

LOGISTICS OF CONTINUOUS MEDIA AND ENERGY (LCME)¹Dušan MALINDŽÁK, ²Vladimír STRAKOŠ

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Abstract

The paper has a scientific- pedagogical character. It deals with the justification of the need to prepare "logistics" experts for the field of continuous media and energies flows. The current logistics is understood as a logistics of discreet flows as well as preparation logistic specialists in current study programmes too. Individual subjects and hence the scientific and professional basis deals with the flows of discrete products, if flows are continuous, they have to be discretized. The article compares logistics of discrete and continuous flows and their identities and specifics. There are many companies in this area. Each city has gas, water, electricity, heat and sewerage networks and networks for international transport of raw materials play a strategic role today. There are no study programs that would prepare graduates for practice for the logistics in this area. The paper also includes the concept of the study program "Logistics of Continuous Media and Energies (LCME)" and design of subjects through which this programme should be implemented in the future.

Keywords: Logistics, continuous media, energies, distribution and collection networks

1. INTRODUCTION

The present theory of logistics is developed in particular as the logistics of discrete systems and processes. The aim of the paper is to open a professional and scientific discussion for the need of the professionals training and content of the university study the programme - logistic of continuous flows, which new knowledge are needed and which differences are from the logistics of the discrete processes. This area of logistics requires other transport technologies, modelling processes, designing, managing of continuous flows. Logistics as a science of management flows in chains and networks [1-3] has a significant application also in the field of transport networks of continuous media by energies such as oil, gas, water, electricity, heat, sewerage [4,5]. LCME has two levels. In the macro-logistics level, i.e. cross-national logistics from raw material resources to their processing as well as, second level, from the point of processing, to consumer (micro-logistics) through communal networks. There are countless companies in this area. Each city has gas, water, electricity, heat and sewerage networks and networks, for international transport of raw materials, play a strategic role today. There are no study programs that would prepare graduates for practice for the logistics in this area.

2. THEORETICAL BACKGROUND AND METHODOLOGY

Simple definition of logistics: the logistics is the management, realization and providing of flows in chains in networks [1,3,6]. The logistic flow is a controlled movement of a substance that changes its parameters in time and space [1,7,8]. The flow is created between points with different potential and it is the consequence of the interaction of active and passive elements of the chain (see **Figure 1**). Active elements are machines, transport means, people, etc.; passive elements are raw materials, products, information, finance flows. Integrated elementary movement of passive elements between the two active elements creates a logistic flow.

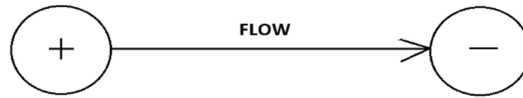


Figure 1 The principle of the logistics flow

For example, the electric current flow between the positive and the negative pole, the flow of goods, between those who have money, and wants goods and who has goods and wants money, i.e. economic potential differences, and so on. Flows and logistics from this point of view give the world in balance, because each system tends to be in a stable state. The current logistics deals mainly with the management of discrete goods flows, where their quantity is expressed in pieces. It is the many of transported substances, the quantity of which it cannot be expressed in pieces such as gases, liquids, bulk masses - whose quantity is expressed in m³, litres, tons, and so on. Their flow is also based on the difference of potentials, other than in discrete products, such as:

- gravity,
- pressure difference,
- electric potentials,
- temperature, etc.

For their modeling and management, for their logistics, another mathematical apparatus, methods, principles from other fields of science are applied. Current study programmes at universities or logistics subjects are being prepared by experts for "discreet logistics" and are insufficiently prepared for the area of logistics, so called "Logistics of Continuous Media and Energy - LCME". The logistics applies a feed forward control principle of flows management because of its high inertia. This principle of control (see **Figure 2**) requires the modelling of a given chain and the logistics chain model - CHM. For the modeling of chains and streams of continuous media and energy the following principles of should be applied:

- hydromechanics,
- thermodynamics,
- state of gas equations (pressure, temperature, volume),
- Kirchhoff's and induction laws,
- decrease of energy when transporting and distributing, etc.

