polish insurers in the construction of the property (cargo) insurance in international transport.

Under these clauses, the insurer may provide insurance coverage in several versions<sup>101</sup>:

- basic range; including damage caused by Acts of God specifically mentioned, such as: fire, explosion, an accident of the means of transport (Institute Cargo Clauses “C”);
- extended range, apart from the mentioned kinds of risk also damage arising from the goods being washed off the deck, the sea, lake or river water getting into the hold of the vessel, the container or the storage place (Institute Cargo Clauses “B” – this set of clauses is applicable only to sea transport);
- full range, includes any damage resulting from Acts of God, bar incidents specifically excluded (Institute Cargo Clauses “A” or Institute Cargo Clauses Air – for air transport).

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<sup>101</sup> <http://www.pzu.pl/produkty/ubezpieczenie-ladunkow-w-transporcie-miedzynarodowym>, 12.08.2013.

## 7. Automatic identification in transport processes

### 7.1. Packaging in transport

In practice, transport is nothing else but the physical movement of products from the dispatch point to the destination point through means of transportation, including all functions of management. Efficiency and effectiveness of moving products in the supply chain are, among others, dependent on packages that should be properly designed and tailor-made to suit customer requirements, fitted to transport, identification and regulations in force.

From the perspective of transport, freight and logistics services, packaging should fulfill the following functions:

- protective – a package should be fully adapted to technical and operational characteristics of a product as well as to its “value”;
- storage, transport and manipulative – involving the vulnerability of packages to mechanization and automation processes (packages should be adapted to a current standardized dimensional system, facilitate storage, form unit load etc.);
- informative – a package is a carrier of information that is used in the processes of identification, manipulation (including dynamic procurement), storage, and also they are useful in controlling the traffic of goods across the whole supply chain;
- recycling, cassation.

Considering the requirements involved in TFL participation, a type of unit load (logistic unit)<sup>102</sup>, the marking system applied, packages can be divided into five groups<sup>103</sup>.

The first group (global use). Units of trading that can be estimated, ordered and invoiced for trading purposes between participants at any point in the supply chain. This definition applies to everything that has predefined characteristics, starting from resources up to products (and production waste) sold to the end user.

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<sup>102</sup> Unit load (logistic unit) – a compact form of packaging that contains material in a unit package or a collective package, having its own identification and labeling, wrapped in a way that enables its storage, transport and collecting secondary units from it. <http://www.mags1.ilim.info.pl/slownik>, 15.06.2013.

<sup>103</sup> *Kody kreskowe* [Bar codes], ILiM, Poznan 2012, pp. 32-42.

The second group (global use). Logistic units of any composition, created for storage or transport purposes, which need to be distinguishable and tracked in the whole supply chain. The process of creating a logistic unit encompasses:

- arrangement of goods – making greater units out of several smaller products combined together;
- standardization – unifying the size and shape of single units;
- ability to apply mechanical means in manipulation;
- adapting single units to piling.

We can distinguish a few forms of logistic units:

- packaged goods;
- containers;
- crates;
- pallets;
- packaged units and other.

The third group (global use). It covers reusable resources (packages or transport devices of a particular value, such as: beer kegs, gas cylinders, plastic pallets or crates).

The fourth group (global use). Involves dispatches and deliveries made by the vendor (shipper) of the freight.

The fifth group (internal use). Packages used within the country (or company).

The most common forms of reusable transport packaging are flat cargo pallets called the “Euro Pallet”, with an inscription “EUR” at the side. The Euro Pallet has been made for the first time in 1950 by the Swedish company BT Industries, as a universal pallet fitting all kinds of forklifts.

Currently, Euro Pallets are manufactured in dimensions: 800 x 1200, 1200 x 1000, 1000 x 1200 and 800 x 600, based on the charter of the *International Union of Railways* (UIC), which is equivalent to the Polish norm PN-M-78216:1997<sup>104</sup>. The use and disposal of pallets is managed by the *European Pallet Association* (EPAL<sup>105</sup>), founded by UIC. Euro pallets would

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<sup>104</sup> A. Korzeniowski, M. Skrzypek, G. Szyszka, *Opakowania w systemach logistycznych*, ILiM, Poznan 2010, p. 57.

<sup>105</sup> From August 1, 2013, the International Railway Union (UIC) ended cooperation with the European Pallet Association (EPAL). Since August pallets produced by members of EPAL will bear only the indication of the organization. UIC plans to release the first pallet own production in the beginning of 2014. EPAL believes that railway organization thus forms a closed pallet pool (a standardized pallet collection), and it is not the entrepreneurs, but the UIC that is to own the pallets;

have the EPAL markings and the EUR markings in an oval frame, which is a registered trademark of the International Union of Railways (UIC).

In Europe and in Poland, with the aim in mind to manage pallets properly, economic systems emerge, which provide services regarding inventory, rental, collection and control of the pallets.

For standardization of the main objectives of environmental policy in relation to packaging and packaging waste, *Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste* has been introduced in all EU member States.

The Directive concerns all packaging used on the EU markets and the packaging waste coming from industry, trade and service units, households etc., regardless of the kind of the packaging materials used. The guidelines apply to all packaging and packaging materials used for the containment, protection, marketing, transportation and presentation of products, with respect to the following division:

- direct sales (individual) packaging;
- group and collective packaging (intermediary packaging);
- transport packaging.

The aim of the Directive in question is to<sup>106</sup>:

- harmonize the national resources regarding the management of packaging and packaging waste;
- prevent environmental pollution, via rational management of packaging and impact waste, regarding all Member States and the third countries, or reducing such impact, this way ensuring high level environmental protection.
- ensuring the functioning of the internal market, avoidance of obstacles in trade, disruption or restriction of competition within the Community;
- to establish measures aiming at packaging waste prevention;
- promotion of reusable packaging; promotion of recycling and other forms of re-use of packaging waste, thus reducing the final disposal of packaging waste.

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<http://biznes.pl/wiadomosci/kraj/jedna-czwarta-swiatowego-rynku, 20/08/2013>.

<sup>106</sup>Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste, art. 1, p. 352.



## 7.2. Package marking

Under conditions of free-trade economy development an appropriate package marking in commodity circulation takes a greater meaning. In Poland there are regulations in force that determine, among other things, the type and scope of information which placing on a package is mandatory, voluntary or prohibited, while ensuring a complete customer protection and maintaining a fair trade practice.

Markings, through which basic information on products and packages is conveyed, can be divided into<sup>107</sup>:

- obligatory – those without which a wrapped product is not to be distributed;
- facultative – used voluntarily by companies in order to shape a specific image of the product or company.

Taking content into account, delivery markings can be categorized as:

- basic – enabling identification of the product and its manufacturer;
- informative – describing characteristics of the product, determining its properties, use, quantity, value, data utilized at the time of automated identification of products in the supply chain etc.
- danger – indicating threats to humans and environment;
- manipulative – informing about the necessity of handling the package in a specific manner, while storing, transporting or using it;
- advertising – marketing a particular product.

As for the graphic form of markings, the following division can be introduced:

- graphic sign – presents mostly a subject or activities, evoking specific associations in the form of writing, a pictorial symbol or a graphic symbol;
- graphic symbol – a sign made of geometric elements, expressing a term or a subject;
- pictorial symbol, pictogram – a graphic sign in the form of a simplified drawing, expressing a term or a subject.

The most significant for both the company introducing a product to the market and the consignee-customer is the scope of obligatory marking, defined by right law regulations.

Such marking is the CE symbol (*Conformité Européenne*), which is a key measure of product conformity with EU legislation and allows free movement

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<sup>107</sup> [www.eko-spec.pl](http://www.eko-spec.pl), 08.08.2013.

of goods across the European market. Placing the CE mark on a product, the manufacturer declares under sole responsibility that the product complies with all legal requirements necessary to achieve CE marking and therefore that the product can be marketed in the European Economic Area (EEA, i.e. the 27 EU Member States and the EFTA countries, namely Iceland, Norway, Liechtenstein) and in Turkey. However, not all products must be CE marked. This obligation applies only to the product categories subject to specific directives, which state that goods must bear the CE marking. CE marking does not indicate that the product was manufactured in the EEA, but merely that it has been evaluated before putting it on the market and that it meets the legal requirements (e.g. a harmonized level of safety) to be introduced into commerce in the area. This means that the manufacturer has verified that the product complies with all essential requirements relating to it (e.g. with health and safety), or – if so stated in the Directive(s) – that the manufacturer has submitted the product for control by a notified unit, accredited for compliance testing.<sup>108</sup>

In turn, looking from the environmental perspective, the important symbol is the Ecolabel (in the shape of a flower) which is the main official European honor awarded to the products that fulfill higher environmental standards.

The Ecolabel was established in 1992, along with the awarding program. The legal grounds for awarding it is the Regulation of the European Parliament and Council Regulation (EC) No 66/2010 of 25 November 2009 on the EU Ecolabel for each group of products. The “Ecolabel” has been established by the European Commission as a voluntary “green mark”, aiming to encourage companies to manufacture products that are less harmful to the environment. The companies that have received the “Ecolabel” certificate, are allowed to mark their products with the above-described symbol. The European ecological mark on the products shows that they are less harmful to the environment than similar items throughout their entire lifecycle, as they meet the published environmental criteria established by the EU Member States, in consultation with all parties involved (including the representatives of the industry, consumers, environmental organizations, trade organizations and public services)<sup>109</sup>.

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<sup>108</sup> <http://ec.europa.eu/enterprise/policies/single-market-goods/cemarking/downloads/ce>, 27.07.2013.

<sup>109</sup> <http://www.pcbc.gov.pl/ecolabel/>, 28.07.2013.

For TFL purposes, depending on the market, to each package there is assigned a system of marking i.e. type, barcode format or transponder size in case of electronic marking.

In universal application, standardized (international) marking systems are used, which are recommended by the GS1 non-profit organization (previously EAN.UCC). In Poland the implementation of automatic identification<sup>110</sup>, barcodes and EDI<sup>111</sup> is handled by the Institute of Logistics and Warehousing GS1 (ILiW GS1) in Poznań. Moreover, ILiW GS1 elaborates domestic solutions and participates actively in developing global standards and new applications. It executes research and development (R&D) works and renders consulting services that increase the effectiveness of enterprise operations and the whole supply chain.

Each group of packages (presented in the previous section) has its own specific and unique system in the global standard, recommended and developed by GS1.

