Periodica Polytechnica
Transportation Engineering

45(1), pp. 48-52, 2017
DOI: 10.3311/PPtr.9091


RESEARCH ARTICLE

# Information System as a Tool of Decision Support

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Received 15 February 2016; accepted 30 May 2016

***Abstract***
*The article deals with possibilities of creating system for support the activities of logistics systems. This system would serve as a means for decision support. In support of the activities of logistics systems is necessary to implement a large number of decisions. Decisions are realized on different management levels. Any decision on individual levels can cause improvement, respectively aggravation of system operation. The impacts of decisions can have local effect on the overall operation of logistics systems, but may also seriously affect the whole system, positively or negatively. Many experts and scientific literature define and argue that "logistics is only one" and is associated with ensuring of chain "purchase - production - sales", or "supply - production - distribution". All other activities are only for ensuring of activities of the main chain. Of course, that without the support activities should the main chain was unable to function effectively. For ensuring main and support activities for logistics needs is possible to use great number of methods from different branches. By joining of methods into one system, it is possible to create a universal program means for support decision and effective operation of logistics systems.*

***Keywords***
*design, decision, logistics, system, methods*

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## 1 Introduction

The basic aim of each company is the creation of profit or its maximization from short-term point of view (1 year). There are long-term aims (more than 1 year) such as company growth, i.e. profit growth as well as production volume growth, company, market position improvement etc.

The assumptions for achieving all these aims are effective operation of all processes and operations in the process of transformation, accumulation and transport that are determined optimally by plans in the operative as well as tactic and strategic level.

In the phase of dynamic development of information technology and logistics with more attention paid on effective company management there is effort to make the decision process more effective. The research and development of this topic is up-to-ate and various versions of systems which are created for DSS (Decision Support System).

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**This issue is also deal with the following author:**

*Daniel Kahneman, Amos Tversky (2000). Choice, Values, Frames. Cambridge University Press. ISBN 0-521-62172-0*

Human performance with regard to decisions has been the subject of active research from several perspectives:

Psychological: examining individual decisions in the context of a set of needs, preferences and values the individual has or seeks.

Cognitive: the decision-making process regarded as a continuous process integrated in the interaction with the environment.

Normative: the analysis of individual decisions concerned with the logic of decision-making and rationality and the invariant choice it leads to.

*Schacter, Gilbert, Wegner (2011). Psychology. Worth. p. 369.*

Decision-making can also be regarded as a problem-solving activity terminated by a solution deemed to be satisfactory.

*Kepner, Charles H.; Tregoe, Benjamin B. (1965). "The Rational Manager: A Systematic Approach to Problem Solving and Decision-Making". McGraw-Hill.*

Problem analysis & decision-making

It is important to differentiate between problem analysis and decision-making. The concepts are completely separate from one another. Traditionally, it is argued that problem analysis must be done first, so that the information gathered in that process may be used towards decision-making.

*Kutty, Ambalika D., and Himanshu Kumar Shee. "Too much info!" Monash Business Review 3.3 (2007): 8+. Academic OneFile. Web. 3 Mar. 2013.*

A major part of decision-making involves the analysis of a finite set of alternatives described in terms of evaluative criteria. Information overload occurs when there is a substantial gap between the capacity of information and the ways in which people may or can adapt. The overload of information can be related to problem≠ processing and tasking, which effects decision-making.

*Triantaphyllou, E. (2000). Multi-Criteria Decision Making: A Comparative Study. Dordrecht, Netherlands: Kluwer Academic Publishers (now Springer). p. 320. ISBN 0-7923-6607-7.*

Solving such problems is the focus of multi-criteria decision analysis (MCDA), also known as multi-criteria decision-making (MCDM). This area of decision-making, although very old, has attracted the interest of many researchers and practitioners and is still highly debated, as there are many MCDA/MCDM methods that may yield very different results when they apply on exactly the same data.

