THE QM SOFTWARE PACKAGE-THE TRANSPORTATION PROGRAMME

Pâslariu Tatiana
Master student Romanian-American University, Bucharest Romania
paslariu_tatiana@yahoo.com

Abstract

QM software package represents a business instrument for the underlying of management or marketing decisions.

This software package is used to solve many classes of problems, among which one can enumerate the transportation problem, that can be solved with the Transportation programme. The main objective of this programme’s usage is to optimize the total transportation costs. This programme is the best choice in the case of important problems whose solving is difficult by means of traditional methods, thus eliminating an extremely laborious stage and implicitly exposed to error risks, the results being obtained much faster.

Key Words
QM, transportation, optimization, costs, sources, suppliers, destinations, beneficiaries.

Transportation and the Transportation Problem

Transportation, as an essential activity in merchandise distribution, knows a large range of approaches, destined to try to optimize the process. The main problems the logistics people are confronted with, in their attempt to achieve an optimal distribution of the products to the final clients are the following: to minimize the transportation distances, the costs and the last, but not the least, the transportation time.

Transportation has always been a basic human and economic necessity and has singularized through its contribution to reducing or increasing the products selling costs. A decrease in the costs implied by the distribution activity, including the transportation ones, allows the firms to practice smaller selling prices or to obtain bigger profit rates.

The classical transportation problem is part of the much larger class of problems worked up through the transportation networks. A transportation network shapes an economic situation in which an amount of a certain substance must be transported from a certain number of points, called sources to another series of points, called destinations. The above circumstances can be materialized then in an extremely large number of ways, mentioning whether there are any intermediary points between the sources and the destinations, the modality of the transportation, the purposes of the transportation, etc.

The purpose of the classic transportation problem is to “find” the quantities that need to be transported on each route so that each destination receives what it needs, as long as there are the necessary amounts at the sources, with the lowest possible costs. In other words, to solve the classic transportation problem means to determine an optimal transportation plan from the supplier to the consumers, so that the transportation costs should be the lowest ones.

The Software Product Presentation

Among the advantages of QM programmes package one can enumerate the following:

- Its reduced size,
- But also the fact that the computer it works on does not need to be of a great performance.

The disadvantages of this software package are the following:

- The programmes package works in MS-DOS,
- It does not have a special graphic interface,
- It is difficult to transfer the data to other programmes (in Word documents, for instance),
• Although the results can be printed, there are no control options for the printed pages. The programmes package can be downloaded for free from http://www.asecib.ase.ro/soft.htm

The Transportation programme of the QM software package can be applied in order to solve a varied range of problems.

Firstly, it can be applied to the classic transportation problem that can be generalized to a series of issues derived from real life situations met in the merchandise distribution practice. One of these is the case of the transportation problem with a surplus in demand, where the demand at the delivery centres exceeds the amount already in stores. Similar to this is the transportation problem with a surplus of supply. These situations can both be solved by the introduction of fictional suppliers/consumers, so that the available amount could be considered equal to the demanded amount.

This programme can also be used to solve various variants of the classic transportation problem.

• The transportation problem with blocked routes.
  There can be situations when certain routes between the suppliers and consumers cannot be used. This problem can be solved with a usual transportation model, where the forbidden routes are associated to very high unitary transportation costs if compared to the costs of the usable routes. As a consequence of this very high penalizing costs the optimization algorithm is “forced” to by-pass the forbidden routes.

• The transportation problem with intermediary routes.
  There are situations where the consumers are supplied by means of intermediary centres and not directly from the suppliers. The optimization problem consists in minimizing the costs for the transportation from the suppliers to the intermediary centres, plus the costs for the transportation from these centres to the final consumers. This problem can be the equivalent of two usual transportation problems.

• The problem of timing.
  There are operational programming problems that can be represented by transportation problem models. In this case, the optimization’s purpose is to find a certain modality of work allocation among workers so that the total period of time needed for the job execution to be a minimum.

• The problem of equipment loading.
  Being a part of the same frame of the operation programming of production, the problem of equipment or outlet loading is one of the most important.

• The transportation problem of Koopmans.
  Although the transportation problem of Koopmans had been tactical and military in character, it can also be considered an economic problem. If the unused transportation capacity reduces, the transportation becomes more profitable.

The Software Product’s Instruction Book Structure and Synthesis

The window with the main menu contains the programmes of the QM software package that can solve various types of problems. A letter is associated to each of these problems. The mouse is inactive in all the windows.