Trading units are marked by the *Global Trade Item Number* (GTIN) with the use of its four structures: GTIN-8, GTIN-12, GTIN-13 and GTIN-14. All the numbers are stored in the 14-digit fields in the database. The main application of this system is identifying units intended for scanning in retail outlets, also known as consumer units. To identify them the GTIN-13 number is used and if they are tiny, the GTIN-8 number (or the GTIN-12 number with abbreviated zeros), presented in the form of EAN-13 or EAN-8 barcodes respectively. Units not intended for retail are also identified by the GTIN-14 number.

Trading units can appear as<sup>112</sup>:

- unit package<sup>113</sup> – GTIN-13, GTIN-8, GTIN-12 numbers used;

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<sup>110</sup> Automatic identification – is a technique that enables something to be coded and then automatically read. A few categories of automatic identification can be distinguished: barcodes, electronic product marking (RFID – Radio-frequency identification), voice-recognition system, etc.

<sup>111</sup> Electronic Data Interchange (EDI) – is transmitting electronic communication (equivalents to commercial or administrative documentation in the written form), created according to a commonly agreed standard between applications in different computer systems, by means of tele-transmission. EDI is also understood as a documentation exchange technology between different applications cooperating with trading partners. <http://e-prawnik.pl/artykuly/prawo-spolek/edi-elektroniczna-wymiana-danych-electronic-data-interchange-co-to-jest-i-czy-jest-ci-to.html>, 20.06.2013.

<sup>112</sup> A. Korzeniowski, M. Skrzypek and G. Szyszka (2010) *Opakowania w systemach logistycznych* [Packaging in logistics systems], ILiM, Poznan, p. 85.

<sup>113</sup> Unit package – a package containing a defined quantity of the product intended for retail, PN-O-79000:1997.

- collective package<sup>114</sup> – the GTIN-13 for different goods gathered, the GTIN-14 while dealing with uniform goods;
- variable quantity package (e.g. fruit, meat) – the GTIN-13 in case of an abbreviated number of trading unit, the GTIN-14 for international trade.

Logistic units receive the *Serial Shipping Containere Code* (SSCC), which needs to be unique for different logistic units, even if they contain identical trading units. Their characteristics, for instance, gross weight, are presented in a standard size.

The SSCC number is the only mandatory element of the logistic unit and is generated by the company creating it. The best practice is for this company to use their own prefix.

Packages and reusable devices (3<sup>rd</sup> group) identifies itself by:

- Global Returnable Asset Identifier (GRAI) – enables all the correct data for packages to be tracked and noted;
- Global Individual Asset Identifier (GIAI) – used for identifying packages in an enterprise.

Dispatches and deliveries are marked with the Global Shipment Identification Number (GSIN). It is assigned by the vendor (shipper) of the freight. It constitutes a unique number which identifies consistent formations of physical units for the purpose of shipping. The GSIN was suggested by the World Customs Organization (WCO) as an identifier suitable for presenting the marking of the Unique Consignment Reference (UCR). The GSIN was recognized as a global GS1 identifier which in a simple and comprehensive way can fulfill the requirements set by the WCO with regard to the UCR. Thus, the GSIN, as a global identification number of transport units formations in commerce, the so-called dispatch, fully meets the requirements of customs' organizations.

Logistic labels (placed on packages), which are intended for marking and monitoring the flow of logistic unit in supply chains (e.g. pallets), are frequently used in TFL. The GS1 logistic label is a carrier of information in the supply chain, in which all the participants (the manufacturer, the carrier, the distributor, the retailer) communicate via the same language. This is feasible by following the GS1 global standard system (previously EAN.UCC).

The GS1 logistic label consists of three parts<sup>115</sup>:

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<sup>114</sup> Collective package – a package containing at least two unit packages, most frequently used in shipping containers at the time of transport and warehousing, PN-O-79000:1997.

<sup>115</sup> *Opakowania w systemach logistycznych...*, pp. 87-88.

- upper – contains any text information provided by the shipper (the content is dependent on the company, but in general companies obligatorily place the SCCM logistic unit identifier, the GTIN trading unit identifier, the production date etc.);
- middle – contains information provided by the consignee including one's location and order data;
- lower – contains information on the shipping process pertinent to the carrier (postal codes, change of the place of residence information etc.)

Data on the label should include standard application identifiers (AI). In the GS1 system this marking identifies (defines in a unique way) the type and format of the subsequent information. In other words, AI advised what information is contained in the code following it. For example, after AI 00 the SSCC number follows, after AI 01 – the GTIN, after AI 10 – the batch number, after AI 15 – the date of minimum durability, after AI 37 – the quantity of trading units in the logistic unit etc.

### **7.3. GS1 barcodes vs. the Electronic Product Code (EPC)**

In practice, we most frequently encounter two ways of physical marking of packages i.e. through the barcode or the Electronic Product Code (EPC).

Barcodes originate in their application in retail trade and warehouses across the USA. The rapid growth of supermarket chains in the USA and Canada in the 1960s triggered the works on creating the standard for automatic identification through the barcode in cash points.

Barcodes is a definite sequence of light and dark lines (bars) of varying widths, reflecting in a specific way different machine-readable signs, digits – in case of numerical codes or digits, letters and other signs in – alphanumerical codes. In order to present the largest number of signs on a possibly the smallest space, a few hundred types and varieties of barcodes were developed (linear, including the reduced ones, 2-dimensional, including the composite and complex ones), but only several are applied, especially in logistics, performing the functions of universal, international standards specified by GS1.

Currently the following standard barcode symbols<sup>116</sup> are used:

- EAN/UPC: EAN-8, EAN-13;
- UPC-A, UPC-E;
- ITF-14;

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<sup>116</sup> <http://www.gs1pl.org/gs1-polska/dzialalnosc>, 20.06.2013.

- GS1-128;
- GS1 DataBar;
- GS1 DataMatrix;
- *Composite Symbology*.

In retail cash points only EAN/UPC barcodes can be used. In other applications, such as, receipt, inventory and assembling the goods at the warehouse, three different symbols can be employed: EAN/UPC, ITF-14 or GS1-128. In the case of barcode marking of products and packages of little space, such as syringes, vials, communication subunits, etc. GS1 DataMatrix and Composite Symbols can be applied.

In the scope of product marking (including packages) a major breakthrough came when a new way of electronic product marking EPC (*Electronic Product Code*) was put into practice. Interchangeably, the following synonyms are used: the RFID marker (*Radio Frequency Identification*), the RFID radio identifier, the tag, the transponder.

The first application of RFID dates back to World War II. The IFF system (*Identification, Friend or Foe*), invented in Great Britain, was intended for identification of aircrafts and it can be named an RFID predecessor.

In 1948 Harry Stockman's work gave rise to the RFID passive systems conception. In the 1950s and 60s scientists in the United States, Europe and Japan conducted research on using radio waves for the remote identification of objects. First RFID technology commercialization referred to anti-theft systems. The 1990s was the period when RFID became a part and parcel of everyday life and business activity. Since that time thousands of companies, working on development and applications of RFID technology, have been established<sup>117</sup>.

Among the well-known global companies, which commenced the implementation of RFID technology to electronic product marking, there are: Wal-Mart, Target, Albertsons, Metro, Tesco, Marks&Spencer, Proctor&Gamble, Gillette. In the near future RFID technology will replace the barcode system used for marking goods, which will increase the efficiency of transport, storage and the process of selling goods. The American retail chain Wal-Mart is an epitome of the successful implementation of such a system.

Currently, the scope of RFID applications in logistics, public transport, security systems, the electronic payments market broadens<sup>118</sup>.

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<sup>117</sup> <http://www.bankier.pl/wiadomosc/Historia-i-dzialanie-technologiei-RFID>, 20.06.2013.

<sup>118</sup> Ibid.

The Electronic Product Code (EPC) is a 96-bit identifier of a package containing goods, stored in a tag equipped with an antenna. The EPC is developed according to global GS1 standards, which allows supply chains to better integrate and not forces to make changes in the so far used package identifiers (in the form of barcodes).

The radio identification system contains a base, to which an antenna is attached that irradiates energy essential for the transponder's feed. The same antenna of the base station is used for communication with the RFID transponder, enabling reading and recording of data from/to the marker. The base station is connected to an external computer through a wired interface. The base station, communicating with the transponder, uses a radio interface. The circuits of the transmitter and the receiver are tuned to the same frequency. RFID transponders can be divided into two groups: RO (*Read-Only*) and RW (*Read-Write*). The latter have the option to modify the content.

In terms of power supply transponders are categorized as:

- active – they possess their own power source, which provides energy to the microprocessor chip and the transmitter with the antenna (the advantage of this kind of tag is the greater memory and the possibility to read as well as record data, whereas the disadvantage is a much larger size, higher price and shorter life span as opposed to passive tags);
- passive – they do not have their own power source, the electric power, needed for momentary feed of the microprocessor chip is drawn from the electromagnetic field emitted by the reader (the advantages are: its small size – some chip models are measured in tenth parts of a millimeter and low price, whilst its disadvantage is a short read range);
- semi-passive – they are sort of compromise between passive and active tags (the internal battery is powered by the microprocessor chip only, the antenna takes energy from the electromagnetic field emitted by the reader as it is with passive tags).

By analyzing the usefulness of currently applied barcodes and RFID, we can draw the following conclusions:

- the volume of information we can gain online about the unit load is considerably greater in the case of EPC application as the data can be placed in the marker as well as in the information system, whereas, the logistic label with a barcode, for instance, informs of the load (e.g. a pallet) but not of its content<sup>119</sup>;

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<sup>119</sup> See A. Szymonik *Information Technologies in Logistics*, Lodz University of Technology, monographs 2012, pp. 98-99.

