

**"IMPROVING PRODUCTIVITY IN THE NIGERIAN CONSTRUCTION INDUSTRY
- A MANAGERIAL APPROACH"**

**A THESIS PRESENTED TO THE DEPARTMENT OF BUILDING,
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POINTS TO PONDER OVER

"One thing is certain, ..., in this country, all of us without an exception, are performing below average. Or what else could one say?"

N.A. BAMGBOPA

DAILY TIMES

SEPT. 17, 1981. Pg.17

"... (Perhaps) the management theorist has been wrong in assuming that managers plan, organise and control in a vertically linking way. The fact is that very little of their time is (actually) given to such cerebral activities as planning, organising and controlling..."

J.W. HUNT
ASSOC. PROFESSOR OF MANAGEMENT,
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"THE PLIGHT OF THE MANAGER"
- article in WORK AND PEOPLE,
Vol. 5, No. 1, 1979.
PP.27 - 31

ABOUT THE AUTHOR

Born in March 1959 to a soldier father, Anthony Aboki Okwa can well claim to be a truly National Nigerian. Although he was born in his parents' home town, Otukpo, he spent most of his early years in Lagos where he started school. His studies, and the army's transfers, have taken him to most parts of the country including Kaduna, Zaria and Maiduguri.

As an undergraduate student he carried out an "Analysis of job planning on the Ahmadu Bello University teaching hospital, Shika" as part of his work leading to the degree of Bachelor of Science (Building) which he got in 1979.

Now, at 22, his one big dream is to see management, in Nigeria, carried to the height of professionalism it enjoys in the United States of America. He enjoys books, magazines, journals, music and, as a graduate member of the Nigerian Institute of Management, spends a great deal of his time in the pursuit of knowledge in this, his favourite field.

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A.A. OKWA,

SEPTEMBER, 1981

ABSTRACT

This study, based essentially on the premise that the construction industry retains a great deal of un-released potential in terms of productive capacity, has sought to evaluate the capacity and capability of managers in the industry to release this potential - to improve productivity from within their firms.

The problem of low productivity as experienced in our construction industry has been highlighted by abnormally high costs, delays and general inefficiency. These problems, it is noted, are detrimental to the industrial and technological advancement of the nation because of the pace-setting nature of construction activities - major- infrastructural and physical facilities have to be provided before industrialisation can take off.

The objectives of this study, therefore, have been to evolve practical guidelines to enable managers in the industry to improve productivity from within the spheres of their organisations to the extent that factors within their control can be manipulated in this direction. This is in line with the contention that managers, more than anyone else, have the greatest potential to bring about the much-needed increase in the level of productivity of the construction industry.

The procedure adopted includes an overview of the current level of productivity to identify potential areas for improvement. Management responsibility for productivity improvement is emphasised with support drawn from relevant literature and eventually from construction managers themselves.

In subsequent discussions, it is suggested that management leverage for productivity improvement is undermined by the classical approach to organisation and management. Pointing to the fact that the modern management ideas and techniques discussed and recommended in the second part of the thesis have, most of them, been available for a long time, managers, it is noted, often ignore them, feeling either that they are impracticable, or that they are just common-sense descriptions of what they do instinctively. Thus, this researcher has emerged with the view that managerial response to the problem of low productivity has been far from adequate. This view is supported by the nature of the productivity frustrations suffered and the factors mitigating them.(as identified in the survey, chapter 3*0).

Thus, with the problem recognised and the factors responsible identified, areas requiring management involvement are pin-pointed. These are achieved in the first part of the thesis, THE RESEARCH REPORT. The second part, GUIDELINES FOR MANAGING PRODUCTIVITY IN THE CONSTRUCTION FIRLL, outlines a practical, workable framework

f.r.o

The study also outlines a practical, workable framework
for improving productivity from within the construction
organisation.

