EDUCATION OF THE LOGISTICS SYSTEMS ACCORDING TO THE DEMAND OF INDUSTRY AND ECONOMY

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Abstract: Today, logistics plays increasingly recognized role in the production and service activities, and thus the demand for logistics professionals in Europe has been increased. Logistics education is related to two areas of the training, the training of the technical engineers and of the economists. The economy expects logistics professional that are able to plan, operate, control, monitor and optimize their logistics systems. An outstanding and experienced logistics professional is proficient in the engineering and IT fields and is aware of the economic and legal issues. Imparting knowledge to the student needs so many well-defined and structured educational programs.

Keywords: material flow system, information flow system, material flow–time function, hierarchical logistic management system

Introduction

Workplaces and equipment providing technology and service operations are completed by material and information flow systems. The optimal design of these material and information flow systems allows for the improvement of production and service systems. Material handling systems are based on material handling machines (i.e., machine systems) and their operation is ensured by information flow systems. It is the integration of the techniques and technologies of these two systems which leads to the engineering logistics. The design and operation of the logistics systems can be handled by theoretical methods, which require descriptive mathematical methods and the application of computer aided mathematical models and methods. In the logistics processes, the product identification and product management activities are determining factors. To solve these problems, IT and automation skills are indispensable. Abstracting ability is necessary in order to model economic impacts and various factors that affect costs for the economic investigation of logistics systems.

1. How to define material and information flow systems?

Logistics systems can be divided into defined material flow systems. From the point of education it is very important to give not only verbal information about the logistics systems, but to be able to give mathematical description of them. This is extremely important since systems can only be handled with time dependent numerical data.

From the point of education we should define the notion of the logistic system. The

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logistic system is not else than a material flow system together with an associated information flow system.

1.1. Description of material flow system. The material flow systems are large systems characterized and described by many parameters. The material flow processes inside the system are dynamically changing, stochastic processes. Very rarely these processes can be simplified to stationary or quasi-stationary processes. Fig. 1. represents the general, simplified model of the material flow system.

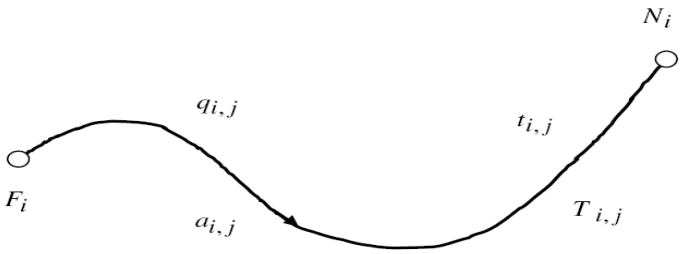


Figure 1. General model for the material flow system

Fig. 1 exhibits the connection between two arbitrary points of the material flow system. The notations on Fig. 1. are the following:

- F_i – the *i*.th source in the material flow,
- N_j – the *j*.th sink in the material flow,
- $q_{i,j}$ – the material flow intensity between the source *i.* and sink *j.* (material quantity/time),
- $a_{i,j}$ – The material type identifier between source *i.* and sink *j.*
- $t_{i,j}$ – The start time of the material flow between source *i.* and sink *j.*,
- $T_{i,j}$ – The end time of the material flow between source *i.* and sink *j.*

The material flow can be given by

- graphs (Fig. 2),
- diagrams (Fig. 3),
- matrices (Fig. 4).

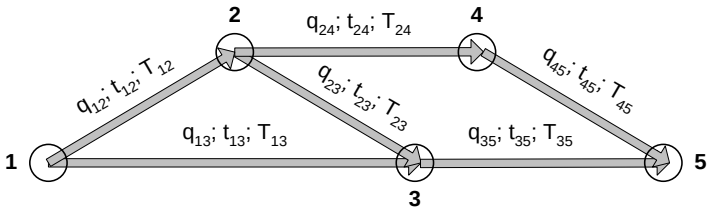


Figure 2. Representation of a material flow by graph

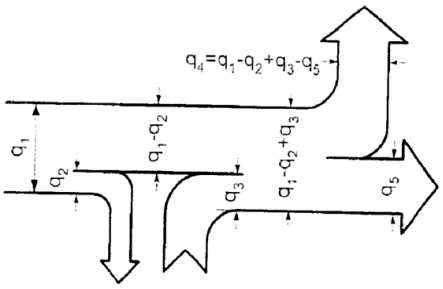


Figure 3. Representation of a material flow by diagram

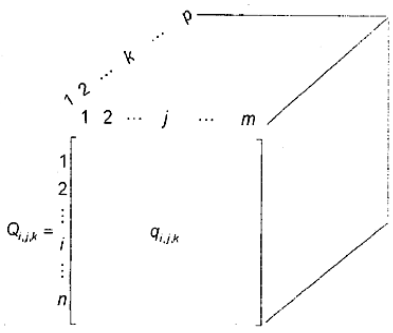


Figure 4. Representation of a material flow by matrix

A material flow connection $Q_{i,j}$ according to Fig. 1.:

$$Q_{i,j} = Q_{i,j}\left(F_i, N_j,\ q_{i,j}, a_{i,j},\ t_{i,j}, T_{i,j}\right)$$

When we give for all possible connection *i-j* the connections $Q_{i,j}$ and we summarize them in a multi-dimensional matrix Q then it is possible to describe the material flow system mathematically. The main problem of this description is that each element of matrix Q varies stochastically in time. The reliable treatment of the matrix elements depend on the determination of the density and distribution functions associated with the elements. The structure for the material flow-time function is exhibited on Fig. 5.

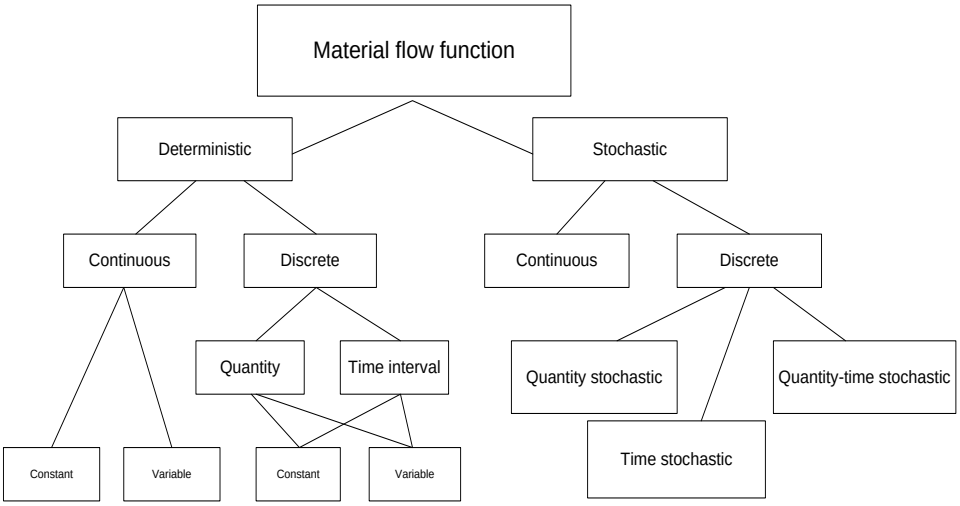


Figure 5. Material flow-time function structure

The material flow –time functions allow the quantitative scaling of building blocks for logistics systems. Such properties are: storage capacity sizes, tool numbers for transport links, tool numbers for cargo handling equipment, etc.

1.2. Description of information flow relationships. In the logistics system, a variety of information flows. By definition, this information is tied to the material flow. It is practical to group these many types of information for clarity. The criteria for classification are connected to the material flow. The information set criteria for grouping are the following:

- information set inducing the material flow,
- information set accompanying the material flow,
- information set confirming the material flow.

A simplified model for the material flow connections are shown on Fig. 6.

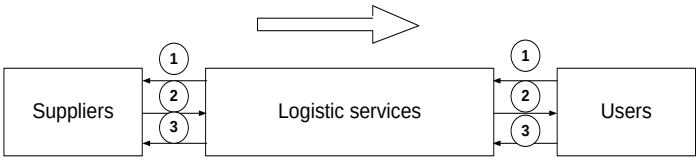
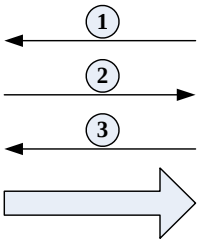


Figure 6. Information flow relationship model

Notations for Fig. 6.:



Information inducing the material flow

Information accompanying the material flow

Information confirming the material flow

The material flow direction

According to Fig. 6., we can deduce the following:

- The information set inducing the material flow is characterized as it precedes the material flow and its direction is opposite to the direction of the material flow. It is used to call primary information set.
- The information set accompanying the material flow is characterized that it flows simultaneously with the material flow in time and its direction is the same as the direction of the material flow. It is used to call secondary information set.
- The information set accompanying the material flow is characterized that it is generated after the completion of the material flow and its direction is opposite to the direction of the material flow. It is used to call tertiary information set.