- in the case of the barcode read, you need to reach to the package with a reader (or the other way around), which extends the time of taking reads and engages the employee (raises costs), the inconveniences absent with the EPC, where everything goes automatically without the human factor;
- when taking a barcode read we are certain, whether the product is there or not, for instance, on the rack, which is confirmed by the warehouse operative and the reader, whilst with RFID there might be a situation that the lack of information from the reader can be interpreted as a stock unavailability or that one of the radio identification system elements failed (caused by, for instance, the connection loss between the base station and the transponder, static in a radio wave spread, too large a distance between the tags – the base station, a corrupted electronic element, power outage, the inappropriate system of recognition and identification);
- the EPC protects from counterfeit products (the volume of information in the database enables the data on the product to be coded), and additionally facilitates identification and tracking of a single unit of packaging in the whole global supply chain, for example, for traceability purposes<sup>120</sup>;
- the EPC enables many labels to be read simultaneously, which is impossible in the case of barcodes;
- the EPC streamlines, for instance, the management of baggage at the airports, in comparison with barcodes, readable at the level of 70-80%, the EPC allows for approximately 99,3% of baggage readability<sup>121</sup>;
- RFID prevents waiting in lines on condition that good and infallible radio identification systems are in place (multidirectional base antennas);

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<sup>120</sup>Traceability – is a tracking ability (history reproduction) of the flow of goods in the supply chain and networks, including the registration of parameters identifying those goods and all the locations covered by the flow. Ensuring protection of the supplied products entails registration and collection of data on them at each stage of the food chain supply, therefore on the level of each enterprise participating in the chain. It is significant, especially in a situation when for some reason a product needs to be withdrawn from the supply chain. In accordance with the law requirements (ordinance (EC) no 178/2002) traceability is obligatory in the food industry and since July 1<sup>st</sup> 2013 the cosmetics one (ordinance (EC) no 1223/2009). One of the most important elements of the traceability process is withdrawing goods from the market (Recall). Most frequently the system of tracking movement and origin of products is used for locating unsound and hazardous food, pharmaceuticals or other detrimental to the customer products which are marketed; source: <http://www.gs1pl.org/traceability>, 22.06.2013.

<sup>121</sup> J. Ejsymont, (2006) *Czy nowa technologia EPC zastąpi kody kreskowe* [Will new EPC technology replace bar codes]. In: The „Logistyka” Magazine, 6/2006 p. 85.



- barcodes will be used for long in logistics because of their reliability (if we place the transponder directly on metal packages, then its range equals zero<sup>122</sup>), commonness and comparatively low costs of implementation and maintenance;
- owing to the electronic memory the RFID marking enables any data to be recorded repeatedly;
- RFID tags work in the wide range of temperatures and have a strong resilience to ambient conditions;
- the life span for information carriers is measured in years, whereas the number of reads is measured in millions.

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<sup>122</sup> S. Kwaśniewski and P. Zając (2004) *Automatyczna identyfikacja w systemach logistycznych* [Automatic identification in logistics systems], PW, Wrocław, p. 137.

## 8. IT systems for the needs of logistics

### 8.1. IT technologies supporting and integrating information flow

The most known systems of logistics management support used in practice include:

- Materials Requirement Planning (MRP);
- Manufacturing Resources Planning (MRP II);
- Enterprise Resource Planning (ERP);
- Efficient Consumer Response (ECR);
- Consumer Relationship Management (CRM);

The presented identification of IT systems used in supply chain demonstrates that the producers of systems attach increasingly more value to the construction of scalable applications, i.e. those that would 'grow' together with the length and capacity of the supply chain. They usually offer their customers a new application, on the surface very similar to the previous one, yet much more functionally developed, using a modern, efficient data base. Thanks to this, the participants of the supply chain who decided to purchase and implement the programme suitable for their current situation may easily exchange the software in the future, when their needs increase.

The results of the conducted research demonstrated that the necessary conditions for the IT integration within multinational and cooperative supply chains, are as follows<sup>123</sup>:

- IT technologies existing in companies and supply chains;
- homogeneous identification standard;
- automatic identification;
- electronic communication, including electronic data exchange;
- integrated IT system;
- protecting the flowing information from unauthorised access and warranting their credibility.

The new program is similar in use, so the employees who work on it do not need to learn it from scratch. Moreover, the implementation time and costs are significantly reduced. An important tendency in company management-supporting systems is their continuously growing flexibility. The modern software may be increasingly more easily modified.

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<sup>123</sup>Cf. A. Szymonik, *Technologie informatyczne w logistyce*, Placet, Warszawa 2011, p. 102.

A pre-condition for building the network of interrelations among external companies within the supply chain, which is also confirmed by the results of individual study, is for these companies to have information systems of a certain class that is required. These should be the ERP-class system, providing the possibility to expand economic activity by e-business, i.e. ERP II solutions, which also account for the external elements of the business environment. 70% of the Western companies, along with most NATO members (Germany, Turkey, USA, Canada, the UK, Spain, Portugal, France, Italy, the Netherlands and others) use the ERP systems, which confirms that Polish companies should be implementing systems of this class<sup>124</sup>.

The complex integration of IT systems may be executed according to different strategies depending on the type of business. The aim of such integration is optimisation of the supply chain and then particular participants. Fulfilling this condition requires the following provisions from the IT system:

- the possibility of obtaining information in every demanded spot of the flow along the logistics chain;
- accessibility of information to all cooperating partners;
- accuracy of information;
- satisfying speed of the information flow and its topicality;
- the possibility of processing information for the support of the decision making process;
- the possibility of automation of activities connected with manufacturing, obtaining and processing information and making decisions.

### **Material Requirements Planning system (MRP)**

*Material requirements planning is a collection of techniques which enable management of the upper part of the supply chain, and particularly in the supply subsystems and production. These techniques are often supported with appropriate computer applications<sup>125</sup>.*

The main objective is making the flows between the supplier and the recipient more efficient. It is achieved by optimization of the supplies needed for production.

The information about planned production or the amount of sale or accepted orders for ready goods is fed into the system. On that basis the system plans the

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<sup>124</sup> Ibid, p. 103.

<sup>125</sup> Cf. Z. Banaszak, S. Kłós, J. Mleczko, *Zintegrowane systemy logistyczne*, PWE, Warsaw 2013, p. 169.

production of particular elements and supply of sub-assemblies and materials. Planning may be made in advance or backwards (i.e. calculating from a given day, when the required production will be completed or when the process should commence in order to achieve required production for a given date). The system foresees the production times and supply times.

The planning process may include optimization of costs, time of completion and profitability. Different types of algorithms are used for various types of production.

The objective of the MRP system is to:

- provide a sufficient number of materials, parts and products for the needs of the planned production or supply to the customer;
- maintain the minimum level of supplies;
- plan production, supplies and purchasing;

The main elements of MRP systems include:

- Master Production Schedule (MPS);
- a specification of elements which create the structure of the product – Bill of Materials (BOM);
- Master Production Schedule (MPS);
- Inventory Master File (IMF).

## **Manufacturing Resource Planning System (MRP II)**

*Manufacturing Resource Planning II* system is the development of the MRP system and is an “integrated multi-accessible IT system” designed for supporting management of a production enterprise, which is in fact the basic link in the supply chain.

The system is based on MRP II standard, compiled and published by the APCIS (*American Production and Inventory Control Society*) organisation commission in the late 80s.

It joins the process of planning, steering and manufacturing. Moreover, the processes also include, apart from the cells directly connected with production, the cells from other functional departments of the company (supply, distribution and others, according to needs), integrating them together<sup>126</sup>.

Implementation of MRP II enables better customer service through limiting the cases of shortages or lack of supplies, more efficient supplies and higher

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<sup>126</sup>J. Majewski, *Informatyka dla logistyki*, ILiM, Poznan 2002, p. 25.

sensitivity to the changes in demand, and therefore make the relation between the supplier and the recipient more efficient in the supply chain. The system of planning production supplies facilitates the reduction of costs of stock and downtime of the production line and increases the flexibility of flows.

The MRP II system covers most of all the planning of:

- undertakings;
- production;
- Material Requirements Planning (MPR);
- Capacity Requirements Planning (CPR).

In the “MRP II Standard System”, the official description of the MRP II, presented 16 groups of features that it has to meet:

- Sales and Operation Planning (SOP);
- Demand Management (DEM);
- Master Production Scheduling (MPS);
- Material Requirement Planning (MRP);
- supporting material structures management – Bill of Material Subsystem (BOM);
- Inventory Transaction System (INV);
- Scheduled Receipts Subsystem (SRS);
- Shop Floor Control (SEC);
- Capacity Requirement Planning (CRP);
- Input/Output Control (I/OC);
- Purchasing (PUR);
- Distribution Resource Planning (DRP);
- Tooling Planning and Control;
- Financial Planning Interface;
- Simulations;
- Performance Measurement.

Two most important functions in planning MRP II production resources are performed by two components:

- MRP – material requirements planning;
- CRP – capacity requirements planning.

In order to plan the material requirements well, you need to introduce the following into the data base:

- the forecast of the ready goods sales;

- the number of components, raw materials and materials falling on one unit of sale of the ready good;
- dates of supply of components, raw materials and materials;
- the length of the production cycle of the ready good;
- warehouse state of the ready goods, components, raw materials and materials;
- minimum units of purchase and size of packaging;
- the size of the safety supplies of ready goods, components, raw materials and materials.

The right functioning of MRP II requires previous opening of the order:

- for the customers;
- for production;
- for the purchase of components, raw materials and materials.

The forecast of the production capacity requires the knowledge about:

- production scheduling;
- capacities of the working centres;
- production routes;
- workload of the working centers;
- working time parameters;
- available resources of production capacities in machine hours<sup>127</sup>.

It is estimated that about 70% of complex IT implementations of industrial companies in the most developed countries are the systems which fulfil the MRP II criteria<sup>128</sup>.

The benefits of using MRP II system include:

- the improvement in production planning and the possibility of its tracking;
- decreasing the stock state by their better distribution and tracking their state in the warehouses;
- lowering the costs connected with decreasing of the stock state;
- complex reporting, reports about production planning and execution;
- ordering the information flow and facilitating the access to it;
- the possibility of short and long term planning on the basis of the possessed data and also conducted simulations; the improvement in supply and sale through integration of data about it with the data about the company's demand.

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<sup>127</sup> *Logistyka biznesu*, edited by M. Ciesielski, PWE, Warsaw 2006, p. 126.

<sup>128</sup> Cf. A. Szymonik, *Technologie informatyczne...*, op. cit., p. 109.

The main disadvantage of MRP is that the original MRP method is already 50 years old and often it is not able to fulfil the needs of contemporary enterprises, e.g. MRP/MRP II are not sufficient in case of a complex approach to logistics chain management or production cooperation of a few companies. Another drawback is that the *Master Production Schedule* is too rigid a tool for modern companies.

## **ERP Enterprise Resource Planning System (ERP)**

*Enterprise Resource Planning* (ERP) (more often translated by producers as Advanced Resources Management) – a term describing a class of IT systems which support enterprise management or cooperation of a group of enterprises, through gathering data and enabling making operations on the gathered data.

The support may cover all or some of the management levels and it facilitates optimisation of using the enterprise resources and the processes taking place. ERP systems consist of modules, i.e. they contain individual yet cooperating applications and are classed as IT integrated systems.

