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Construction Management Process and Management of New Information and Technology: The New Frontiers.

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ABSTRACT

Uncertainty stemming from regulatory agencies, environmental issues and financial aspects of construction should be at least mitigated or ideally eliminated. Owners are keenly interested in achieving some form of breakthrough that will lower the costs of projects and mitigate or eliminate lengthy delays. Such breakthroughs are seldom planned. Generally, they happen when the right conditions exist, such as when innovation is permitted or when a basis for incentive or reward exists. However, there is a long way to go before a true partnership of all parties involved can be forged. The risks related to organizational relationships may appear to be unnecessary but are quite real. Strained relationships may develop between various organizations involved in the design/construct process. When problems occur, discussions often center on responsibilities rather than project needs at a time when the focus should be on solving the problems. Cooperation and communication between the parties are discouraged for fear of the effects of impending litigation. This barrier to communication results from the ill-conceived notion that uncertainties resulting from technological problems can be eliminated by appropriate contract terms. The net result has been an increase in the costs of constructed facilities.

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1.0.INTRODUCTION

Project management as stated by R. M. Wideman, 1986, is the art of directing and coordinating human and material resources throughout the life of the project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality, and participation satisfaction. Generally, project management is distinguished from the general corporate management by the mission-oriented nature of the former. The general management of business and industrial corporations assumes a broader outlook with greater continuity of operations. There are sufficient similarities as well as differences between them, but the modern management techniques developed for the general management may be adapted for project management. The organization of construction process requires the knowledge of modern management techniques as well as an understanding of the design and construction process. Construction projects have a specific set of objectives and constraints, such as time of completion, the relevant technology and institutional arrangements. While the process may differ, the management of such projects has much in common with the management of similar types of projects in other specialties, be it aerospace, pharmaceutical or energy developments.

2.0.CONSTRUCTION MANAGEMENT

Construction management is the study and practice of the managerial and technological skills of the construction industry, including but not limited to construction, construction science, construction management, and construction technology, as it affects a business model where one party to a construction contract, serves as a consultant, providing professional advice on design, construction and management techniques. The basic ingredience for a construction project management framework may be represented schematically as in fig 1, below. A working knowledge of general management and familiarities with the special knowledge domain related to the project are indispensible. Supporting disciplines such as computer science and decision science may also play an important role. The modern management practices and various special knowledge domains have absorbed various techniques or tools, which were once identified only with supporting disciplines. For an example, computer-based information system and decision support system are now common tools for general management. The operation research techniques such as linear programming and network analysis are now widely used in many knowledge or application domains (Frank Harris and Ronald McCaffer 2001).

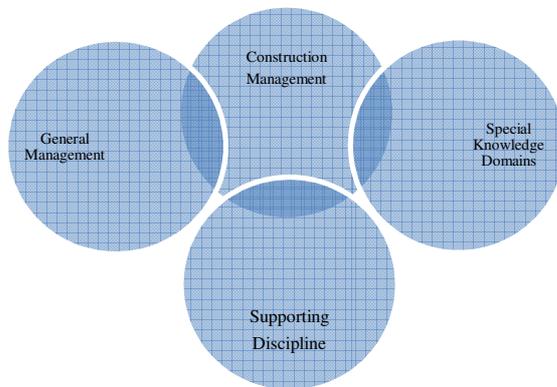


Fig 1 Project management framework
Source: Frank Harris and Ronald McCaffer (2001) Adopted

Fig 1 above reflects only the sources from which the project management framework evolved.

Specifically, project management in construction encompasses a set of objectives, which may be accomplished by implementing a series of operations subject to resource constraints. There are potential conflicts between the stated objectives with regards to the scope, cost, time and quality, as well as the constraints imposed on the human, material and financial resources. These conflicts are usually resolved at the onset of the project by making the necessary tradeoffs or by creating new alternatives.

The Construction Management Association of America (CMAA) stated that there are one hundred and twenty common responsibilities for a Construction Manager, which they

grouped under seven major categories; Project Management Planning, Cost Management, Time Management, Quality Management, Contract Administration, Safety Management and Construction Management Professional Practice, which includes specific activities like defining the responsibilities and management structure of the project management team, organizing and leading by implementing project controls, defining roles and responsibilities and developing communication protocols, and identifying elements of project design and construction likely to give rise to disputes and claims.