Noting the emphasis on management responsibility for productivity improvement, problems are discussed specifically from the management angle under two main classifications, viz;

1. Managing the work force: Improving labour productivity.
2. Managing the work: towards a rationalisation of the work process.

Under these two contexts those factors which management can be held directly responsible for are dealt with. The buck, however, is not stopped there. In order to achieve truly maximum and total productivity, management, it is advocated, should further strive to limit the negative aspects of those factors imposed on the firm from outside. Thus a ^{portion of the thesis} ~~third~~ chapter is devoted to the evolution of a managerial approach to this latter task, dealing separately with each of the external factors that frequently come into play on the construction project.

The thesis is concluded with a reiteration of management responsibility for productivity improvement together with a summary of some of the most prominent factors highlighted in the course of the project. The appendix includes more definitive treatments of two of the most strongly advocated approaches to improving productivity; one for labour productivity and one for rationalisation of the work process. Two more practical ways of stimulating labour productivity that can easily be applied by any construction firm are discussed in a further extension of the appendices.

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CHAPTER 1

1.1 INTRODUCTION

With the advent of politics and the subsequent clamour for a revised national minimum wage, one word seems to have gained prominence as the magical solution to workers' problems. That magical word is "productivity". Hardly a day has passed since the Nigerian Labour Congress, headed by Alhaji Sunmonu demanded the heady ₦300 minimum wage, that reference has not been made to the word in at least one of our dailies. Economists, politicians, labour leaders and managers have been having their say on the subject. Articles and editorials have been written, theories propounded - none coming out with any practical solution to the problem.

The fact that this thesis topic was chosen before the call for improved productivity became a topical issue reiterates the underlying existence of the problem as an important and explosive issue in the minds of many.

The need to improve productivity in organisations today is evident to everyone; national leaders, chief executives, and individual managers alike. Not so evident to many of those who have made the call, apparently, is the fact that "lower productivity is not entirely the fault of organised labour it is not entirely the fault of our patronising interfering government it is not entirely the fault of the shifting

attitudes of the younger generation the real fault lies squarely at the foot of management for not seizing the initiative to take remedial action".⁴

That industrial productivity in Nigeria, as in a host of developing countries (and in fact many developed countries too) is much lower than it could be, is a fact that is glaringly obvious to all economy-conscious persons, institutions and businesses. As indicated earlier, much has been said (but alas little done!) about the problem. It is all very well to talk about improving productivity, advocating for technological transfer and development, provision of capital, etc. But one wonders how effectively available resources are being utilized. Who is responsible for the effective utilization, the management of available, albeit scarce resources. Again, the answer is management. The means by which individual managers can achieve improved productivity, however, are not so obvious. This may be attributable to three basic shortcomings in the approach to the problem.

First (as will be made obvious in Chapter 2 of this thesis), there is a proliferation of topics, techniques and theories on productivity. These range from time management to decision making, from communications to basic supervision, from managing conflict to leadership styles, and so on. All of these topics are important but there is no integrating framework

that relates one topic to the other and to the whole. This makes it difficult for a manager or a student of management to build a logical, integrated body of knowledge and practice. It is hoped that this study will help to deal with that shortcoming by integrating the most important and basic management techniques around a system of "productivity management".

A second problem has been the lack of an applied approach that tells the user how this or that method can be applied on the job. Finally, how does one IMPLEMENT these methods for the actual achievement of improved productivity?

It is the primary objective of this study to find a solution in form of a framework for the practical application of the various methods of productivity improvement available to the manager in the construction industry.

1.2 STATEMENT OF THE PROBLEM

As a developing country, Nigeria is involved in numerous construction projects - Industrialisation, service, institutional, and of course, the new federal capital. These projects necessarily pose a strain on the limited resources available to us as a developing country especially as much of the technology and materials are imported and much of the major work is undertaken by foreign firms, either in the guise of joint ventures,

partnerships, or by direct contracting.

