

SUMMARY

A CONSTRUCTION EQUIPMENT MANAGEMENT INFORMATION SYSTEM MODEL FOR THE CONTRACTING FIRMS.

Construction equipment is one of the three major inputs of the building construction process, together with labour and materials.

One of the reasons for the development and use of equipment within construction is, to enable construction activities to be performed which are beyond the limit of human strength, and to achieve high standards, which is required by current construction technologies and designs. The second one is to make the construction process more economic.

Construction equipment can be used,

- to reduce costs and an increase productivity,
- to replace manual operations, particularly the heavy tasks, such as handling construction materials and components, excavating and concrete production and placing,
- to maintain the budgeted cost and planned production process where labour is scarce or too expensive to employ,
- to reduce construction material wastage on handling and assembly.

The construction sector ranges from one story family houses to the nuclear power plants. Therefore different kinds of construction equipment are available in the market and these can be used in different types of construction activities. In this thesis, whether to limit the subject or to investigate the most frequently used ones, the equipment, which is used in building construction process, are aimed.

By investigating construction equipments used in the building construction sites currently, the problems in the construction equipment management are evaluated in points of different management levels of the contracting firms.

The ultimate object of the thesis is to establish a model, which can be used to support the managers working in different management levels, in making a decision to solve problems they are encountered.

In the second chapter, the equipment management in the contracting firm is considered in the building construction process basically in two phases. Pre-construction and construction. In the pre-construction period, the equipment management can be taken into consideration in two interrelated phases. These are tendering and preparation before the contract. In tendering stage it is a global equipment planning process, whereas in pre-contract stage it is a detailed equipment selection process for the project.

It is required to analyse a number of factors to select the proper equipment for the project to be build. Some of these factors affect the equipment selection on project level are the project itself, site conditions and the characteristics of the equipment, while the others on firm level are environmental factors and the characteristics of the firm.

In the construction period, economic evaluations of the equipment alternatives, measurement of the equipment productivity, equipment acquisition and the financial aspects, equipment utilisation planning and coordinating, controlling and monitoring the equipment both operationally and financially are the major subjects investigated.

A CONSTRUCTION EQUIPMENT MANAGEMENT INFORMATION SYSTEM MODEL FOR THE CONTRACTING FIRMS

In the chapter it is mentioned that present worth and equivalent annual cost techniques can be used to make comparisons between two or more equipment schemes, and inflation adjustments should be made after the total present worth is calculated.

And it is told that present worth, internal rate of return and discounted cash flow yield calculations can be used to measure the productivity of the equipment hired or owned.

From the equipment acquisition point of view, there are six major ways for the firm. Direct purchase, credit sale, hire purchase, finance leasing, and operate leasing and hiring. It should be evaluated in a systematic manner, because equipment acquisition requires considerable sums of money.

It is also crucial to monitor equipment operating and ownership costs in a well-planned cost reporting system. Equipment ownership costs occur whether the machine is working or not. Ownerships that should be monitored and converted to hourly basis are capital cost, depreciation cost, insurance expenses, tax, licences and storage cost. Operating costs occur when the machine is operated. Oil, lubricants and the other consumables, maintenance and repair costs, tyre costs for the rubber-tyre machines and operator s wages and the other expenses are equipment operating costs to be monitored.

In this chapter equipment maintenance is also examined. The purpose of the maintenance is to keep the equipment in service. Equipment maintenance policy options are planned preventive or corrective maintenance, unplanned on-site breakdown maintenance or maintenance in workshop, and replacement. Firm s attitude to maintenance, the number of machines owned, type of tasks performed by the firm affect the equipment maintenance policy of the firm.

In the third chapter, some general definitions are given on the system, information and information systems. A system is a group of interrelated components working together toward a common goal by accepting inputs and producing outputs in an organized transformation process.

In this context if a firm is accepted as a system, it can be recognized that the firm is surrounded by a physical and a conceptual system. Physical system is simply regarded as a input, process and output cycle of the firm s physical resources. Conceptual system, however, is an information system. An information system can be viewed as a system that accepts data resources as input and processes them into information products as outputs.

There are three basic elements of the conceptual system. These are managers, information processor and standards. An information processor, i.e. information producing mechanism, processes data, comes from physical system and firm s environment, and transforms data into information. Management receives information that describes the physical system s output. Manager compares the actual performance with standards that represents the desired situation. Managers also send feedback signals to control the physical system whether the corrective action is necessary. Managers stand on three major management levels in organisational hierarchy:

- Strategic planning level,
- Management control level,
- Operational control level.

Computer based information systems gather, processes, stores and distributes information to support managerial decision-making and control functions of the firm. Computer based information systems consists of five components:

- Person,
- Procedures,
- Data,
- Hardware,

A CONSTRUCTION EQUIPMENT MANAGEMENT INFORMATION SYSTEM MODEL FOR THE CONTRACTING FIRMS

- Software.

Computer based information systems support operational procedures and activities via Data Processing Systems and Office Automation Systems, support managerial decision making via Management Information Systems, Decision Support Systems and Expert Systems and provide competitive advantage.

A firm's data processing tasks are performed by data processing system that gathers data describing the firm's activities, transforms the data into information, and makes the information available to users. A data processing system performs four basic tasks. Those are data gathering, data manipulation, and data storage and document preparation.