ERP are a development of MRP II systems. Their basic element is a data base which is usually shared by all the other modules.

The modules usually cover the following areas<sup>129</sup>:

- information for management;
- decision-making support;
- data protection;
- multimedia integration;
- data access through search engines;
- storing;
- resources management;
- tracking supplies in progress;
- production planning;
- supplying;
- sales;
- contacts with customers;
- accountancy;
- finances;
- human resources management (payroll, HR).

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<sup>129</sup>Cf. [http://pl.wikipedia.org/wiki/Planowanie\\_zasob%C3%B3w\\_przedsi%C4%99biorstwa](http://pl.wikipedia.org/wiki/Planowanie_zasob%C3%B3w_przedsi%C4%99biorstwa), 24.08.2012.

The ERP systems may also include other modules, such as for example transport management, *controlling* or project management. ERP systems are fairly flexible and enable matching them with the specifics of particular enterprises, also because particular modules may be independent of each other (that is, they may work without the presence of other modules).

These systems usually allow for establishing the access authorisation for particular users. Other typical feature of these systems is the possibility to enable the users *bottom-up* re-planning, that is a possibility of entering changes (making corrections, looking at alternative solutions) in the solutions offered by the system.

It is estimated that systems such as ERP will not be functional in a few year time in the age of *e-commerce*, that is electronic business interactions between the staff of the company, business partners and customers within one business community.

In the age of a *global village* and *knowledge based economy* companies must maintain closer relations with partners and customers than a few years ago. The idea of traditional ERP systems is slowly failing to match the contemporary economic and technological reality. Therefore those companies who want to become more competitive are already beginning to plan migration from ERP to ERP II.

The first ERP II class systems were created at the end of the previous century. They are a yet another development of the idea of integrated systems supporting the enterprise management. Apart from all functions ERP systems also cover the functionality of the CRM class systems – customer relations management – (usually by expanding modules of sales and distribution) and SCM – *supply chain management*. Additionally the following subsystems are available<sup>130</sup>:

- suppliers relations management – a tool supporting efficient managing of cooperation with suppliers;
- product life-cycle management – a solution which enables management, tracking and controlling all the information connected with the product;
- strategic enterprise management – a solution which supports strategic planning (*Business Intelligence*, data warehouses and controlling);
- human resources management – solutions for HR and payroll departments.

Expanded functionality is not the only feature which distinguishes ERP II systems, though. The change of the system's architecture has a particular

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<sup>130</sup> Cf. <http://www.systemy-erp.yoyo.pl/?cat=3>, 24.08.2012.



meaning. ERP II is based on Internet technology and consists of components (and not modules, like it is with ERP).

This affects the openness of the system and means that it is easily integrated with other systems within the enterprise and also beyond it. Due to the possibility of creating Internet portals the access to information resources of the system – through a WWW search engine – is available not just to internal users, but also business partners and customers.

However, the differences between previous generations of management supporting systems and an ERP II class system go beyond the functional and technical zone. Since ERP II changes the very approach to conducting business and causes opening to the outside and facilitates management of an organisation which is an integral part of the external environment.

This is why Gartner Group – the creator of the ERP II term – defines ERP II not as an IT system, but as a business strategy and a collection of applications specific for particular industries, which generate values for customers and shareholders by making available and optimising processes both inside the company and between partner companies.

Among the named processes served by ERP II one can distinguish financial processes within accountancy, purchasing, registration of orders, sales, cost calculating and among operational processes there should be those, which enable cooperation with the enterprise partners within providing them with access to information about shared processes.

ERP II is a development of the traditional ERP idea, however the role of the system has changed. From the technical point of view the ERP II architecture is based on the network and consists of components (ERP is composed of modules). This allows for an easy integration with other systems and an active and immediate participation in the whole chain of information exchange between business partners. Bearing in mind the tasks that ERP II fulfils, it should not be perceived solely as an IT system supporting enterprise management and enriched by the e-business possibility, but as a business strategy for a company. ERP II is able to increase the efficiency of the enterprise's business processes, also in the field of the relations with external environment.

### **SCM (Supply Chain Management) system**

Supply Chain Management SCM (*Supply Chain Management*) – IT solutions that serve the company to manage the supply chain network. SCM is competitive to SCOR and was proposed by The Global Supply Chain Forum.

Thanks to them, it is possible to synchronize the flow of materials between the cooperating parties, which is significantly helpful.

Internal SCM covers issues related to inventory, production and distribution. The external SCM integrates the company with its suppliers and customers.

The SCM solutions are used primarily in the product design phase, selection of supply sources, forecasting the demand for products and controlling their distribution. In fact they contain specialized tools that enable the supervision of individual logistic activities of the company.

The overall conclusion is that the supply chain management model is based on eight complementary business processes that are supported by IT tools<sup>131</sup>: customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, supplier relationship management, product development and sales, managing complaints.

The supply chain management system allows to establish clear principles of cooperation between the bodies that take part in the process of production and distribution of goods<sup>132</sup>.

The overall company performance is not only considered from the perspective of global revenues and costs differences. The efficiency of production and distribution of any product, distribution channel of a product or the supply of materials is optimized as well.

It should be noted that the SCM cannot be implemented without production control, warehouse management and material management, in other words, without the implementation of Enterprise Resource Management (ERP). So with the method of SCM's the companies acquire a tool to manage not only what happens inside them, but also outside. With SCM one can manage not only the processes in the same institution, but also elsewhere in the supply chain.

During the detailed implementation of SCM the functions of planning and supply chain realization are taken care of with particular attention. SCM allows to develop a model of the entire supply network and all its limitations. Then, using this model, one may synchronize the activities and plan the flow of materials throughout the supply chain. On this basis, supply is being adapted to the demand and feasible plans for the provision, manufacture, inventory and transportation are created.

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<sup>131</sup> Cf. *Strategie łańcuchów dostaw*, M. Ciesielski, J. Długosz (eds.), PWE, Warsaw 2010, p. 25.

<sup>132</sup> Cf. J. Majewski, *Informatyka dla logistyki...*, op. cit., p. 60.

The SCM plan includes many different locations, their interdependencies, the global supply chain and the business partners of the company. The process of collaboration on a global scale is new for larger companies and requires the introduction of organizational changes.

This includes not only the implementation process, but also strategic, tactical and operational planning. As a result, SCM has an impact on business processes, even at the lowest level.

Scheduling in real time, advanced methods of simulation and optimization capabilities using SCM provide an entirely new process flow, other than the ERP system. SCM users must therefore become thoroughly familiar with the functioning of the entire supply chain.

The benefits brought by SCM systems are<sup>133</sup>:

- integration of internal and external business processes of a company via the Internet;
- integration with the electronic markets;
- Facilitating the global planning level of a demand for specific products;
- the ability to simulate the current market, enabling rapid response to emerging demand from the customers;
- the ability to optimize the supply sources;
- co-specialized material requirements planning and determination of capacity;
- ensuring transparency of mutual interdependence between the individual chains of the supply chain;
- the creation of collective plans for the procurement, storage, production and transport of manufactured goods;
- defining all limitations of the existing supply network.

The growing popularity of e-business, the Internet, or corporate portals<sup>134</sup> directed the integration process within international logistic channels via eSCM (*electronic Supply Chain Management*). Electronic management of the supply

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<sup>133</sup> Cf. [http://pl.wikipedia.org/wiki/Zarz%C4%85dzanie\\_%C5%82a%C5%84cuchem\\_dostaw](http://pl.wikipedia.org/wiki/Zarz%C4%85dzanie_%C5%82a%C5%84cuchem_dostaw), 24.08.2012.

<sup>134</sup> A corporate portal is an IT platform, which integrates systems and technology, data, information and knowledge that function in the organization and its environment, in order to allow users a personalized and convenient access to data, information and knowledge, according to the tasks arising from their needs, anywhere, anytime, in a safe manner and through a single interface. The creators of the concept of corporate portals are Shilakes C. and J. Tylmanna from Merrill Lynch, according to <http://mfiles.pl/pl/20/08/2013>.

chain is friendly to singular transactions and operations in virtual business carried out via a network of independent temporary companies (suppliers, manufacturers, customers, clients and competition, a set of partner companies). The e-SCM system consists of the following elements<sup>135</sup>:

- e-trade;
- e-manufacturing;
- e-logistics;
- e-planning;
- e-supplies;
- e-design.

## **8.2. Instruments and tools used in modern transportation systems**

Transport systems should secure efficient movement of goods and people both locally and globally, and provide the conditions for their functioning.

One way is to implement transport processes through the creation of an integrated transport system which will optimally meet the transport needs by linking the activities of all modes of transport together both internal (i.e. intermodal operations) and external (i.e. relative to the entire economy and the departments of transport users on the national and international scale).

The transport system should include:<sup>136</sup>

- internal domestic coordination – meets other areas of the economy; here attention should be paid to the spatial, quantitative and time-related aspects;
- external international coordination – is to align the transportation system to that of other countries;
- internal horizontal coordination – related to the modal split between different modes of transport, as part of the transport system, the state in their transport policy can provide the impetus and encouragement to boost the development of certain modes of transport, or may develop them equally alongside each other;
- internal vertical coordination – includes all activities which, under an efficient transport system ensure complementarity and substitutability of the various modes of transport.

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<sup>135</sup> See. *Instrumenty zarządzania łańcuchami dostaw*, M. Ciesielski (ed.), PWE, Warsaw 2009, p. 328.

<sup>136</sup> J. Neider, *Transport międzynarodowy*, PWE, Warsaw 2012, p. 26.

The basic condition for the creation of integrated modern transport systems is the use in the practical operation of modern management methods and techniques and technologies.

In road transport, the opportunity to improve both efficiency and security are created by modern telematics and informatics.

The telematics systems allow to monitor vehicles or the transported load, control the parameters of the vehicle and driver and transfer recorded data by telecommunications, to the place where they can be processed.

On the other hand, the IT systems, allow the processing of the the data obtained and make it possible to use them to make more effective business management through more effective management of its human resources and hardware, minimizing the direct costs in transportation, greater control of cargo and safer control of their movement and to minimize the risk of loss or incidental change of cargo.

The continuous development of the IT industry and the rapid increase in the availability of solutions based on satellite systems (mainly GPS) means that the European market today there are many modern systems that support enterprise management. Data obtained through the use of these systems support management processes, which increase the efficiency and competitiveness of enterprises in an increasingly integrated European transport market. They allow not only the creation and development of databases for route optimization and cost minimization of direct transport, which significantly shortens the operational time needed, and directly supports company management, but also to increase the safety of drivers, vehicles and cargo, and improved control of fleet<sup>137</sup>.