Also, the fact that construction projects in this country tend to cost so much more than similar projects in other countries; some of which cannot boast of being more developed technologically than this country, is a cause for concern.

The role of construction is such that it necessarily sets the pace for development-industries, hospitals, educational institutions, etc. will have to be housed and the green revolution, if it is to succeed, will require the construction of numerous storage facilities to preserve any surplus food we may reap.

The aspirations of our political leaders to achieve so much within the current plan period despite decreasing revenues from oil sales will necessitate massive increase in productivity in all sectors of our economy and most importantly, the construction sector because of its aforementioned pace-setting nature.

This aspiration is not so easy to achieve. For remedial action to be taken to boost productivity, measures are needed to highlight inefficiencies within organisations and their constituent departments. Perhaps this is where much of the problem lies - measurement of productivity is difficult to achieve (and owing to limitation of time and facilities, will not be attempted in this study). Nevertheless, evidence abounds that the level of

productivity in Nigerian industry, particularly in the construction industry, is not as high as it could be. Such evidence also points to the conclusion that there is room for blame across the board. Viewed objectively, the problem of improving productivity is no more the problem of the labourer than the foreman, site supervisor, project manager or even the general manager of the company. According to Richard C. Gerstenberg, a former chairman of General Motors Corporation of America, "better productivity results from better management."²

The question then is, if this is so, why do so many people overlook the leverage potential of management? Is it because the managers themselves overlook it or are they unaware of the techniques and methods at their disposal?

To be able to provide answers to these questions necessitates identifying the factors affecting productivity, examining the state of the art in productivity management in the construction industry in general and with particular reference to Nigeria. This will be followed by a broad assessment of the effect of the different factors identified on the productivity of labour and the other resources under management control (time, money, materials and plant) which go into the construction of a project. Comparison and assessment of these factors as observed in different organisations will be made with a view to combining systematic as well as .

scientific management techniques to evolve guidelines for improving "specific" and "overall" productivity in the construction industry.

1.3 LIMITATIONS

It has been said time and again that to effect a remedy for any problem an assessment of, or measure of the problem and its effect is an important pre-requisite. This condition has been a major setback in efforts to achieve improved productivity. This is because so many interrelated and variable factors affect the end result of the construction process, thus making it difficult to measure.

The problem is even more complicated and divergencies appear when attempt is made to accurately express productivity in quantitative terms. This is even more pronounced in the construction industry which can be described as an intermediate industry because most of its inputs come from other industries, to be put together and processed to give the end-product. Two problems readily spring to mind: The first, a technical one, is with the definition of the heterogeneous nature of the factors and the procedure to be adopted for combining them in one form or another (this is probably why productivity has been defined and viewed in so many ways). Another problem is the interpretation of the results of such measures. It may be assumed that any significant

measure of productivity will introduce all the different factors involved. This, because of the degree of involvement required and the time needed to obtain enough and sufficiently reliable statistical information, cannot be attempted within the three-month period for this project. This work will therefore be limited to an overview of the construction industry based on prior acceptance of the opinion that productivity in the industry is not as high as it could be and that there is room for management to apply its leverage potential. The study will therefore involve mainly identifying and assessing areas of weakness with a view to providing workable suggestions to enable managers make full use of their leverage potential for improving productivity within their firms.

1.4 OBJECTIVES AND SCOPE

The primary purpose of this study is to provide, firstly, a clear understanding of the concept of productivity within the sphere of the construction firm and the factors that influence it. A second objective is to describe new skills and proven strategies that can be used for productivity improvement.

The study will encompass discussion of the several factors that may influence productivity and subsequently the cost of construction projects. This will be followed by a treatise on the role management can play and discussion of some of the many managerial

processes that can be implemented in a number of practical ways within the organisation with particular emphasis on those that have been found to be particularly useful in the construction industry. It is hoped that the study will come up with a practical operating guide for those who wish to introduce productivity improvement within their firms.

