

Material Management in Construction Firms

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KEYWORDS

Material management, Construction firms

ABSTRACT

Material management is a new management technique to be used for controlling the production process in building firms. Decisions can be taken with the help of the information provided, which will result in the dynamic control of execution on site. The use of computers is necessary. Computer programs include qualitative and quantitative information about materials, handling procedures, suppliers, costs, etc. On the basis of this information decisions can be taken on questions about orders, times of delivery, transport, machinery to be used, manpower needed, etc. The programs will warn management about alternatives, which necessitate to update the planning and the budget.

An interactive program has been devised for material management in building firms, including a warning system for decisions on building site. The system contains basic questions concerning the delivery and the use of materials for a building project and also an interactive matrix with questions about the progress of work on the project.

It is intended to develop computer programs for the scheduling of activities on site. In these programs it will be possible to consider all kinds of alternatives on the basis of comprehensive building project information.

The management on site can use the instrument of material management to react immediately to disruptions and improve its decisions concerning the organization of all activities on site. The computer opens up possibilities for realizing perfect material management on site that have not been available previously.

"Material Management" (Maîtrise de la mobilisation des composants et matériaux sur le chantier)

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SOMMAIRE

"Material management" est une nouvelle technique permettant de contrôler le processus de production dans les entreprises de construction. Les décisions peuvent être prises à l'aide d'informations, sous la forme d'un contrôle dynamique de l'exécution sur le chantier. L'utilisation d'ordinateurs sera indispensable. Les programmes d'ordinateur comprendront des informations qualitatives et quantitatives sur les matériaux, les procédés de traitement, les fournisseurs, les frais, etc... En se basant sur ces informations, il sera possible de prendre des décisions sur les questions concernant les commandes, les délais de livraison, le transport, les machines à utiliser, le personnel nécessaire, etc... Des signaux seront donnés là où le travail n'aura pas été complètement effectué.

Un programme interactif a été créé pour la maîtrise des matériaux dans les entreprises de construction, comprenant un système de signal avertisseur pour les décisions à prendre sur le chantier de construction. Ce système renferme les questions de base au sujet de la livraison et de l'utilisation des matériaux pour un projet de construction, et contient, en outre, une matrice interactive avec des questions sur l'avancement du travail sur un projet de construction.

On envisage de développer des structures pour la programmation des activités sur le chantier, où, au moyen d'un ordinateur, il sera possible d'effectuer toutes sortes de manœuvres, basées sur des informations complètes en ce qui concerne un projet de construction.

La maîtrise sur le chantier peut se servir du "Material management" pour réagir immédiatement aux interruptions et améliorer ses décisions à propos de l'organisation de toutes les activités sur le chantier. L'ordinateur permet de réaliser un excellent "Material management" sur le chantier, ce qui n'était pas possible auparavant.

INTRODUCTION

In the last decennia the building process has been subject to many changes. In general, developments in the execution on site have been, that many more experts have taken part in the process,

each of them specializing on particular contributions. The building process has developed into a form of production, that is characterized by the use of more and more prefabricated elements.

The collaboration of contractors, sub-contractors and suppliers in the building has introduced many more problems for the management of the execution on site. The character of management activities has considerably changed and management tasks are more and more key elements in the overall management of the construction firm.

Not only this development has complicated the realization of building projects. At the same time the financial possibilities that are decisive for construction activities, have become so much narrower in different countries. This means in general that the financial margins for the operations of a building firm have turned out to be so much narrower during recent times.

These two factors have in combination stressed the importance of a well structured organization of the construction process. As a rule only a construction project that is very carefully organized can be expected to promise financial success.

An analysis of the factual developments of the organization of the building process on site leads to the conclusion that the main task of the builder will be to organize the process in such a way that the staff planned will use the planned materials within the planned time according to such a manner that will be optimal under the given conditions.

This means that the organization of the construction process is mainly a matter of logistics. The logistic problem is the management and control of the flow of products, staff and information to the site, as well as on site and from the site to the builder's office.