*Quoted sentenced said by Paul Saffo; website written by John Foley. "Managing Information: Infoglut". Retrieved 2013-04-19.*

Information overload is a gap between the volume of information and the tools we need to assimilate it (Saniuk et al., 2014). It proves that the more information overloads system and influence the worse the quality of decisions made.

*Hall, Ariss & Todorov with an assistant Rashar Phinyor (2007)* described an illusion of knowledge, meaning that as individuals encounter too much knowledge it actually interferes with their ability to make rational decisions.

*Turban, E., Aronson, J. E., Liang, T. P.: Decision Support Systems and Intelligent Systems. New Jersey, Pearson Education, Inc. 2005*

Decision Support Systems (DSS) is a computer system that includes mathematical models, computer databases and user interface to provide recommendations for decision making by managers.

DSS combines intellectual resources of an individual computer with the ability to improve the quality of decisions. It is a dynamic system able to perform for example, data analysis and member of the decision-oriented planning of the future.

## 2 History and present

The concept of decision support has evolved from two main areas of research. Theoretical study of the organization of decision-making developed at Carnegie Institute of Technology in late 50s and early 60s of the 20th century, and work on specific technology DSS in 1960.

The subject of more research DSS has happened in the mid-70s, and his research gradually gaining momentum. In the mid-80s of the 20th century, Executive Information Systems (Executive Information System - EIS) system to support group decisions (Group Decision Support System - GDS) and system to support organizational decision (Organizational Decision Support System - ODSS) have evolved the simple and model-oriented DSS.

DSS is a framework of definitions changed substantially over time. In the 70s DSS was defined as "computer systems to support decision making." In late 70s perceptions DSS began to be seen as "interactive computer system that helps you to use databases and models to solve ill-structured problems, using appropriate and available technologies to improve the efficiency of managerial and professional activities".

In 1987, the company completed the development of Texas Instruments Gate Assignment Display System (gads) company for United Airlines. This system of decision support is attributed to a substantial reduction in flight delays by helping the management of ground operations at various airports, starting with the International Airport and Chicago's O'Hare airport on Stapletonskom in Denver Colorado.

In the 90s of the 20th century, the empire began to expand DSS data warehousing and online analytical processing data. At the turn of the millennium, they were introduced new analytical web-based applications.

## 3 Decision support system

System for decision support (Decision support system - DSS) is a computer information system supporting organization and decision activities and processes in the field of business. DSS serves for managers, operational managers on various levels (usually on middle and higher level) with decision support in situations which can quickly change and are unpredictable (non-structured and semi-structured decision problems). The DSS can be fully automated, operated manually or operate in the combination of these two modes.

DSS can help managers on various levels:

- Operational level - helping with daily executed routine decisions.
- Tactical level - helping with planning and management with the usage of analytical tools.
- Strategical level - helping with long-term decisions using internal and external information analysis (Jašková, 2014).

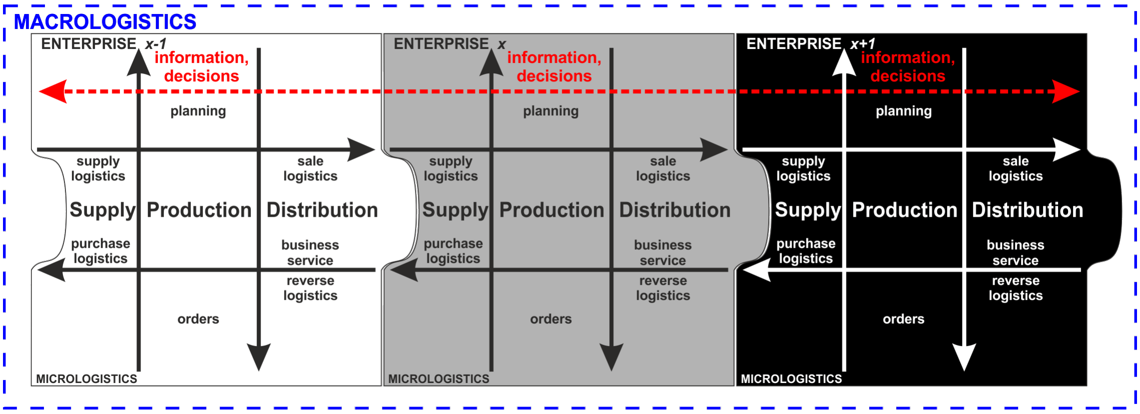


**Fig. 1** Macrologistics model

The components of DSS:

- database (information, data, knowledge),
- model (system behaviour, source code,…),
- user interface (hardware, software) (Haettenschwiler, 1999; Gyimesi et al., 2015).

## 4 Scope of operation

Decision-making within the company extends to different areas of the company and logistics (Bokor, 2008). Decisions of the long-term, strategic nature of the decision and the hierarchically higher level. Level dealing with the company as elements in the supply chain enterprises is described as a macro level.

The decisions at the macro level (Fig. 1) tend to have longer-term impacts and their scope of action covers an extensive area chain.

More often use of decision-making is at micrologistics (Fig. 2). Regular activities that the company periodically perform as purchase, supply, production, sale and distribution because of the constant change input and output parameters (price, quantity, quality) require a perfect system of decision-making for achieving optimal results.

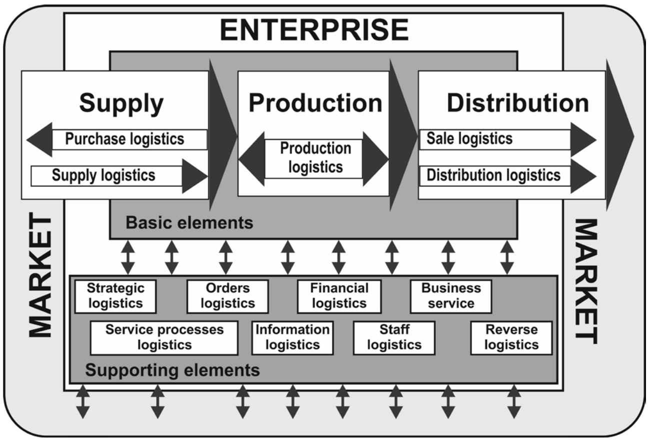


**Fig. 2** Micrologistics model of company (Straka, 2013)

## 5 Design of support system

Many experts and scientific literature define and argue, “Logistics is only one” and is associated with ensuring of chain “purchase - production - sales”, or “supply - production - distribution” (Straka, 2013). All other activities are only for ensuring of activities of the main chain. Of course, that without the support activities should the main chain was unable to function effectively. For ensuring main and support activities for logistics needs is possible to use great number of methods from different branches. By joining of methods into one system, it is possible to create a universal program means for support decision and effective operation of logistics systems.

Support system as application project of Decision-making support system is designed for industry logistics (Keen, 1980; Pekarčíková, 2015; Samolejová et al., 2012; Trebuňa et al., 2015). The design describes the operation of web application based on cooperation of selected methods of multi-criterion decision and forecasting by synthesis of their results.

The structure of web application consists of areas of micrologistical company model and each area contains a selected set of analytical methods of multi-criterion decision or forecasting methods to serve the user with useful and summary information from each company area. The results should help the user with decision-making.

In the field of custom-made management the application contains evidence and evaluation of orders and its technical-technological reviewing, that ensures the comparison of order with products made so far, evaluates the need of raw materials and components and if available, it evaluates the amount of them in stock. Information needed is stored in database and it is connected to web application (Štangová, 2014).

Economical evaluation of order follows. It contains among others a method of breakthrough point based on fixed and variable costs, unit price and the amount of product evaluates the progress of profit in the dependence on production volume (Saniuk et al., 2014). Figure 3 shows an example of this method calculation.