As an outline study, this thesis may not be able to encompass all the details which could be obtained from a topic as broad as this; it is hoped that it will, nevertheless, serve as a useful model which may be built upon as groundwork for further research and development.

1.5 NEED FOR THE STUDY

"Productivity," it has been said, "is like the weather; many talk about it but do nothing."³ The truth of this statement has become very obvious from recent commentaries on the Nigerian Labour Congress' demand for ₦300 minimum wage. Blame has been passed from one party to the other, with managers, politicians and economists alike, placing full responsibility for improving productivity on the shoulders of workers, thus lending credence to Gerstenberg's astonishment at how "few even know what productivity is".⁴

The "Daily Times", in an editorial published on Saturday, June 21, 1981, headed "NEED FOR GREATER PRODUCTIVITY", almost hit on the problem with the statement; "those in the management cadre

in all institutions across the nation need to better understand their crucial role in the scheme of things" However, this was foiled by the succeeding paragraph which went on to suggest that, ".... in the final analysis, the challenge is before the Nigerian workers....."

It is this researcher's opinion that far from being a task for workers, the task of improving organisational efficiency belongs to management which is entrusted with the responsibility of marshalling and controlling available resources for efficient provision of the services of the firm.

It must be noted that the construction industry is second only to NEPA and the Nigerian Airways in being criticised for inefficiency. This is probably only due to the fact that the generality of the public is not usually directly affected by its laxity. Nonetheless, the problem is there and has been reflected in complaints from all quarters about the high cost and frequent long delays in construction time. More recently, the problem has been reflected in the government's imposition of "turn-over tax" in a bid to tax the increasing number of construction firms which have consistently been declaring little or no taxable profit inspite of what the government and most people believe to be highly inflated contract prices.

From these clamourings, three points clearly emerge which emphasise the need to increase productivity in the construction industry. These are the need to reduce costs; to reduce construction

time in line with the government's determination to execute large number of housing and other construction projects in the nearest future; and, finally, to be able to meet increasing demands for higher wages. This is because:

The very high cost of construction is not a price Nigeria can afford to continue paying - we are fast running out of the oil money which hitherto was used to finance numerous 'white elephant' projects. The urgent need to replace the oil industry with other industries, house our teeming population, and construct the new federal capital, will have to be met with the now limited resources available.

Henceforth, managers in the construction industry will, in the face of growing competition and public awareness of the need for economic austerity, have to lower prices in order to survive. Then of course, the dynamism which the still fledgling civilian administration wishes to portray will have to be reflected in the performance of construction firms who will be responsible for turning out the projects which the politicians promise the voters. The goods will have to be delivered - on time!

The other point of concern is the increasing demand for higher wages at all levels and in all sectors of the economy which, if it succeeds, will hit the largely labour intensive construction sector really hard. In fact the furore generated by the recent #100.00

minimum wage legislation and the construction industry's inability or unwillingness to pay had hardly left us before demands for ₦200, ₦300, etc. surfaced with some temerity. With the presence of politicians and growing labour union strength, it is not unlikely that such issues will continue to crop up and managements may well have to face them.

For all these demands to be met, and for the construction firm to survive (and grow), urgent management action in the form of better cost control and improved productivity will be needed.

Perhaps it will not be an understatement to say that the economic independence and rapid development of our country demands urgent improvement of productivity while maintaining a harmonious atmosphere. This study seeks to help the construction manager to steer his firm towards meeting this demand.

1.6 METHOD

A three pronged approach will be adopted to facilitate and ensure exhaustive identification of the factors affecting productivity in the construction industry. This will involve enquiring from contractors and their agents by means of interviews/discussions and questionnaires to identify their problem areas and find how they are tackling these problems. This will be supplemented by a survey of readily available current periodical literature and texts in order

to determine what is current practice in the handling of productivity problems. Information thus obtained will be collated and analysed to evolve guidelines for improving productivity in the construction industry from within the construction firm.