The management of the information flow sets and the logistics system has a continuous connection in time. The development of information flow in logistics systems is a function of the material flow system. In education, great emphasis must be placed on acquainting with the possible solutions of product identification. The product identification systems affect the reliability of information duration as well as of the pace of decision making regarding management.

2. Management of logistics systems

Due to its complex structures, the management of logistics systems requires the formation of autonomous units, and the aggregation of intelligence which are able to solve groups of problems individually. These autonomous groups receive only the information that is relevant for them. This leads to the development of a structure that enables the proper distribution of information. The navigation system of logistics systems is characterised not only by this distribution of intelligence, but also of hierarchical structure. As an example the hierarchical structure of the production logistics with distribution of intelligence is shown on Fig. 7.

In education, it is not only the navigating systems of the logistics systems that receive a high degree of focus, but also the investigation of the applicable strategies.

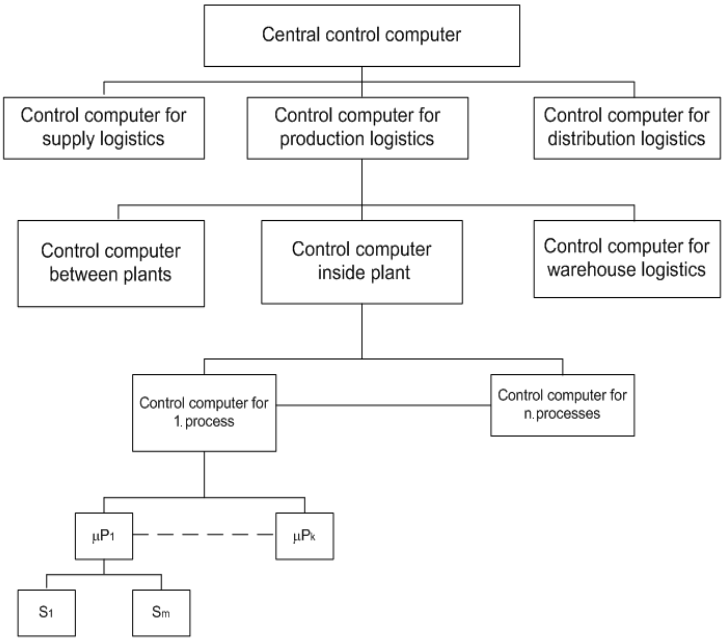


Figure 7. Structure of hierarchical logistic management system with distributed intelligence

3. Some methods in the education of logistics

Logistics is an integrated science, and as such appropriates existing methods from other sciences in order to optimize the planning, construction, management and monitoring of logistics systems.

The applied methods are the following:

- to search transport centers by mathematical methods, to choose suppliers by mathematical methods, installation and design by mathematical methods, to form unit loads by mathematical methods, design of different closed looped routes,
- route designs,

- mathematical design of multi-stage collecting and distributor system, mathematical treatment of logistics costs, stock management models, simulation methods,
- quality management methods,
- etc.

Conclusion

The above mentioned considerations outline a few of the reasons why the education of logistics requires a structured program that allows for imparting a constantly changing and complex knowledge base. In order to provide a high quality, up-to-date and modern education, research in the application of industrial and economic uses as well as networking with international stakeholders must be built into the curriculum.

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References

[1] Cselényi, J.; Illés, B.: *Logistics systems I.,* Miskolci Egyetemi Kiadó, Miskolc 2004., pp. 1-378. (in Hungarian)
[2] Cselényi, J.; Illés, B.: *Design and management of material flow systems I.,* Miskolci Egyetemi Kiadó, Miskolc 2006., pp. 1-384. ISBN 963 661 6728 (in Hungarian)
[3] Illés, B.; Glistau, E.; Machado, N. I. C.: *Logistik und Qualitätsmanagement,* Budai Nyomda, Miskolc 2007., pp. 1-195. ISBN 978 877 3814 (in German)
[4] Illés, B.; Glistau, E.; Machado, N. I. C.: *Logistics and quality management,* Budai Nyomda, Miskolc 2007., pp. 1-197. ISBN 978 963 877 3807 (in Hungarian)