3.0. NEW TRENDS IN MODERN MANAGEMENT

There are major developments in construction management which reflect the acceptance to various degrees of the following elements (Britell, P. S., Goldstein, N And Das, A. 2003):

- 1) The management process approach
- 2) The management science and decision support approach
- 3) The behavioral science approach for human resource development
- 4) Sustainable competitive advantage approach.

These four approaches complement each other in current practice, and provide a useful groundwork for construction project management.

The management process approach

The management process approach emphasizes the systematic study of

management by identifying management functions in an organization and then examining each in detail. There is a general agreement regarding the functions of planning, organization and control. The major tenet is that by analyzing management along functional lines, a framework can be constructed into which all new management activities can be placed. Construction management is regarded as coordinating a process of interrelated functions, which are neither totally random nor rigidly predetermined, but are dynamic as the process evolves. Another tenet is that management principles can be derived from an intellectual analysis of management functions. Construction management can

be divided into functional components. Each of the principles based upon each function can be extracted. The management functions can be organized into a hierarchical structure designed to improve operational efficiency as in Fig 2 below. The basic management functions are performed by all managers, regardless of the enterprise, activity or hierarchical levels. This will lead to a development of a management philosophy which the managers will use to establish relationships between human and material resources. The outcome of following an established philosophy of operation helps the manager win the support of the subordinates in achieving organizational objectives.

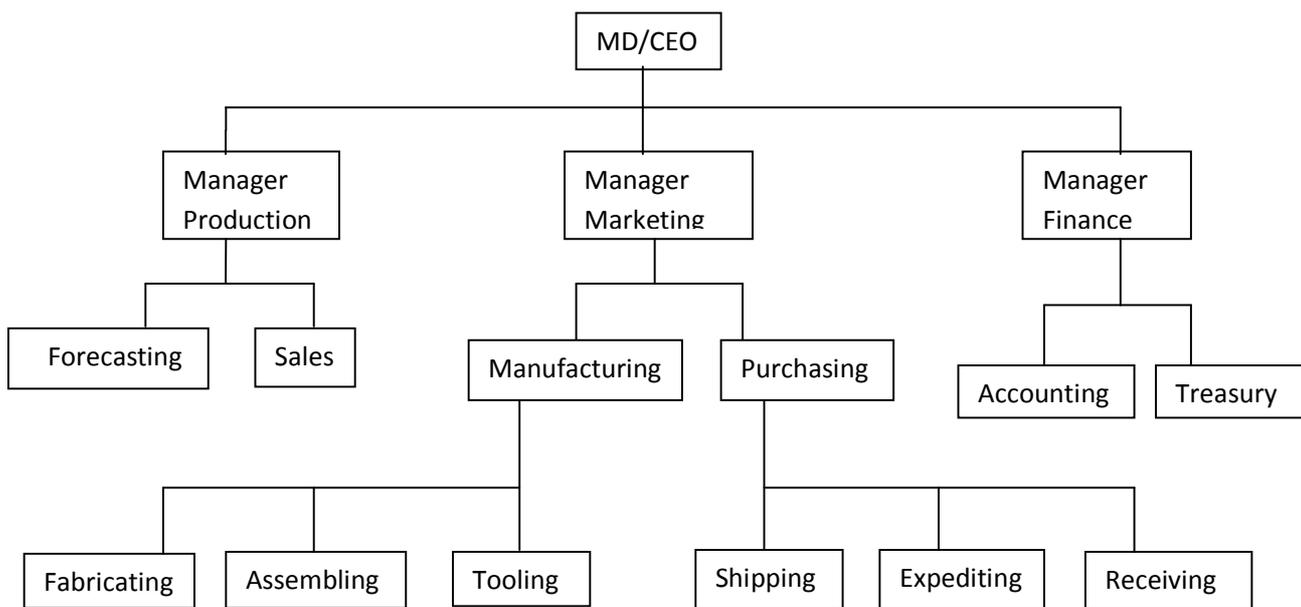


FIG 2 Illustrates Hierarchical Structure of Management Functions.
 Source: Frank Harris and Ronald McCaffer (2001) Adopted

The management science and decision support approach

The management science and decision support approach contributes in developing a body of quantitative methods, designed to aid managers in making complex decisions related to operations and production. In decision support systems, emphasis is placed on providing managers with relevant information. In management science, a great deal of attention is given to defining objectives and constraints, and to constructing mathematical analysis models in solving complex problems of inventory, materials and production control, among other things. The topic of major interest in management science is the maximization of profit, or in the absence of a workable model for the entire system, the sub optimization of the operations of its components. The optimization or sub optimization is often achieved by the use of operations research techniques, such as linear programming, quadratic programming, graph theory, queuing theory and Monte Carlo simulation. In addition to the increasing use of computers accompanied by the development of sophisticated mathematical models and information systems, management science and decision support systems have played an important role by looking more carefully at problem inputs and relationships and by promoting goal formulation and measurement of performance. Artificial intelligence has also begun to be applied to provide

decision support systems for solving ill-structured problems in management.