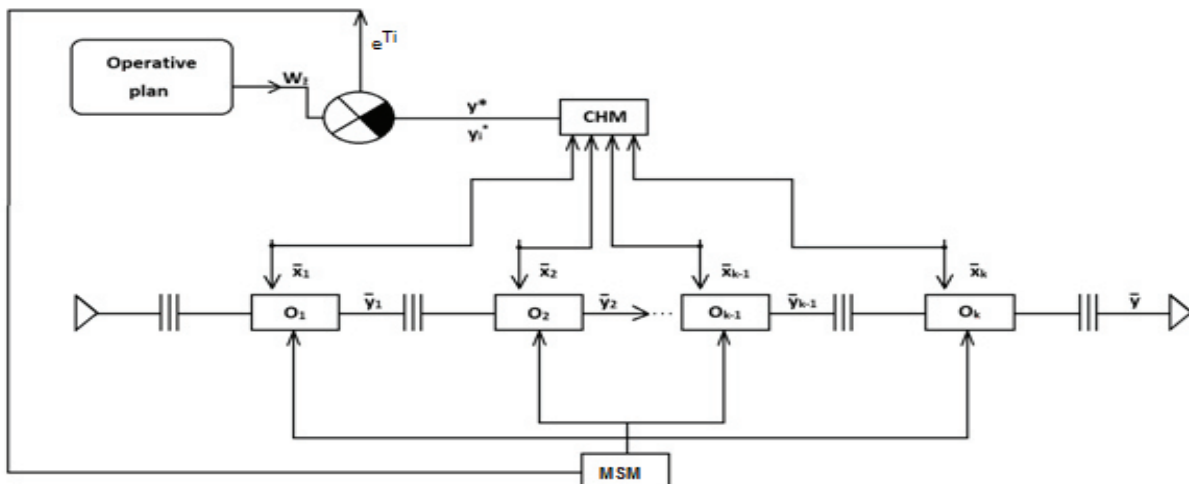


Figure 2 "Feed forward" chain management principles

Where:

x_i - vectors of input parameters,
 y - output vectors,
 W_z - goals of processes in the chain,
 y_i^* - output modeled vectors,
 O_i - active elements implementing operations, processes,
 e^T_i - deviation for element I in period,
 CHM - model of logistics chain,
 MSM - management system model.

As it follows from the above, in addition to the general subjects of logistics, students should be given a different theoretical-technical basis for the preparation of experts in LCME. The study of LCME, with regard to the necessary natural science base, will be very difficult.

3. DESIGN OF CONTENT AND STRUCTURE OF THE LCME STUDY PROGRAMME AND COMPARISON WITH THE CURRENT PROGRAMMES

The specificity of transport network logistics lies in the continuity of their modelling and management flows, in the principles of motion security based on gravity, potential differences, hydromechanics, thermodynamics, etc., in particular through dispatching systems. It is very important to prepare graduates for next periods and in disturbed states (political situation, control of the flow at the distance more than 1,000 km in a pipe with a diameter of 1.2 m). Another significantly different factor is a financial issue, the choice of payments from consumers and the possibility of several suppliers using one transport network. This way of logistics chain, which is the connection of the source, the transport and the customer, will be constantly expanded for reasons of environmental protection against overloaded road and railway networks. A major challenge in this field will be also the expansion of renewable resources, where the only reasonable option is to work and use a common transport network and a common portfolio of customers.

In comparison of the subjects of current study programmes in logistics at Technical University of Košice, Faculty of Mining, Ecology, Process Control and Geotechnologies, Institute of Logistics, i.e.:

- Industrial Logistics,
- Transport logistics of the company,
- Commercial logistics,

and the subjects from the study programme "Technologies in the napkins and gas industries" of the proposed study programme - the LCME needs to apply next subjects:

A. General subjects (need to adapt the contents):

- Theory of systems and information,
- Technological logistics,
- Simulation systems,
- Measurement and regulation technology,
- Methods of logistic systems analysis,
- Distribution logistics,
- Design of internal transport systems.

B. New technological subjects:

- Raw material extraction technology,
- Technologies for the production of electricity and heat,
- Technology of raw materials processing,

- Sources and stacks of continuous media.

C. New subject for transport systems:

- Transport systems and technologies I. (oil, gas, water),
- Transport systems and networks II. (electricity, heat, sewerage),
- Technical means of logistics I. (machinery and equipment),
- Technical means of logistics II. (transport and storage systems),
- Diagnostic and maintenance management systems.

D. New theoretical subjects:

- Hydromechanics and thermodynamics,
- Logistics of transport networks I. (oil, gas and water),
- Logistics of transport networks II. (heat, electricity and sewerage),
- Professional practice I. (global systems),
- Professional practice II. (communal systems).

4. CONCLUSION

As it follows from the above, in addition to the general subjects of logistics, for the preparation of experts in the logistics field - LCME, students should be given a different theoretical-technical basis. Studying, with regard to the necessary natural science base, will be very difficult. It is necessary to prepare a special study program with the necessary natural science base in order to prepare logistics for LCME. The amount of new subjects from technologies, transport systems and specialized subjects from logistics of continuous flows in networks requires a new study programme within 5-year study engineering programme.

ACKNOWLEDGEMENTS

This paper is the result of the implementation of the project KEGA 009TUKE-4/2016 Design of the specialized training concept oriented to the development of experimental skills within the frame of education in the study branch logistics.

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