The data processing system is the only computer based information system that has the responsibility of meeting information needs outside the firm. The data processing system has a responsibility to furnish information to each environmental element except competitors.

Data processing contributes to problem solving by producing standard reports that summarize the firm's financial condition, and providing the database that is used by other computer based information subsystems.

Management information system is a computer-based system that makes information available to users with similar needs. The information describes the firm in terms of what has happened in the past, what is happening now and what is likely to happen in the future. The information is made available in the form of periodic reports, special reports, and outputs of mathematic simulations. Both managers and nonmanagers in the firm use the information output as they make decisions to solve problems.

The management information system contributes to problem solving, in providing organisation wide information resources to large number of managers, and lending strong support in problem identification and understanding.

Decision support system assist managers in making decision to solve semi structured problems, support the manager's judgement rather than try to replace it, improve the manager's decision making effectiveness rather than its efficiency.

A decision support system consists of two types of information producing subsystems. Report writing software provides information as periodic and special reports. Mathematical models provide information as simulation results.

Office automation system includes all of the formal and informal electronic systems primarily concerned with the communication of information to and from persons both in and outside the firm. Office automation system is used by all of the people, managers, professionals, secretaries and clerical employees, who work in offices.

Computer based office automation applications are word-processing, electronic mail, electronic bulletin boards, computer conference, image processing, multimedia systems, desktop publishing etc. Non-computer based office automation systems are facsimile, voice mail, videoconference, audio conference etc.

Development and use of a computer based information system is realized through a life cycle. It is told that the life cycle of the computer based information system consists of five phases named planning, analysis, design, implementation and use in turn.

The system life cycle is an application of the systems approach to the task of developing and using a computer based system. A number of participants and information specialists work in each phase of the system life cycle. There is a Management Information System Steering Committee at the top of the management of the system life cycle. The MIS Steering Committee controls project teams working in different functional areas. A project leader directs the project teams, which are

A CONSTRUCTION EQUIPMENT MANAGEMENT INFORMATION SYSTEM MODEL FOR THE CONTRACTING FIRMS

constituted by systems analysts, information specialists, database administrators, network specialists, programmers, end users etc..

In the planning phase, the problem is recognized and defined, system objectives are set, manager identifies system constraints, and a feasibility study is conducted and a system study proposal is prepared and presented by systems analysts to the MIS Steering Committee.

If the system study is approved, the committee announces it to the firm. Manager and systems analysts together organize the project team; define information needs and system performance criteria. Systems analysts finally prepare the design proposal and present to the MIS Steering Committee.

After the design proposal is approved, the detailed system design is prepared, alternate system configurations is identified and evaluated, the best one is selected and the implementation proposal is prepared and presented to the committee by systems analysts.

The implementation is planned and announced by the committee and the manager. The hardware and software resources are obtained, the database and the physical facilities are prepared by system analysts. After all of the participants and end users are educated, the current system is left immediately or phased, or the new system is operated in a pilot department, or the old and new systems are operated parallel.

In the fourth chapter, systems approach is applied to the equipment management problem to build the framework of the model to be established. First of all, the contracting firm is viewed as a system, and environmental systems and subsystems of the firm are recognized. One of these subsystems of the firm is the equipment management system.

In order to identify the subsystems of the equipment management system, a functional decomposition is applied. And a managerial decomposition is applied also to define the management levels of the functions realized in the context of the equipment management system. These functions are discussed in building construction process during pre-construction and construction periods.

The functions realized in the different stages of the building construction process in the framework of the equipment management system are:

- Determining general long-term and short-term equipment policy of the firm,
- Controlling the equipment management during building construction period,
- Global equipment planning during pre-construction period,
- Detailed equipment planning for the project,
- Selecting the proper equipment for project,
- Evaluating the equipment alternatives economically,
- Planning the acquisition of the equipment during construction period,
- Planning the distribution of the equipment between sites,
- Coordinating and controlling the equipment transfers between sites,
- Controlling the equipment operating costs,
- Controlling the equipment ownership costs,
- Analysing the equipment costs and cost variances,
- Analysing the equipment performance and productivity,
- Planning and controlling the equipment maintenance and repair,
- Planning and coordinating the safety measures on site,

A CONSTRUCTION EQUIPMENT MANAGEMENT INFORMATION SYSTEM MODEL FOR THE CONTRACTING FIRMS

- Planning the equipment replacement and retirement,
- Controlling and maintaining the equipment storage areas and workshops.

According to these functions and the organisation chart of the equipment management system, current system is analysed. The analysis is realized on sites and offices of a sample-contracting firm, which uses equipment extensively in building construction. Different observation, interviewing and questionnaire techniques are used to determine who, how, when, where and why performs each task. The information comes in and goes from the units of the equipment management system is also determined.

In terms of the tasks performed by units and the information (forms, reports, hard copies etc.) used on the performance of the each task, decisions made by managers to solve problems are evaluated. These decisions are placed on a matrix related to the levels of management as programmed, semi-programmed and un-programmed.

Programmed decisions are repetitive and routine. It is possible to specify algorithms or rules that allow the problem to be identified and understood. Programmed decisions are made with computer assistance. Therefore it is told that managers can take the advantage of five computer-based management information systems in making decisions in the construction equipment management.

Data flow diagrams are plotted for the functions of the construction equipment management. Data structures of the BICEM software are established in terms of information gathered. Microsoft Access database management system software package is used to build a prototype of the model.