The behavioral science approach for human resource development

An effective construction management system must understand the importance of human factors such as needs, drives, motivation, leadership, personality, behavior, and work groups. It is within this context that more emphasis may be placed on interpersonal behavior, which focuses on the individual and his or her motivations as a socio-psychological being; others emphasize more on group behavior, in recognition of organized enterprise as a social organism, subject to all the attitudes, habits, pressures, and conflicts of their cultural environment.

The major contributions to behavioral science management approach are as follows:

- i) The formulation of concepts and explanations about individual and group behavior in an organization.
- ii) The empirical testing of these concepts methodically in many different experimental settings.
- iii) The establishment of actual managerial policies and decisions for operation, based on the conceptual and methodical frameworks.

Sustainable Competitive Advantage Approach

This system stems primarily from good management strategy. As Michael Porter of Harvard Business School argues;

Strategy is creating fit among a company's activities. The success of a strategy depends on doing many things well – not just a few – and integrating among them. If there is no fit among activities, there is no distinctive strategy and little sustainability. By this view, successful firms must improve and align the many processes along the strategic vision.

Strategic positioning in a construction management firm requires the following;

- + Creating a unique and valuable position.
- + Making trade-offs compared to competitors.
- + Creating a “fit” among a company's activities.

Construction Management inculcates the strategic position of their own organization and that of other organizations involved in the business. Construction management faces the difficult task of trying to align the goals and strategies of these various organizations in accomplishing such project goals. For example, the owner of an industrial project may define a strategic goal as being the first to market a new product. In this case, facility development will be oriented to fast-track, for rapid construction. In another instance, a construction firm may see their strategic advantage in new technology and emphasize profit opportunities for value engineering (William, R. 1986).

4.0. MANAGEMENT OF INFORMATION AND NEW TECHNOLOGY FOR CONSTRUCTION

The Management of information and new technology emphasizes the need to proffer solutions to design and construction management that will suit particular and different circumstance, rather than adopting preconceived patterns and methods. Project Management can be defined as the process of combining and utilizing, or allocating an organization's inputs (MAN, MONEY AND MATERIAL) by planning, organizing, directing and controlling for the purpose of producing outputs (goods and services or whatever the objectives are) desired by customers so that the organizational objectives are accomplished. Management Information System (MIS) are techniques for providing management that is timely, accurate with useful information with which decisions could be made. To make dynamic you need up dated information and systems. This can usually be adapted from the latest construction methods or state of the art management techniques. However, effective management of information depends largely on the attitude and state of mind of persons responsible for the management of the office or construction at all levels as the case may be. For the purposes of this paper important sections to be discussed are the foundational subjects concerned with how Construction Management handles information and introduction of new

technology for construction, which is stated as follows;

- 1) The study of the present system.
- 2) Develop a priority of information management needs on the site.
- 3) Develop a priority on the sequence of construction operations.
- 4) Install ICT facilities necessary for effective site operations.

The economy affects all production processes and thus affects the performance of construction industry. Shifts in Government policy also affect the industry. Government agencies in the third world countries form the majority of the source of contract patronage and rely on Government subventions. The payments on schedule are only possible when government is interested in such projects. Any disinterest is never in your best interest and the outcome could be disastrous. The Information management process and new technology to be adopted is usually a pre-design decision, which involves up to date adequate and accurate information on design standards, construction techniques, materials and proper legislation for that type of construction. Sources of such information are listed below but not limited to;

- 1) Manufacturer's data on products and materials.
- 2) Government booklets and publications
- 3) Law report
- 4) Checklist
- 5) Contracts, standards forms, and documentation

- 6) Professional magazines and publication and technical articles
- 7) Internet
- 8) Job records and feedbacks
- 9) Building regulations
- 10) Textbooks and technical reports

The responsibility of proper handling, interpreting and analyzing this information and appropriating it before the start of construction and during construction in such a manner that the data collected are properly distributed to every facet of the works, lies with the construction management team. Usually, construction management relies heavily on hindsight in deciding which program, methods and when to employ them. There are two crucial issues, key to this decision and that is; The Timing of a project, because once approved or award has been obtained, it influences the successful completion of the project. The other is Viability of the project, considering risks and uncertainties that could affect the resources and cash flow of this investment, which when epileptic the project implementation process can easily slip into comatose and sometimes recovery is illusive (Fenn, P. and Gameson, R. 1992).