In rail transport, an important instrument is the **European Rail Traffic Management System – ERTMS** (European Railway Traffic Management System).

It is one of the key projects aimed at maximizing the interoperability<sup>138</sup> of transport, especially the railways in Europe. The ERTMS system allows to<sup>139</sup>:

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<sup>137</sup> J. Łacny, *Systemy telematyczne i informatyczne w nowoczesnych przedsiębiorstwach transportu drogowego* <http://www.google.pl/#hl=pl&output=search&scIent=psy-ab&q=J.+%C5%81acny>, 18.07.2012.

<sup>138</sup> Interoperability means the ability of the trans-European rail system for the safe and unhindered railway traffic, while providing the required performance values. In practice, this means that the interoperable rolling stock can move through the interoperable railway infrastructure and move between the railway networks of particular states without having to stop at the borders, exchange locomotives or drivers. These features are designed to provide a high level of security and quality of service; source:

- improve the safety of the train;
- increase the capacity of the railway line;
- reduce the risk of accidents, communications equipment renewal and adaptation to international standards;
- improve the quality of rail services as additional services can be provided with its usage.

**ERTMS**, among other features, contains an unified European radio communication **GSM-R** (*Global System for Mobile Communications – Railway*) and a unified European control system **ETCS** (*European Train Control System*). Both systems are essential components of the European policy on removing barriers in transportation, both in terms of technical barriers in railway networks within the borders of the EU and the creation of a common market of goods and services for the railroad.

ETCS – ensures continuous cabin signaling and controlling the work of the driver. Under Polish law, the driving at speeds exceeding 160 km/h requires cab signaling. The ETCS system adapts to the needs of the railway line through the implementation of an appropriate level of ETCS. The levels first, second and the third are backwards compatible, which means that the vehicle with a higher level can drive not only on the same ETCS level, but also at lower ones<sup>140</sup>.

GSM-R – is a railway version of GSM, running in the 900 MHz band. GSM-R is functionally similar to the GSM version 2 +, that provides users with a digital radio channel and a channel for data and functions provided for specialized applications for railways. GSM-R in addition to carrying out the functions of communication technology for railways, is also a transmission medium for ETCS Level 2 and 3, by which permissions to move are transmitted, issued by the Radio Control Center (Radio Block Centre – RBC) between trains located in the area of the RBC. Radio signal using the GSM-R system is also sent to update the system ETCS Level 1 uses radio infill functions. The GSM-R

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M. Kornaszewski, M. Chrzan, *Zaangażowanie Polski we wdrażanie systemu ERTMS na ile wybranych krajów europejskich* [olish involvement in the implementation of the ERTMS system to selected European countries], The „Logistyka” magazine 3/2012, p. 169.

<sup>139</sup>[http://www.utk.gov.pl/wai/pl/11/213/Europejski\\_System\\_Zarzadzania\\_Ruchem\\_Kolejowym](http://www.utk.gov.pl/wai/pl/11/213/Europejski_System_Zarzadzania_Ruchem_Kolejowym), 18.07.2013.

<sup>140</sup><http://www.dobralogistyka.pl/europejski-system-zarzadzania-ruchem-kolejowym-ertms,artykuly>, 19.07.2012.

in the next several years is planned to replace the currently operating, outdated 150 MHz analog radio communication system<sup>141</sup>.

GSM-R is useful to the railway, as has the ability to<sup>142</sup>:

- simultaneously transmitting voice messages, transfer data to multiple recipients;
- interrupting less important conversations in favor of the more important;
- connection with a specific person because of their function;
- connection with a particular person because of the locations in the area, such as the train driver dispatcher of segmental motion at the push of a button.

According to the International Union of Railways UIC, GSM-R communications in Europe is installed at different levels. The leaders in this area are German and Italian railways.

Slightly different rules apply to freight rail transport, regulated by the PKP, but more and more often it is required to monitor all trains and their cargo (it's not about controlling the flow). The problem also applies to the security service and the means of transport themselves.

The monitoring of the movement of rail transport may be important in the case of valuable cargo or that requiring special supervision for other reasons (e.g. strategic). Due to these ways the monitoring is applied, the users may include: the customs, police, SOK (Railway Guards), Border Guard and security firms, specializing in the transport of money, goods of a special nature (e.g. radioactive materials), coal (e.g. from Silesia deeper into the country) etc. Here the valuable tools are those that are used in telematics in road transport. Those include the systems<sup>143</sup>:

- electronic communication, combining individual elements of the telematics system (WAN, LAN networks, mobile communications, satellite systems);
- obtaining information (sensors, video cameras, radars);
- presenting information for the telematics system administrators (GIS systems, access control systems);
- presenting information for the users of the system (traffic signals, broadcasting, web technologies – web, SMS).

A tool that is to be widely deployed and used in rail transport is the Global Navigation Satellite System – GNSS (Global Navigation Satellite System),

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<sup>141</sup> Ibid.

<sup>142</sup> M. Rabsztyń, *Łączność GSM-R w ruchu międzynarodowym* [GSM-R connectivity in international traffic], Newsletter, Ministry of Infrastructure, Warsaw 2010, 4/2010, p. 17.

<sup>143</sup> See: <http://www.it.pw.edu.pl/twt/loader.php?page=telematyka>, 17.07.2012.

which consists of two basic elements: the space segment and the ground segment. In addition, controls segments also operate, considered by some as a part of the ground segment.

According to a study conducted by the CER and UIC<sup>144</sup> more than 40 ways of using the GNSS application can now be indicated in the railway transport. In simple terms it can be divided into five main groups<sup>145</sup>:

- GNSS in railway engineering, construction and modernization of railway systems, inspections, diagnostics and servicing;
- commercial applications, mass-market, comprehensive information and management;
- basic safety systems;
- safety-enhancing applications – power management, security, basic systems;
- automation of processes related to the management of the rolling stock and rail traffic, precise coordination, the use of GNSS as a time source for other systems.

In practice applied GNSS Systems allow to:

- facilitate the surveying necessary for modernization and construction of high-speed trains;
- assess the quality of the work or the technical condition of the track;
- perform the monitoring of large rail networks; using digital cameras connected with the GNSS receivers installed on the locomotives (It allows unmanned, easy documenting of the condition of the railway network and its surroundings);
- accurately determine the position, movement speed and time, so that the passengers of the train on their individual passenger terminals and the general wagon monitors are able to see the map of the route with an indication of where they actually are, and find out how fast they are moving as well as if the train is going according to the timetable (passengers planning to find out if their trains depart in accordance with the timetable and the platform, and those waiting for the train will be fully informed about the time remaining until the arrival);
- allow tracking of wagons through RFID transponders and gates along the route of the train, allowing the wagon owners, shippers and freight

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<sup>144</sup> CER – The Community of European Railways and Railway Infrastructure Managers, UIC – International Union of Railways.

<sup>145</sup> See. J.W. Sobstel, *GPS na szynach* <http://www.kosmos.gov.pl/ekatalog/materialy/>, 17.07.2012.



customers know where they are and when they will reach the goal. It is called the automatic identification systems in rail vehicles (AVI – Automatic Vehicle Identification);

- help reduce the risk during transport of toxic, explosive and flammable materials, as well as nuclear waste and radioactive materials by:
  - monitoring of the load along its entire route,
  - choosing safer routes and parking areas,
  - reducing transport time,
  - detection of anomalies and threats,
  - quick location of a threat when one is detected,
  - shortening the response time for an event,
  - usage of appropriate manpower and resources to combat the threat.

Some of these solutions are currently utilized using the GPS system with all its advantages and limitations. Implementation of some of the solutions, especially in terms of security, will be possible only after the certification of the Galileo system.

In aviation, despite the undeniable technical progress that has been made in the last 40 years, European airspace is still organized the same way as in the 60s when the overall air transport volume was much smaller and dominated by bilateral agreements between countries. Air traffic control in Europe is still organized within national borders without a clear indication of airspace borders. This solution contributes to inefficient management of space. It does not account for the need to look at the traffic flow across borders, more in blocks of airspace.

Currently 440 airports serve 1.400 million passengers a year. Every day, 26 000 flights traverses the European sky. Every year there are 10 million flights – the number is growing every year by 5%. In 20 years it will have 16.9 million flights a year – this means that by 2030 in Europe there will be as many annual flights, as there are people in Beijing<sup>146</sup>.

The dynamic development of the air transport market and the increasing globalization meant that the market needs to be opened just like other EU markets. The *single aviation market* in the EU is composed not only from the open market for air transport, which was created in the years 1987 to 1997, but also of the Single European Sky, which includes services related to air traffic management.

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<sup>146</sup> [http://ec.europa.eu/polska/news/111125\\_lotnictwo\\_pl.htm](http://ec.europa.eu/polska/news/111125_lotnictwo_pl.htm), 22.07.2012.

The next step is to reform the air transport sector, which is expected to lead to the creation of an *unified system*. To accomplish that, in 2000, the initiative of *Single European Sky* (SES) was proposed.

The bodies responsible for the implementation of the SES are: the European Commission, the Member States, the Eurocontrol<sup>147</sup> and the aviation industry.

The main objectives of the Single European Sky include<sup>148</sup>:

- increased safety – air traffic control in Europe is one of the safest in the world, but it requires full harmonization in all Member States (in response to the increasing traffic in the airspace it is required to create a more systematic and binding approach in the management of safety);
- the elimination of disparities in the allocation and air traffic control – today every country organizes air traffic control in their own airspace (the differences in the rules and organization of the order in the sky create inconsistencies that have significant impact on the regularity and air traffic flow);
- ensuring closer cooperation with the army in the organization of air traffic control and the legislative process;
- increase in airspace capacity, which is necessary due to the annual air traffic growth of about 5%;
- increasing the efficiency of air traffic management system;
- facilitate the introduction of new technology – is required here, collaboration among providers of air traffic control, aviation equipment manufacturers, airlines and other airspace users;
- 10% reduction of the negative impact of aviation on the environment;
- 50% cost reduction of air traffic management.

Actions taken under the *Single European Sky* relate primarily to the organization and use of airspace, in particular:

- the creation of functional airspace blocks (FABs) and related common rules;
- establishment of the *European Upper Flight Information Region* (EUIR);
- the development of rules for the flexible use of airspace (*Flexible Use of Airspace* – FUA);
- the development of airspace classification rules;

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<sup>147</sup> Eurocontrol The European Organisation for the Safety of Air Navigation. It is composed of 38 Member States (including the EU). Poland belongs to the organization since September 1, 2004.