The basis for this organization process will be the drafting of an efficient planning for the control of the different streams of products and the use of manpower. No results are to be expected if the different planning activities cannot be controlled in a dynamic way. This means that during the many changes that may occur during the building process all planning items are adapted to any change, thus ensuring an effective control. All changes will have to be evaluated as far as their impact on the complete process is concerned, since they may have far reaching effects on the overall planning of the process. Only through systematic control of all possible changes and of their

effects on each of the other items of the planning an efficient and effective building process can be guaranteed. It will enable management to update plans and budgets according to consequences of changes.

The construction process becoming more and more complicated will ask for more sophisticated planning procedures. This will demand the use of computers, since the control of the process gets too complicated to abstain from the help of computerized systems. Manual network planning for big projects leads to considerable problems since the many changes, that happen continuously cannot be processed any more.

Quite a few systems for dealing with setting up and controlling the planning of construction activities are in use. There are, however, no systems available so far, that combine the planning of the execution on site with a satisfying planning of manpower, plant, materials and costs and that also will function dynamically.

This was the reason why Stichting Bouwresearch wanted to find out whether such a dynamic system, that could meet the needs of material management in construction firms. In this system a systematic control of the different flows of materials is made possible in relation with the use of manpower and the indication of the exact situation of the different supplies of materials and elements. The results of the study have been laid down in a first publication, which is discussed below.

PRINCIPLES OF MATERIAL MANAGEMENT FOR THE BUILDING PROCESS

Every automation of a process or activity should be adapted carefully to the needs of the process. In the building process the aims will be the dynamic control and optimization of the flow of products, plant and manpower to the building site and on the spot of production. Material management is therefore an instrument for the optimization of the control of the execution on site. The use of the instrument will depend on the size of the building project. It can either be used by the project leader or by the site agent, depending on who is directly responsible for the production process on site.

It will be possible to extend the system for activities such as work preparation and the processing of administrative information. These possibilities can be considered as extra options, but they have not been dealt with in the study of the Stichting Bouwresearch, since they are not decisive for the direct applicabil-

ity of the system. They will, however, enlarge its usefulness.

The conditions for the usefulness of an automatized system in general are as follows:

- it should correspond with the work methods in use
- the system should offer its assistance especially for routine activities, but it should not be harmful to the specific qualities of the experts using it
- the activities of the experts using the system should in no way enlarge, or in other words the amount of their work should remain constant or diminish
- the feeding of the system with data should be well defined and controlled
- the system should add to the value of process

Applying these principles to the instrument of material management asks for an analysis of the process of the execution of building activities on site. This has been done with the help of a model, that shows all instruments for control and check-points in the building process.

MODEL OF THE CONSTRUCTION PROCESS ON SITE

This model of the construction process on site has been worked out in a diagram (see figure). The starting point of the process is the estimate of work and the time planning, including all other planning data that are based on those two basic information sources. The whole procedure always should follow the basic demand for what has been planned as a starting-point. It will always be a reference to the aspects of time, costs, supplies etc.

The project manager will ask himself at the end of each working day several questions that will run as follows:

- what has been produced
- what materials have been used for this purpose
- what materials have to be ordered
- where should they be stored
- what manpower or sub-contractors are needed
- what materials do they need

In the diagram the different questions are placed horizontally. On the basis of the initial planning a system of questions and answers will develop, that will lead to reminders and warnings and decisions to be based upon them. Checklists of different

questions can be used to check all decisions on their impacts on the different aspects of the planning. This procedure may lead to the decision to update the planning and the cost-estimate.

The figures used in the diagram have the following meaning:

- step 2 and 3 the information on the execution on site and the problems about results
- step 4 the answers on the basis of this information
- step 5 and 6 the progress control and the new situations resulting from the answers of step 4
- step 7 the warnings given on the basis of the previous steps
- step 8 the decisions to be taken on this basis
- step 9,10, 11 the questions and answers about the effects of these decisions
- step 12 the effects in the shape of answers about changes in time and costs
- step 13 the updated and adapted planning and new formulation of tasks on the basis of accepting the effects of step 12.

If this procedure can be realized on the building site with the help of a computer, then a dynamic and interactive system of work control will be effected. This will add new possibilities to the existing system of improving productivity on site. This system of coupling warnings, decisions and their effects can only be effected with the help of a computer. In the present situation, on the contrary, without computer help results will depend largely upon the ability of the firm's management to improvise and as a rule consequences will be recognized only too late.