In the main menu one can choose a programme, be it with the navigation keys followed by the Enter key, be it by pressing the key associated to the letter of the chosen programme. This choice has a different result in the case of the programmes based only on one method, for example the Linear, Transport Programming, etc. and for those that are the implementation of multiple algorithms, such as CPM (the Critical Path Method)/PERT (Project Evaluation and Review Technique). In the first case, the
working windows appears directly and in the other case, a secondary menu appears that allows one to choose the method and the working window appears only after this second choice.

The working windows are divided in three subwindows. The lowest subwindow contains an operational menu with the following words: “Help”, “New”, “Load”, “Save”, “Edit”, “Run”, “Print”, “Install”, “Directory”, “Esc”, each of them with the first letter in a different, more alive colour (hot key).

The Transportation Programme
When one selects the programme Transportation from the main menu window of the QM software package, a window opens and when one presses the letter N (“New”) the working window appears.

In the open window, in the first subwindow we must type the name of the problem in the “Problem Title” field, the type of problem in the “Type of Problem” field, being asked to identify if it is a minimum or maximum problem, in the “Initial” field we type the way we want the problem to be solved, be it by the North-West Corner Method (“NW”), be it by the Minimum Cost Element Method (“MC”), or by Vogel Approximation Method (“VAM”).

In the “Number of Sources” field we introduce the number of the suppliers.
In the “Number of Destinations” field we type the number of the beneficiaries.

After the introduction of the respective data, when we press Enter, a second subwindow will be initialized in which a matrix will appear where we can type the necessary cost in the intersection between each supplier, “S”, with each beneficiary, “D”, the needed amount in “Des.” and the available amount in “Sources”.

In order to run the programme with the introduced data, we type Esc and then R (“Run”), thus a window will appear that contains the following:
- The matrix with the introduced data,
- A matrix with the initial solution, solved with the chosen method, “NW”, “MC” or “VAM”,
- A matrix with the optimal solution solved with “MODI” (the Modified Distribution Method).

Case Study
Even if the Transportation programme is much more efficient in solving big problems, whose results are difficult to obtain by using traditional methods, in the following a simple case study will be presented in order to understand the way this programme works.

A trading company has four working places, WP1, WP2, WP3 and WP4. In the context of the financial crisis, the company has decided to shut down the production activity. Five of its beneficiaries, B1, B2, B3, B4 and B5 had launched orders. As it happens, the amount of the existent stocks at the moment in the four working places is equal with the amount of the quantities that had been ordered which amounts to 1.600 pieces.

The quantities available for each working place, the quantities necessary for each beneficiary and the unitary costs for the transportation between each working place and each beneficiary will be typed in the respective window.

The trading company must identify the way to distribute the existent stocks, so that the total transportation cost should be a minimum one.

The Transportation Programme
This is a problem of a minimum, one will use the North-West Corner Method, the sources are 4, and the destinations are 5.
After the programme is run, the initial solution obtained with the required method, that is the North-West Corner Method, will be displayed.

In this case, it is clear that:

- The working place WP1 will supply all the available amount to the beneficiary B1, that is all the 366 pieces,
- The working place WP2 will supply 6 pieces, 170 pieces, 325 pieces, and 47 pieces, to the beneficiaries B1, B2, B3 and B4 respectively,
- The working place WP3 will supply 200 pieces to the beneficiaries B4 and 59 pieces to the beneficiaries B5,
- The working place WP4 will supply all the available amount to the beneficiary B5, that is all the 427 pieces.

In this context, the total transportation costs will amount to 16,488 lei.

Then the optimal solution obtained with the Modified Distribution Method will be displayed.
In this case, one can notice the following:

- The working place WP1 will supply all the available quantity to the beneficiary B1, that is all the 366 pieces,
- The working place WP2 will supply 301 pieces and 274 pieces to beneficiary B3 and B4, respectively,
- The working place WP3 will supply 6 pieces to the beneficiary B1 and 253 pieces to the beneficiary B5,
- The working place WP4 will supply 170 pieces, 24 pieces and 233 pieces to the beneficiaries B2, B3 and respectively to beneficiary B5.

In this context, the total transportation costs will be minimum which is 15.354 lei.

In order to interpret the results one must determine the concordance between the theoretical optimum and the practical reality which is the economic optimum. Then, the conclusion obtained from the analysis of the results will be presented to the decision makers.

In conclusion, all the trading companies should become aware of the opportunities of turning the transportation costs into more efficient ones, and of implicitly using specialized software products, because they present advantages that must not be overlooked.

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