<sup>148</sup> [http://www.ulc.gov.pl/index.php?option=com\\_content&task=view&id=390&Ite,](http://www.ulc.gov.pl/index.php?option=com_content&task=view&id=390&Ite,) 20.07.2012.

- the development of rules for the design of airspace (routes and sectors);
- the development of rules on air traffic flow management.

Year 2012 is critical for the single European sky, as provided for in the implementing period of four key objectives:

- the implementation of the performance scheme, setting out the key tasks for air traffic management (ATM Air Traffic Management);
- implementation of the nine functional airspace blocks;
- choosing the manager of the ATM network (already designated for this role Eurocontrol);
- commencement of the implementation phase of SESAR<sup>149</sup>, the technological pillar of the *Single European Sky* (from 2014), moving from a phase of research and development to launching new devices and technologies.

The system of effective implementation is, inter alia, the EU-wide objective regarding capacity, assuming an average of 0.5 minute delay per flight in 2014. If we could achieve this, in 2012-2014 savings would amount to 920 million, thanks to reductions in the number and scale of delays<sup>150</sup>.

### 8.3. Telematics in transportation processes

**Transport telematics** is the area of transport-related knowledge, integrating IT and telecommunications as regards application in management and traffic management in transportation systems, stimulating technical and organizational activity enabling to raise the operational effectiveness and safety of these systems. Particular telematics solutions work together, often under control of some overriding factor.

Telematics in transport processes is identified with such concepts as:

- Intelligent Transportation Systems (ITS) include a wide range of technology solutions to improve transport by increasing mobility and road safety. These systems combine many of the elements and actions aimed at fostering or improving the wider transport communication, prevention, control and traffic management, event detection, surveillance or elimination of traffic violation etc. The ITS system includes, among other things:

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<sup>149</sup> SESAR, *Single European Sky ATM Research* – a program being the technological pillar of the Single European Sky. Its aim is to create a system of air traffic management of new generation that will suit the future needs of aviation, according to the projections contained in the Flight Path in 2050 report and the White Paper on Transport; source: <http://www.ulc.gov.pl/index.php?option, 20.07.2012>.

<sup>150</sup> <http://www.ulc.gov.pl/index, 20.07.2013>.

- Traffic Management Centers;
- integrated traffic management;
- traffic control systems, including traffic light control;
- public transport management systems;
- CCTV<sup>151</sup> video surveillance systems;
- ARTR<sup>152</sup> video surveillance systems;
- speed monitoring systems;
- variable message signs;
- dynamic vehicle weighing systems;
- vehicle height measuring systems;
- parking information systems.
- intelligent transport – are two co-working systems: intelligent route and intelligent vehicle, i.e. a vehicle equipped in devices that maintains continuous, especially wireless, information exchange with the devices installed over/under the road or its sides.

Each telematics system in transportation may be described by specifying its<sup>153</sup>:

- functional structure, which may fulfill the following structures in transport:
  - support electronic transactions in payment for the use of road infrastructure;
  - provide information in situations that threaten the life and health of road users;
  - manage data traffic, including not only the traffic on urban roads and outside cities, but also in case of extraordinary events (incidents) in traffic;
  - supports the management of public transport operations, including the transport fleet;

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<sup>151</sup> CCTV: Abbreviation of the words: Closed Circuit TeleVision. Overall, by the CCTV system we should understand all the related equipment for receiving, processing, transmission and archiving and displaying video and audio in the monitored objects; <http://www.e-army.pl/baza-wiedzy/porady.html?kid=4&id=12>, 17.07.2013.

<sup>152</sup> ARTR is used to identify and search out vehicles identified by the registration number. The system records the vehicle, followed by the time and place of his residence, and automatically detects and assigns car registration numbers with the numbers entered in the system as requested, [http://szrm.pl/inwestycje/242\\_zrealizowane/system-monitoringu-wizyjnego-2/](http://szrm.pl/inwestycje/242_zrealizowane/system-monitoringu-wizyjnego-2/), 17.07.2012.

<sup>153</sup>K. Bartzak, *Technologie informatyczne i telekomunikacyjne jako podstawa tworzenia systemów telematycznych w transporcie* [telematics in transport], [in:] *Współczesne procesy i zjawiska w transporcie*, USz, Szczecin 2006, pp. 14-17.

- helps drivers of the vehicles (navigation);
- provides passengers with information before and throughout the journey;
- supports compliance with road use legislation;
- supports transport operations management;
- physical structure, which in transport is shaped, among others, by:
  - system centers, i.e. places where collected data are stored and transferred with the use of computers, e.g. traffic control centers (TCCC), traffic information centers (TIC), loads and vehicles management centers etc.;
  - sides of the roads, i.e. places where devices for measuring traffic, collecting fares and providing information to drivers etc.;
  - vehicles, i.e. places that are means of transport, where appropriate electronic (on-board) systems have been installed, capable of electronic information exchange with the surrounding environment;
  - personal devices, owned by the driver or the passenger, which allow for electronic connection with other elements of the telematics system;
  - devices installed in the cargo units, such as containers or trailers, which have the possibility of electronic transmission or receipt of information from the environment;
  - kiosks, i.e. devices available in public areas that allow a limited extent access to information resources stored in databases in the transport system;
- communication structure – the individual physical locations in the telematics system, where particular functions or groups of functions are fulfilled; they need to be connected to each other electronically in a given communication system (establishment of appropriate communication structure for transport telematics system requires the selection of appropriate information and communication technologies commonly available on the commercial market).

### **Monitoring of truck transportation**

Growing congestion on the roads and rail routes, changing weather conditions, different incidents that occur on the roads unexpectedly are highly influential to the quality and safety of transport tasks. Mobile communication becomes increasingly important in transport as well as in search and rescue operations.

Many companies, including Polish ones, produce various devices which when synchronized with other techniques and technologies constitute a system for identification of vehicle position and data which allow for:

- automatic transmission of information about the route of given means of transport (continuous monitoring);
- locating a vehicle that was stolen, for example;
- remote immobilisation of the vehicle, e. g. in case of theft;
- providing information related to the transportation of hazardous materials to appropriate services, in order to reduce the probability of disaster and preventing its effects;
- optimizing transport and operational costs (real-time data concerning speed, working time, stopovers as well as planning routes for safety reasons, such as traffic congestion, repairs, weather, road conditions);
- transport management in on-line mode (to eliminate empty runs and unused loading space, quick reaction to unexpected incidents, such as theft or accidents);
- efficient use of transport and human resources (preparation in a timely unloading, quick response to problems in the shipments planning).

In practice, the systems used for monitoring mobile transport are those generally accessible on the market, using the *Global Positioning System* (GPS) in combination with *General Packed Radio System* (GPRS) and *Global System for Mobile Communication* (GSM), digital mobile telephony operating at a frequency of 900 MHz.

GPS is the first global satellite navigation system. It was designed by the U.S. Department of Defense, which gave it its official name: NAVSTAR GPS (*Global Positioning Navigation Satellite Timing and Ranging*). The GPS system consists of three main elements<sup>154</sup>:

- satellites in outer space;
- measuring stations located on the ground;
- a GPS receiver (most important for an individual user).

With satellite navigation, we have access to detailed information about our position on the ground.

The principle of operation is based on measuring the time of arrival of radio signals from the satellites to the receiver. Knowing the speed of electromagnetic wave, you can calculate the distance of the receiver from the satellites. Having

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<sup>154</sup> <http://www.investor.wroclaw.pl/co-to-jest-gps/>, 20.07.2012.

the location of the satellites at a time entered into the memory, chip receiver can calculate the geographical position (longitude, latitude and ellipsoidal height) in the WGS-84system, as well as the current GPS time to within a millionth of a second. The GPS is operated and managed by the U.S. Department of Defense. In principle, practically everyone may use its services, as long as they have an appropriate GPS receiver, which are produced by independent commercial companies.

The currently functioning satellite systems for vehicle monitoring that use GPS can operate thanks to a combination of advanced IT and telecommunications satellite techniques. The satellite vehicle monitoring systems consist of four basic subsystems<sup>155</sup>:

- location system – user 24 US NAVASTAR GPS army satellites the accuracy of the system is approximately 25 m (90% of the measurements), and after the use of the reference station average error is about 5 m;
- data reception and transfer system – installed in a movable object; its tasks include, among others: receiving satellite signals (these signals, first processed by a microprocessor become geographical coordinates and the speed parameter; this information, along with the report on the technical condition of the object is passed on to the monitoring station);
- data transfer system – using conventional and mobile radio networks (e.g. PMR – Private Mobile Radio, PAMR – Public Access Mobile Radio), mobile telephony (GSM – Global System for Mobile Communications, UMTS – Universal Mobile Telecommunications System), including packet data transfer and the satellite connection (the task of this subsystem is to ensure two-way communication between the monitored object and the monitoring center);
- management system – responsible for constant monitoring and managing the object, both while it is moved and during the stops.

Similarly to most other solutions, described further, the presented system provides<sup>156</sup>:

- locating transport objects in real-time using GPS;

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<sup>155</sup>W. Drewek, *Monitorowanie ładunków niebezpiecznych w transporcie drogowym* [Dangerous goods monitoring in road transport], [in:] The „Logistyka” Magazine, 5/2011, p. 515.

<sup>156</sup>W. Szulc, *Elektroniczne metody monitorowania ruchomych środków transportowych* <http://www.zabezpieczenia.com.pl/monitoring/elektroniczne-metody-monitorowania-ruchomych-srodkow-transportowych>, 17.07.2012.

- monitoring objects using detailed, digital city maps and road maps of Poland and Europe;
- 24/7 access to current and archive information regarding the location of the objects.
- cheap and fast data transfer using GPRS packet data;
- activation of the alarm mode by the sensor system in the event of unintended tilt movement or displacement of the vehicle;
- effective all-time protection against theft of the vehicle and the cargo;
- assembly made in a way that prevents unauthorized access to the GPS receiver and its detectability;
- managing vehicle fleet;
- support of cost balancing for transport means exploitation via automated data exchange (this feature is not common among other described systems).

The algorithm of the vehicle monitoring system consists of three main parts:

- a monitoring system (control center);
- GSM station;
- the vehicle (moving transport object).