THE PROGRESS OF RESEARCH ON MATERIAL MANAGEMENT

The theoretical part of the study on material management has been completed. The study contains so far a description of the procedure to follow, to be used in practice. Further research, which has been taken in hand at present, has definitely practical aspects. With the help of a prototype of a building project the system will be evaluated for its practical use. It will be necessary to adjust the system to the convenience of the users in practice. This will lead to a clear view on the practical value of the system.

Testing the system should keep as near to the needs in practice. A guide for the adaptation of the philosophy of material manage-

ment to the needs of the building practice will be needed. Already too often research results have turned out to be of no use in practice because their practical value has been overestimated. The next step of research will be an easily understood description of the system with an indication of the results to be expected. This description will be edited in the form of a manual, that can be the basis for any software house to develop a program for its builder client.

The effects will be, that

- there will be available an universal and well understood basis for the standardization of procedures for material management in building
- the investment in material management of the future user of the system will be limited as far as possible
- the system can be incorporated in the specific organization of a particular construction firm

A well rounded off universal system for immediate use in construction firms will be extremely unlikely since the building practice uses a great variety of organizational structures and management procedures. Individual firms show considerable differences in their progress to automation of their management procedures and a universal system that will help them all, regardless of their progress, is at present inconceivable.

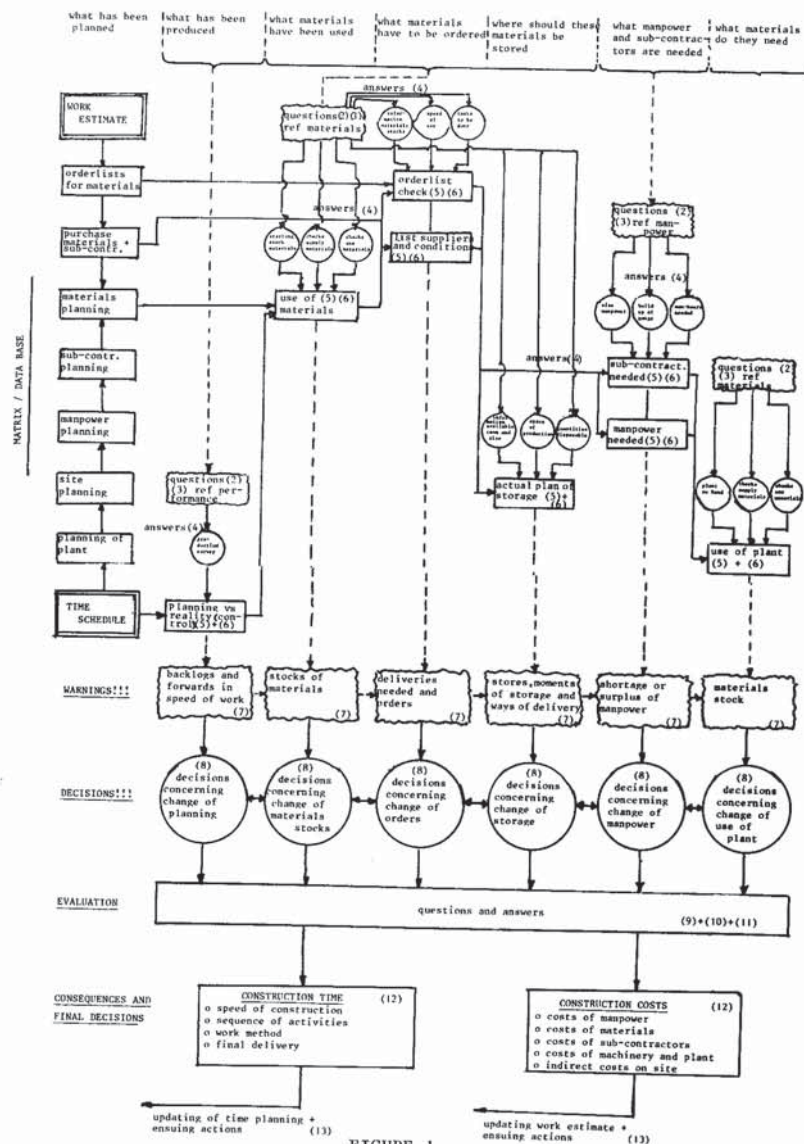


FIGURE 1