5.0. INFORMATION PROCESS

The Management of information in the construction industry covers aspects of personnel, finance, plant and material, as well as general contract planning. Fig 3 below stipulates a process;

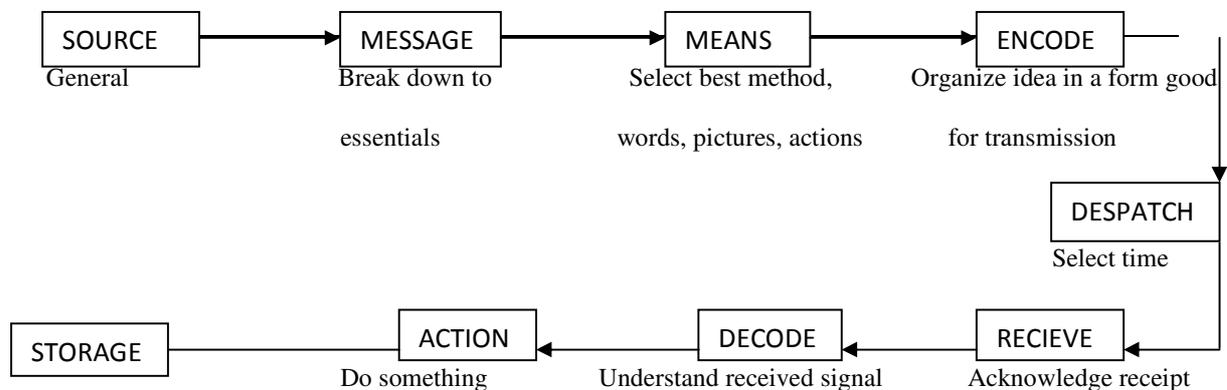


FIG 3 Keep for future use

Source: Frank Harris and Ronald McCaffer (2001) Adopted

From FIG 3 above, it is the duty of the management team to receive or generate information, put them into proper formats for transmission and ensure that such messages are received, understood and acted upon. Meetings are also essential avenues and opportunities to transmit such messages.

QUALITY OF INFORMATION

For management objectives to be actualized effectively in a multi-disciplinary organization, the quality of the information that is transmitted must be **TIMELY**. That is essential information at most auspicious time for critical execution. **CLARITY** of the information is essential, in terms of completeness, candid, unambiguous, concise, correct, courteous and concrete. **ATTENTION TO DETAIL** is also essential in other to remove distractions, be able to ask questions and show empathy.

6.0.WORK BREAK DOWN STRUCTURE

The essence of work break down structure is to bring coherence between goals and objectives for which the organization exists. The techniques used are often recognized methods of solving recognizable problems in a systematic manner. The management team must have a good combination of sound technical and managerial competence. This is very essential because of the rate of growth of technology and its incursion into the scientific approaches of construction project management. Work break down structure will design an official structure that works well in economically adaptable changing circumstances. Work break down structure as it relates to construction management is more or less a division of labour or specialization on an aspect of the work which makes that task easier and

faster. In essence, ranges of responsibility must be considered and distinguished in terms of Professional to Non-professional, work directly related to commissions, as distinct from work of a supporting nature (At Kinson, I. 1971). Commissioned work has job related responsibilities, which has a mixture of professionals and non-professionals saddled with this responsibility as stated below;

- a) Finance and management accounting, costing records etc.
- b) Development feedback, research, planning etc.
- c) Demand for services development contract and public relations.
- d) Demand for facilities, office space, equipment, material etc.
- e) Personnel recruitment.
- f) Information and communication facilities, library, standard specifications, model making etc.

7.0.HIERARCHY OF AUTHORITY

The system has ways of delegating authority and power as well as

responsibilities. Delegation of authority is a means of motivation for workers and is a management tool for reward and control.