The monitoring system, in order to connect to the selected transport, object, connects to the GSM station via Internet or by SMS, with the use of a special terminal. Then, the vehicle (equipped with location and transmission driver) sends the needed information to the GSM station via two variant ways, by GPRS or SMS. The GSM station sends the collected data to a central monitoring station (monitoring center).

All data going to the computer run from the sensors which are located in different parts of the transport means. In practice, we use:

- Detection and identification of containers sensor – detecting a container activates the transponder RFID reader placed at the back of the vehicle cabin. Depending on the loading manner, each container is equipped in one or two RFID transponders. The reader identifies the unique code assigned to each of them. Gathered information about the presence (from the presence sensor) and about the unique code (transponder reader) of the container are passed on to the central unit (a computer), from where, along with information on the geographic location of the vehicle and the time, they reach to the dispatcher (or driver)<sup>157</sup>.

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<sup>157</sup> <http://elte.systemygps.com.pl/produkty/branza-oczyszczania/system-identyfikacji-kontenerow>, 10.07.2012.



- Load stability sensor (there may be several of them makes it possible to establish whether the load is present in the vehicle and whether it is placed in such position as intended during loading. After loading, the container (packaging” gets “detected” – the waves bouncing off the surface of the packaging confirm its presence and the distance from the edge of the box edge or container walls. The sensor plays controlling and activating function for the RFID reader. The reader identifies the code assigned to every sensor<sup>158</sup>.
- The accident sensors send the alarm signal to the GPS/GSM system, providing coordinates. An accident should be understood as a collision or overturning of the vehicle in any axis. Instantly after one of the mentioned occurrences the alarm signal is sent over to the central unit, which sends a message onto the operator’s computer and to 112.
- Fuel cap opening sensor – fuel cap protection for trucks and machinery is a device installed on fuel tank infusion in order to monitor and control the state of opening or closure of the fuel tank. The functioning of the device is based on radio access control technology (RFID), so any attempts to interfere result in a violation signal by SMS or e-mail notification. Installation involves replacing the existing cap with special cast permanently attached to the fuel tank<sup>159</sup>.
- Temperature sensor, of, e.g. a car cooler – the data go to the system and, in combination with the remaining information about the monitored vehicle, are valuable material for analysis. Installing such sensor in a cooler car allows to constantly monitor the temperature of the transported goods. On one hand, we have an independent and remote control of the aggregate functioning, on the other hand it allows to protect oneself against the accusations of the customers that the conditions in which the goods were transported had been inappropriate. The use of a digital sensor allows for high accuracy of the measurement and does not require any additional calibrations.
- The trailer sensor – an identifier in the form of a chip, mounted in the slot of the spiral connector that binds the trailer (semi-trailer) and the tractor. It is used in cases when it is possible to change trailers. It allows to create work combinations with trailers.
- Intrusion sensor, most often a transponder one (a chip with a unique number, read by radio). It allows to control whenever flaps or doors etc. are open.

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<sup>158</sup> W. Drewek, *Monitorowanie ładunków niebezpiecznych w transporcie drogowym...*, op. cit., s. 516.

<sup>159</sup> <http://www.zeus.waw.pl/index.php?a=content&s=46&p=45>, 10.07.2012.

## 9. International logistics security

### 9.1. Security risks

Each action in international logistics in both planning and real areas, are subject to uncertainties, which may be caused by the emerging danger (threats) or interference.

In international logistics any action (phenomenon, event) that disrupts the implementation of logistics processes is a security threat; this includes flows of material goods, maintaining inventory, infrastructure, logistics flow, logistics costs and the flow of information. These types of events can occur standalone or may be combined, creating a hazardous situation from a business perspective, for the economic system and all participants of international logistics channels.

Threats can be directed outwards and inwards; hence, the measures aimed at their disposal should be directed the same way.

Threats are constantly changing, so does the knowledge about them. New threats, as well as the unknown ones – are dangerous. Those already existing and known are not dangerous, because they can be prevented. Some threats are getting more remote, the other closer, becoming inevitable, while others are avoidable<sup>160</sup>.

Threats to the security of international logistics can be divided into four groups.

**The first group** includes natural disasters, and events caused the causes of civilization, i.e. disasters, accidents and other causes of action or negligence of man. This group of threats includes: fires, floods and flooding, strong winds and hurricanes, thefts, epidemics of human diseases, epidemics, diseases of plants and animals, radioactive and chemical contamination, mining disasters, construction and communication failures grids.

**The second group** includes events threatening the constitutional order of the country: terrorism, road blockades, illegal demonstrations, ethnic conflicts, mass migration.

**The third group** includes mechanisms that are designed to destroy or distort the information transmitted, processed, stored for the purposes of international logistics. Any disruption in the flow of information cause difficulties in the efficient and effective logistics management along the entire supply chain.

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<sup>160</sup> P. Tyrała, *Zarządzanie kryzysowe*, A. Marszałek Publishing House, Torun 2003, p. 20.

**The fourth group** includes risks arising from the financial crisis that in reality affects everyone, with no exception to processes and systems of international logistics. Even an economy with great growth rates does not give safety from the crisis and no hundred-percent-sure anti-crisis instruments have been developed so far.

These threats can have destructive impact on the Euro-logistics system, disrupting the flow of material and information flow.

These disturbances may be divided according to<sup>161</sup>:

- the place of danger occurrence – a subsystem:
  - roads all modes of transport (e.g. road, rail, air, waterways, sea),
  - modal points<sup>162</sup> in the logistics network often referred to as points of transport (such as warehouses, container self- points, airports, ports, logistics centers etc.),
  - ancillary equipment to facilitate maintenance of roads and transport points,
  - management (e.g. lack of complete identification of hazards and effects, overestimation of capabilities, improper interpretation of results, the lack of tools to optimize and simulate the actions, the rising price of energy and transport, unexpected bankruptcy of logistics service providers),
  - supplies (e.g. delays, bad quality, price, quantity, assortment, bribery, lack of ability to obtain components for manufacturing, information system corruption, lack of buffer stock),
  - production (e.g. manufacturing systems deficiencies, damages, losses, theft of resources, unavailability of skilled staff, production interruptions, failures, fires, floods, disasters),
  - distribution (e.g. new products, new manufacturers, theft, weather conditions, poor quality products, economic crises, disregard for customer relationship management and the flow of goods in the supply chain),
  - transport (e.g. fire, explosion, accidents during transport, washing from the deck, lack of movement due to weather conditions, inefficient means of transport, misfit internal transport, changes in regulations at the discretion of transportation, theft, disaster),

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<sup>161</sup> See. P. Sienkiewicz, *Teoria i inżynieria bezpieczeństwa systemów*, [in:] *Zeszyty Naukowe AON* No. 1(66)2007, p. 254.

<sup>162</sup> The name of modal (most likely) points of the logistics network refers to all places of stopovers for the products, i.e. warehouses, outlets and transport nodes and factories, distribution networks etc.

- stock and shaping inventories (e.g. theft, losses due to abnormal inventory, fires, floods, building disasters),
- packaging services (e.g. pollution, destruction of goods in transit due to improper selection of packaging, packaging failure on the time due to bad weather conditions),
- handling customer orders (e.g. lack of inventory, incorrect order and invoice, late delivery, damaged goods delivered to the customer, the lack of response to complaints and delays, fires, theft, destruction),
- information (e.g. loss of confidentiality, integrity, and possible disposal, natural hazards, such as fires, climate disruption, electrostatics);
- duration:
  - short-term, occasional,
  - long, and growing,
  - repeated;
- physical properties:
  - material (e.g. transport),
  - information (e.g. damage to a computer system, automatic identification),
  - energy (e.g. gas, fuel),
  - assets (e.g. financial crisis);
- range:
  - local logistics in the economic system, which link the international logistical channel,
  - extensive along the entire supply chain.

## **9.2. Security management of international logistics**

The state of security of every system is not stable and thus it is not a good given to the economic system once and for all. In the real world, there are constant threats, both forces of nature as well as unintentional and intentional effects of human activities.

Therefore every logistic system must put effort to assure itself a stable state of security and also, being a link in the supply chain, should improve the ability of reacting quickly to all changes both internal and external, including the possibility of cooperation with other entities within the scope of the security system.

The security system of international logistics should be tailored to the potential risks and the desired level of security that must be provided. Therefore,

the amount and quality measures necessary to ensure the desired level of safety in the area of international logistics operations, the organization and the conduct of activities (or rather processes), after the liberation of threat (of an event), depends on the type and scale, and also forecast the possibility of threats other types.

Security measures in networks and international logistics channels is a condition that gives a sense of confidence and assurance:

- flow of material goods and services, as a consequence of satisfying the material needs of the supply chain in accordance with the rule “7R”<sup>163</sup>;
- flow of information for planning and management of logistics processes;
- protection and survival during dangerous situations (hazards);
- adaptation to new conditions (vulnerability to unplanned situations).
- Safety system of international logistics associated with:
- prepared and resistance level system to combat emergency situations;
- the quality of the created and functioning security system – understood as a set of forces and means of ensuring acceptable by the participants of the international logistics network security status.

A given degree of international logistics security can be achieved in various ways – not only by providing a direct counter prescribed performance ensuing events.

Thus, we have the opportunity to shape the security level of international logistics services through its management, which can be defined as a set of coordinated actions taken at the time of the emergence of threats (interference), aimed at the logistic resources of all members of the international logistics with a view to achieving the objective, which may be a security of supply, reduce risks, to realize the conditions set by the owner of the cargo and the protection of market position and brand.

Controllable values in this case are the parameters characterizing the factors affecting the level of security of the system, which is associated with<sup>164</sup>:

- prevention of possible threats to the security processes implemented within the framework of international logistics;
- preparation of the logistics systems for the event of activation of these risks;
- resources countering these threats;
- removal of the consequences of the event.

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<sup>163</sup> 7R” – *right product, right quantity, right condition, right place, right time, right customer, right price.*

<sup>164</sup> See. E. Kołodziński, *Istota inżynierii systemów zarządzania bezpieczeństwem*, <http://www.uwm.edu.pl>, 10.04.2013.