**Break even point**

| Quantity sold | Variabile cost | Fixed cost | TC | Total revenues | Profit / Loss |
|---|---|---|---|---|---|
| 0 | 0 | 3000 | 3000 | 0 | -3000 |
| 200 | 100 | 3000 | 3100 | 450 | -2650 |
| 400 | 200 | 3000 | 3200 | 900 | -2300 |
| 600 | 300 | 3000 | 3300 | 1350 | -1950 |
| 800 | 400 | 3000 | 3400 | 1800 | -1600 |
| 1000 | 500 | 3000 | 3500 | 2250 | -1250 |
| 1200 | 600 | 3000 | 3600 | 2700 | -900 |
| 1400 | 700 | 3000 | 3700 | 3150 | -550 |
| 1600 | 800 | 3000 | 3800 | 3600 | -200 |
| 1800 | 900 | 3000 | 3900 | 4050 | 150 |
| 2000 | 1000 | 3000 | 4000 | 4500 | 500 |
| 2200 | 1100 | 3000 | 4100 | 4950 | 850 |
| 2400 | 1200 | 3000 | 4200 | 5400 | 1200 |
| 2600 | 1300 | 3000 | 4300 | 5850 | 1550 |
| 2800 | 1400 | 3000 | 4400 | 6300 | 1900 |
| 3000 | 1500 | 3000 | 4500 | 6750 | 2250 |

Variabile cost / piece - 0,5 Eur

Price 1 piece - 2,25 Eur

BREAK POINT

**Fig. 3** Analysis computation break point

After economical evaluation of the order, the capacitive evaluation process follows focusing on capacity and time demands. The information about space dispositions of raw material stock house, semi-products and products with regard to release time or release time of certain stock area segment gives following graphical description of stock availability, Fig. 4. The graphical model of stock house copies the layout of real building situation. Coloured segments represent already occupied areas. Number indexes describe left days to release certain stock areas segment.

The application evaluates the suitability of supplier selection for strategically inputs of production process basing on multi-criterion decision. The inputs (raw materials, semi-products, energy) are analysed by ABC method for appropriate supplier selection from a set of possible suppliers. The ABC method selects inputs that have high portion on final product price (Kovács et al., 2009). This analysis contains the selection of the most appropriate supplier from price forecast of individual input, the reliability of supply, services of the supplier. The module design is depicting on Fig. 5.

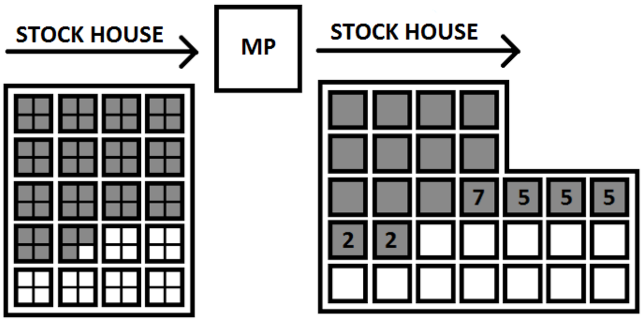


**Fig. 4** Diagram of storage space

The application evaluates and determines current position in the curve of product life cycle basing on data from database regarding sale amounts of products and the forecast of sale. This information for the need of company strategy change is providing in the field of innovations, product portfolio (Szabo et al., 2013). Figure 6 shows product life-cycle analysis.

The forecast used in individual modules of application is made by multi-channel forecast method (Fill et al., 2014).