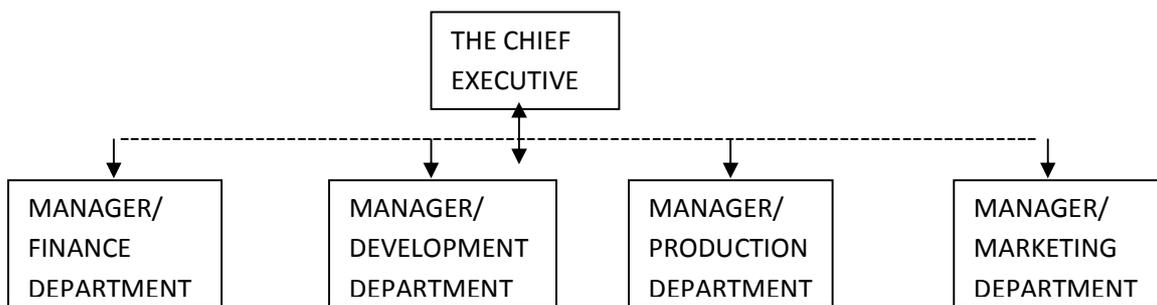
There are three basic organizational types;

- I. LINE ORGANIZATION
- II. FUNCTIONAL ORGANIZATION
- III. LINE-STAFF ORGANIZATION

Line means management roles covers decision making process while staff provides service and expert advice to the decision makers by staff employed in the actual production activities.

i. LINE ORGANIZATION STRUCTURE

In this organization instruction or authority trickles down from the top to the bottom. The Chief executive gives instructions or authority to his subordinates; they in turn give same to all the workers down the line, mostly organized in small groups of trades and activities controlled under the various groupings but do the same kind of job. The groupings are merely for convenience of control and direction. It is known as departmentalized line organization.



DEPARTMENTALIZED LINE ORGANIZATION STRUCTURE FIG 4a

Source: Frank Harris and Ronald McCaffer (2001) Adopted

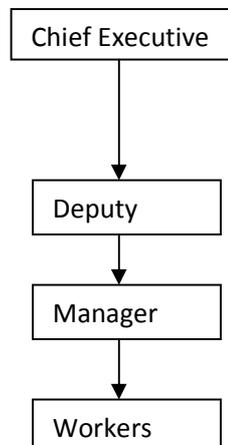


FIG 4b LINE ORGANIZATION STRUCTURE

Source: Frank Harris and Ronald McCaffer (2001) Adopted

In this structure, there are no groupings. Instructions come from the top to the bottom, through the chief executive to the subordinates and they give same to the workers who are doing the same kind of job.

ii. FUNCTIONAL ORGANIZATION STRUCTURE

This type is based on the belief that particular supervisors or managers can have a range of skills that can control staff towards successfully completing array of tasks. These managers could individually or collectively give instructions to particular workers and they perform better after receiving instructions from one superior at a time.

iii. LINE STAFF ORGANIZATION STRUCTURE

This is a compromise between the need to utilize special skills and at the same time maintain a line of authority supervisor. This system allows supervisors functionalizes staff department with a line supervisor.

The structures of organization discussed here are theoretical set-ups in actual practice it could be a combination of all of the above.

8.0.CONCLUSION

Management problems are frequently blamed on a culprit called “Information and Communication Gap”. The modern

construction management process and management of new information and technology have revolutionized the construction industry by creating fast and descriptive changes in a concise manner by which relevant information are sourced and introduced into the construction industry. This has brought about new materials and construction methods as well as management process that is adequate in the distribution of resources, and has eliminated problems associated with process of construction. The effectiveness of information is achieved when people are able to pass ideas and meanings to each other through verbal and non-verbal process.

Contrary to all the contract requirements in force on the project, communication at the job site is essentially done on an oral basis. The most successful jobs are those that are set up with as few tiers of vertical hierarchy as possible. The job site conversation will loop around the project. Discussions and directions will emanate from the person in charge of the field. Someone will leave the job office and give a direction, a huddle will occur, and the one in charge of the work will write out his idea on a lunch bag, piece of sheet rock, lumber or some other handy transportable surface that will take a mark.

Someone will round up a truck, crane, dolly, wheel barrow, and so on, and then forage for what is needed, and the work will get done.

Communication at the site is verbal. No matter how complicated or technological the design may be, its installation must be first turned into spoken, instructional words to people who are not paper oriented. The typical mechanic has no time for paper. Many cannot read plans, none can read specifications and all of them regard the man with the necktie from any office with distrust.

However, new information and technology has furnished the participants with their responsibilities and ways to manage problems associated with the construction industry. Checks and balances are carried out to determine merits and demerits of any construction method employed. There is no gain saying that New Information management and Technology are vital in today's operational process of construction management in the Building industry.

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