**Prevention of possible threats to the security of the international logistics includes:**

- formulation of security policies by all members of supply chain;
- risk assessment during the implementation of processes in the supply chain;
- developing a plan for managing and reducing the identified threats;
- detect, identify, record and control the possible risks;
- forecasting the possibility of crises (e.g. based on data warehouses using computerized systems);
- examination of the acceptance level of risks in the supply chain among its members;
- the type and scope of activities to prevent risks in the area such as road transport, warehousing, distribution, logistics costs – increased fuel costs;
- providing training to the people involved in logistics in the micro (individual economic system) and macro scale, with particular attention to:
  - the institutionalization of logistics relations,
  - standardization of logistics processes,
  - standardization of processes (e.g. according to GS1),
  - growing requirements of transparency of the economic system in business and logistics contacts,
  - tightening the criteria for risk-taking and the professionalization of activities within the supply chain,
  - the need to broaden international cooperation of science and industry in the field of improvement of logistics processes,
  - recreation of a destroyed ecosystem and wider use of renewable energy sources,
  - trust management, risk and security in logistics operations.

**The preparation of the international logistics for the event of activation of threats consists of actions connected with:**

- implementation of safety management system;
- creating documentation of managing logistics safety and supervision over updates within;
- preparation of procedures universally accepted by all participants in the supply chain (not only by a single economic system);
- preparation of a backup logistical infrastructure (for example transport, roads, warehouses, packages, additional supply sources – domestic and foreign, additional receivers) and human resources;

- specifying the way that the information flows within the economic system and remaining members of the supply chain in all of its length;
- specifying the way the flow of goods/services and information is monitored in the period of the disruption including the additional cost of operating.

**Emergency response includes activities and projects related to:**

- commissioning previously developed procedures and supervision of their implementation;
- cooperation and coordination of actions in the implementation of logistics processes along the entire supply chain;
- an on-the-spot current response to additional unplanned situations;
- gathering reports, analyzing them and taking adequate actions connected with the flow of goods and information along the supply chain;

**Rebuilding consists of actions related to:**

- estimating, documentation of losses within the field of logistic costs made by all members of the international logistic channel;
- rebuilding old supply and outlet markets;
- regaining trust among the members of the supply chain and among the end customers;
- reconstruction of the logistic infrastructure.

### **9.3. Instruments used in practical safety management in international logistics**

Tools helpful in managing the safety of logistic systems both in micro and macro scale include:

- solutions normed by national and international organizations;
- technical and technological solutions.

The first group includes:

- The ISO 28000:2007 norm, which was created especially for companies and organizations taking part in the supply chain. It enables identifying the threats and limiting the risk in the supply chain via implementing the processes assuring safety that are to decrease the risk of theft, smuggling, illegal tempering with the cargo and assuring a reaction to danger from criminals, terrorists and other. It demands that the organization using it formulates a safety policy, makes a risk assessment and creates a plan to manage and decrease identified threats, implementing a safety management plan, monitor and supervise the system, undertaking actions to correct, when

required as well as revising the management in terms of constant improvement. The organization in order to determine the requirements connected with safety should include:

- business goals – including safety of delivery, decreasing the risk (theft, piracy, forgery, acts of terrorism), meeting the requirements of the owners of cargo and protecting the reputation of the brand,
- legal and other requirements,
- threats identification and risk assessment.

After identifying the character of the actions of the organization, its scale and other requirements a policy of safety is created and assessment of risk is done. The process of assessing the risk allows the organization to identify assets and processes crucial for further actions, identifying real threats, assess gaps in existing security threats to estimate the likelihood and consider its consequences. Using the risk assessment process, organizations can identify the assumed size, and priorities (for the setting of objectives and security tasks) that are used to establish safety management plans to mitigate the identified risks. Safety management programs should be implemented and continuously monitored for effectiveness. This allows for the implementation of corrective actions, thereby improving the system, which in turn reduces the level of risk during the next cyclical assessment. This standard can be used by companies to ensure a consistent approach by all actors in the supply chain and as a reference point for security management in the supply chain<sup>165</sup>.

- In May 2012, the ISO 22301 was published as an international standard containing requirements for business continuity management system. It replaced the British Standard BS applicable 25999. So far, this standard has not been translated into Polish. Building on its predecessor, it brings new demands beneficial effect on the whole system of business continuity management. At the outset, you can see the differences in the structure of the standard. Requirements of ISO 22301 are presented in 10 chapters, and the British predecessor had 6 of them. The standard includes<sup>166</sup>:
  - new formal requirement to determine the context of the Organization, to provide all information to establish a Business Continuity Management System, appropriate to the organization, being the support of its activities and objectives (within context determination, the organization

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<sup>165</sup> L. Sitkowski, *Zarządzanie bezpieczeństwem dla łańcucha dostaw – ISO 28000*, [in:] „Przemysł Środowisko Jakość Zarządzanie” 2(13)2009, pp. 28 i 29.

<sup>166</sup> See. <http://csr.pl/article/214/>, 20.10.2013.



should identify and document the scope of its business, including products, services, their place in the supply chain, their relationships with suppliers and customers, the links between continuity policy and other existing types of policies and the applicable laws and other regulations,

- detailed requirements for top management (the standard requires top management to be actively involved in the business continuity policy and the establishment of its objectives, in addition should demonstrate evidence of its commitment to the establishment, implementation and monitoring of business continuity management system,
  - requirements for the establishment and implementation of procedures for internal communication (with employees of the organization), external (with customers, partners, local communities and the media) and during a crisis situation, taking into account informing the appropriate organs,
  - detailed requirements for the implementation and coordination of business continuity management system, including for the analysis of business impact, risk analysis, strategy and business continuity management procedures and the rules of their testing (includes requirements for incident management, among others, requires the development of procedures, which will include the detection and monitored incidents to communicate information about them during the entire lifecycle of the incident and saving decisions concerning incidents,
  - requirement for the development of documented procedures to restore the process and return to the normal activities of the organization after the settlement of the crisis,
  - requirements for internal audits and management reviews and the arrangements for monitoring, measurement, analysis and evaluation of the efficiency and effectiveness of business continuity management system,
  - setting measurable objectives and assess their achievements (the organization should define what should be monitored and measured, define the methods used for monitoring, measurement, analysis and evaluation, and indicate when measurements are to be made, and when they are to be analyzed).
- ISO 26000:2010 – International Standard (developed jointly by 99 countries) containing guidelines on corporate social responsibility, or responsibility of the organization for the impact of their decisions and activities

on society and the environment, provided through transparent and ethical behavior that<sup>167</sup>:

- contributes to sustainable development, including health and the welfare of society;
- takes into account the expectations of stakeholders (individuals or groups who are interested in the decisions or actions of the organization);
- is consistent with applicable law and with international standards of conduct;
- is integrated with the activities of the organization and practiced in its relationships, which relate to the organization's activities undertaken within its sphere interactions.

This standard is designed to organize knowledge about corporate social responsibility (CSR Corporate Social Responsibility). The objective of ISO 26000 is to support organizations in their contribution to sustainable development. The standard is to encourage them to go beyond the obligations imposed by law, with the understanding that compliance with the law is a fundamental duty of any organization and necessary part of its social responsibility. The standard is intended to promote a common understanding of social responsibility and complement – not replace – other tools and initiatives in this field. Introducing ISO 26000, one should have regard to the social, environmental, legal, cultural, organizational, and economic differences, while respecting international standards of business.

**The group of technical and technological solutions include, among others:**

- Traceability – a comprehensive system of traceability (identification batch of product, raw materials used for its creation, and then individually each product comprising the batch during production and/or distribution to the direct consumer);
- GS1 Standards: barcodes (standard media used in the automatic identification and data collection), electronic communication (standard means for exchanging transactional documents electronically), synchronization of basic data (infrastructure and standards for the exchange of basic data about products and services), Electronic Code Product (standard identification using RFID technology and the Internet);
- Business Intelligence – (BI) is a very broad term. Most generally, you can submit it as a process of converting data into information and information into knowledge, with the help of a wide range of applications and

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<sup>167</sup> [http://www.pkn.pl/sites/default/files/discovering\\_iso\\_26000.pdf](http://www.pkn.pl/sites/default/files/discovering_iso_26000.pdf), 20.10.2013.

technologies that can be used to increase the efficiency and effectiveness of specific actions, including those related to security logistics systems<sup>168</sup>. BI provides comprehensive coverage of all the phenomena associated with the use of tools which provide Business Intelligence in supporting decision-making processes. BI is not just information technology (IT), but something more, which binds the activities of the various factors in the field of security management. Data, information, knowledge, comes not only from the system itself, but also from outside of it. With BI, one can monitor and analyze the level of security in logistic systems in a situation where it is very complex, the amount of data derived from multiple databases, and is incomplete. The area of use of this tool is very wide, it can be used in many areas of life, not only economic. The basic components of BI include key information technologies, data warehouses, the possibilities given by key technologies and applications that support a variety of decision-making in hazardous situations in the logistics system;

- Monitoring networks which are composed of three subsystems which constitute one unit. The first subsystem is everything directly and indirectly involved in the detection of threats (e.g. sensors and radars and devices on which they are mounted, radiometers, radars, GPS). The second is the transmission media, wired and wireless used to transmit signals. The third subsystem, which is the heart of the system controlling all processes, it is the computer technology.

Rapid technological development and increasing range of economic globalization, the disappearance of traditional boundaries, are some of the many factors causing an increase in security threats within logistics systems. The number of factors generating risk is constantly increasing with the development of civilization. Along those we can include: rising energy and transport costs, the unexpected bankruptcy of strategic logistics providers, difficulty in maintaining cash flow, the need to adapt to the new requirements (including eco-logistics) of the local and international law, shortage of skilled workers in the “shippers”, transport services and logistics, rising insurance fees, road and credit<sup>169</sup>.

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<sup>168</sup> [http://www.zgapa.pl/zgapeda/Business\\_intelligence.html](http://www.zgapa.pl/zgapeda/Business_intelligence.html), 19.10.2013.

<sup>169</sup> See. P. Wittenbrink, *Risiken im Transport und Logistikkbereich*, [in:] “Internationales Verkehrswesen” 2//2013, pp. 20-23.

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The monograph *International logistics* is a response to the needs of students of logistics, production engineering, management and production engineering, as well as managers involved in logistics processes taking place in their companies, which are links in supply chains.

The presented material concerns logistics implemented in global economy, with particular attention paid to international requirements and conditions. Today, leading economists conclude that the efficiency of the economy and well-being of the society depends primarily on the condition of companies affected by international logistics processes, closely linked with the global business.

These problems are described in the following chapters, where the theory has been supported by practical activities:

1. Globalization and international logistics
2. Management methods in international logistics
3. Logistics centers
4. Transport for the needs of international logistics
5. Documents in foreign and domestic transport
6. Transport in foreign trade
7. Automatic identification in transport processes
8. IT systems for the needs of logistics
9. International logistics security

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