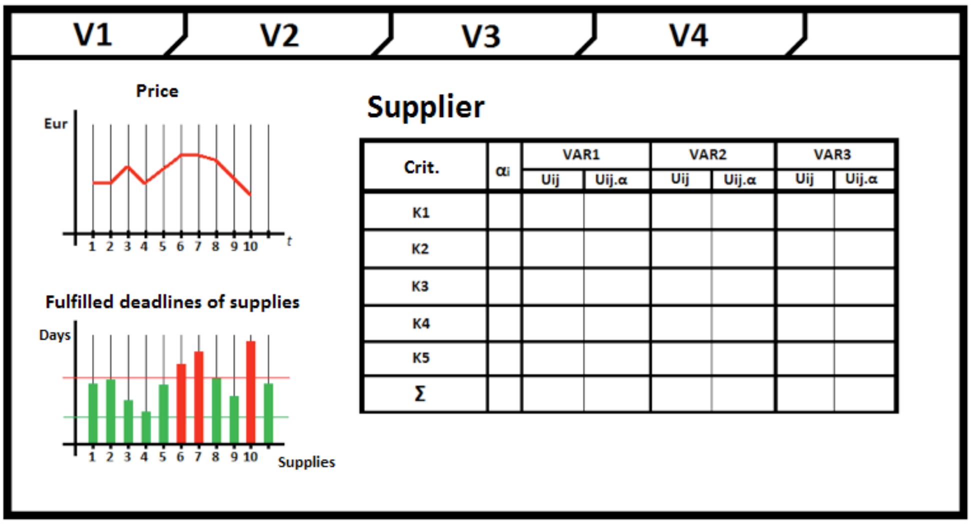


**Fig. 5** Analysis of supplier

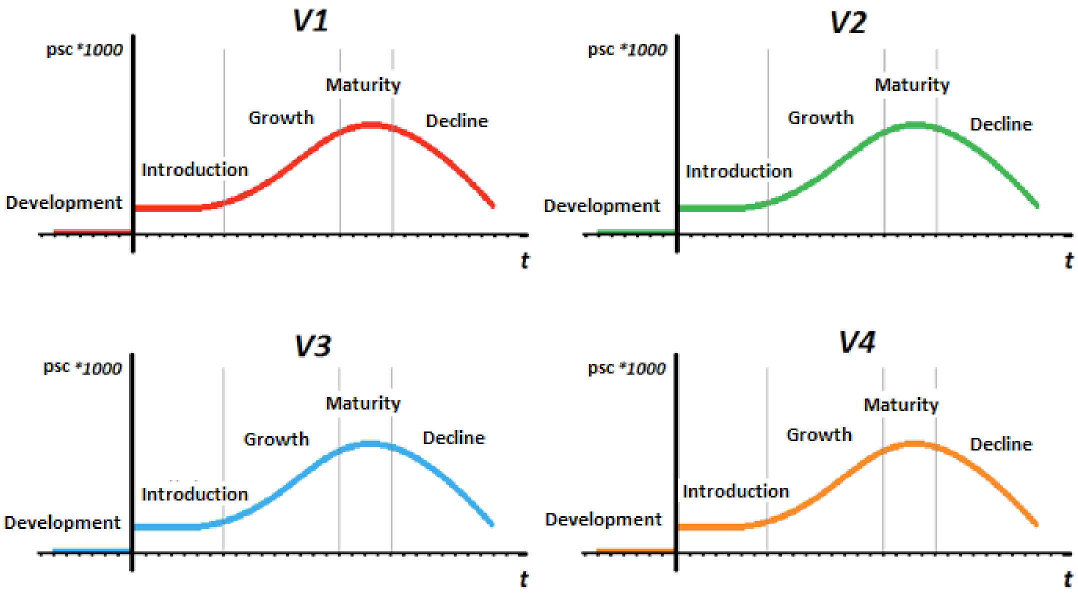


**Fig. 6** Product life cycle analysis

## 6 Conclusion

The application is designing to provide via user interface sufficient information for the user for decision support in all company areas based on inputs from appropriate data from database. Output information are in graphical form to be more summary and to have as much value as possible with the aim to achieve the status of user oriented application.


## Acknowledgement

The information and data presented in this article has been created with the support of the Slovak Research and Development Agency under the grants VEGA No. 1/0216/13 "Methods and new approaches study to measurement, evaluation and diagnostic performance of business processes in the context of logistics management company" and VEGA No. 1/0708/16 "The development of new research methods for purpose of simulation, assessment, evaluation and quantification of advanced production methods".


## References


Bokor, Z. (2008). Supporting logistics decisions by using cost and performance management tools. *Periodica Polytechnica Transportation Engineering*. 36(1-2), pp. 33–39. https://doi.org/10.3311/pp.tr.2008-1-2.07

Fill, M., Kačmáry, P. (2014). Programová analýza kvantitatívnych dát za účelom tvorby prognózy (Software analysis of quantitative data in order to create of forecast), In: Management of manufacturing systems 2014. Stary Smokovec, Slovenská republika, Oct. 1-3, 2014. pp. 58-62. (in Slovak).

Gyimesi, A., Bohács, G., (2015). Developing a New Logistics Based Model and Pilot System for Construction. *Periodica Polytechnica Transportation Engineering*. 43(4), pp. 211-217. https://doi.org/10.3311/PPtr.7845

Haettenschwiler, P. (2001). Neues anwenderfreundliches Konzept der Entscheidungsunterstützung. In: Absturz im freien Fall – Anlauf zu neuen Höhenflügen.(Mey, H., Pollheimer, D. L.), pp. 189-208. vdf Hochschulverlag AG, Zurich. 2001.

Jašková, Ľ. (2014). Aplikácie IS - Informačné systémy na vyšších stupňoch riadenia. (Application of IS - Information Systems on the higher levels of management) Fakulta matematiky, fyziky a informatiky, Univerzita Komenského, 2014. (in Slovak) URL: http://edi.fmph.uniba.sk/~jaskova/InformacneSystemy/tema08/tema08.html#pojmy

Keen, P. G. W. (1980). Decision support systems: a research perspective. Center for Information Systems Research, Alfred P. Sloan School of Management, Cambridge, Mass., 1980. URL: https://dspace.mit.edu/bitstream/handle/1721.1/47172/decisionsupports1980keen.pdf?sequence=1

Kovács, G., Bóna, K. (2009). Applying a multi-criteria decision methodology in the implementation of tenders for the acquisition of the infrastructure of logistics systems. *Periodica Polytechnica Transportation Engineering*. (37)1-2, pp. 39–44. https://doi.org/10.3311/pp.tr.2009-1-2.07

Pekarčíková, M., Trebuňa, P., Markovič, J. (2015) Simulation as Part of Industrial Practice. *Acta Logistica*. 2(2), pp. 5-8. https://doi.org/10.22306/al.v2i2.36

Samolejová, A., Feliks, J., Lenort, R., Besta, P. (2012). A hybrid decision support system for iron ore supply. *Metalurgija*. 51(1), pp. 91-93. URL: http://hrcak.srce.hr/file/105959

Saniuk, S., Saniuk, A., Lenort, R., Samolejova, A. (2014). Formation and planning of virtual production networks (VPN) in metallurgical clusters. *Metalurgija*. 53(4), pp. 725-727. URL: http://hrcak.srce.hr/file/180712

Straka, M. (2013). Logistika distribúcie: ako efektívne dostať výrobok na trh (Distribution logistics: how effectively put product on the market). EPOS, Bratislava. 2013. (in Slovak)

Szabo, S., Ferencz, V., Pucihar, A. (2013) Trust, Innovation and Prosperity. *Quality Innovation Prosperity=Kvalita Inovácia Prosperita*. 17(2), pp. 1-8. https://doi.org/10.12776/qip.v17i2.224

Štangová, A. (2014). Programming of methods for the needs of logistics distribution solving problems. *Acta Logistica*. 1(2), pp. 15-18. https://doi.org/10.22306/al.v1i2.17

Trebuňa, P., Straka, M., Rosová, A., Malindžáková, M. (2015). Petri nets as a tool for production streamlining in plastics processing. *Przemysl chemiczny*. 94(9), pp. 1000-1003.