Classical management philosophy, principles and techniques will be used in an attempt to apply the logic of effective thinking to the solution of productivity problems identified in the course of this study as well as to provide guidelines to facilitate the solution of problems that are likely to be encountered during the course of a construction project.

FOOTNOTES

1. J.E. ROSS, "MANAGING PRODUCTIVITY", 1977
RESTON PUBLISHING COMPANY pp. 2-7
2. *ibid*
3. *ibid*
4. *ibid*

CHAPTER 2

PRODUCTIVITY IN THE CONSTRUCTION INDUSTRY

A REVIEW OF THE LITERATURE

2.1 INTRODUCTION

As indicated in the previous chapter, productivity has been a very topical issue. So many people have involved themselves in talking about the problem and need for improved productivity. Higher productivity has been hailed as the solution to the problem of workers, employers, and the government alike. It has nevertheless remained a very elusive and undefined "goal" - if it may be called that.

A cursory glance through available literature reveals that no target has been set, no productivity scale devised, by which organisations or nations can measure their progress (or otherwise) on the path of productivity. This is because productivity measurement, in fact the very concept itself, seems to have been a subject of much deliberation and upon which no definition has been arrived that is acceptable to or can be applied by all.

The fact that even the more advanced nations are as much in the higher productivity quest as the "developing" ones has also meant that the latter are made even less sure of themselves and have largely had to rely on the former for direction. This will no doubt

have led to a lot of misdirected effort on the part of these countries which operate under quite different conditions.

With no generally accepted and workable definition of productivity and its measures, the factors affecting it and the extent of their effect are inevitably a point for further disagreement. Opinions vary so widely that one would be bewildered in trying to choose a suitable path to take towards higher productivity. The questions remain; which way, how far, and by what means?

That productivity is affected by many different factors is generally admitted. The bone of contention is not so much the factors involved but the extent of their influence on overall productivity. A review of the available literature on productivity will reveal that the factors generally accepted as determinants of the overall productivity of an organisation are:

1. The industry (its nature and stage of modernisation)
2. Technology
3. Labour
4. Government
5. Management

This list is by no means exhaustive nor is it ordered to reflect the magnitude with which each factor influences the productivity of the organisation. Other factors emerge which seem to influence productivity to various extents but the ones listed above seem to

maintain the "batting average". The extent to which each of these factors have been played will be examined here in order to identify the factor(s) which seem to have the most significant effect on the relative productivity of any construction firm. However, before this can be done, a note on the concept of productivity is necessary to gain an insight into the nature of the subject.

2.2.0 THE CONCEPT OF PRODUCTIVITY*

The basic concept of productivity has been defined as "the degree to which the power to make or provide goods or services having exchange value is utilised as measured by the output from the resources expended"¹.

It is often presented as the deceptively simple ratio:

$$\text{Productivity} = \frac{\text{output}}{\text{input}}$$

It "thus expresses, in a rather convenient manner, the increases or decreases in output from one period to the next which result from the utilisation of more or less or varying proportions of the factors of production"².

One must be careful to distinguish between the two general types of productivity measures, total and partial:

* Culled from "A conceptual framework for Understanding productivity"
- E.E. BURCH Jr. INDUSTRIAL MANAGEMENT Vol. 21 #3, May - June
1979. pp. 1-5.

$$\text{Total productivity} = \frac{\text{Total output}}{\text{Total input}}$$

$$\text{Partial productivity} = \frac{\text{Total output}}{\text{Partial input}}$$

Total input includes all factors of production, i.e., capital labour and raw material. A partial measure of input includes any single factor of production or an incomplete combination of factors.

Generally measures of total productivity are preferable to partial measures since they relate all factors of production to final output rather than focussing on a single factor of production. Increased productivity reflects the joint effect of changes in labour skills and quality, changes in technology, capital, stock, scale of production, management skills, and other factors whose contributions cannot be ascertained separately.

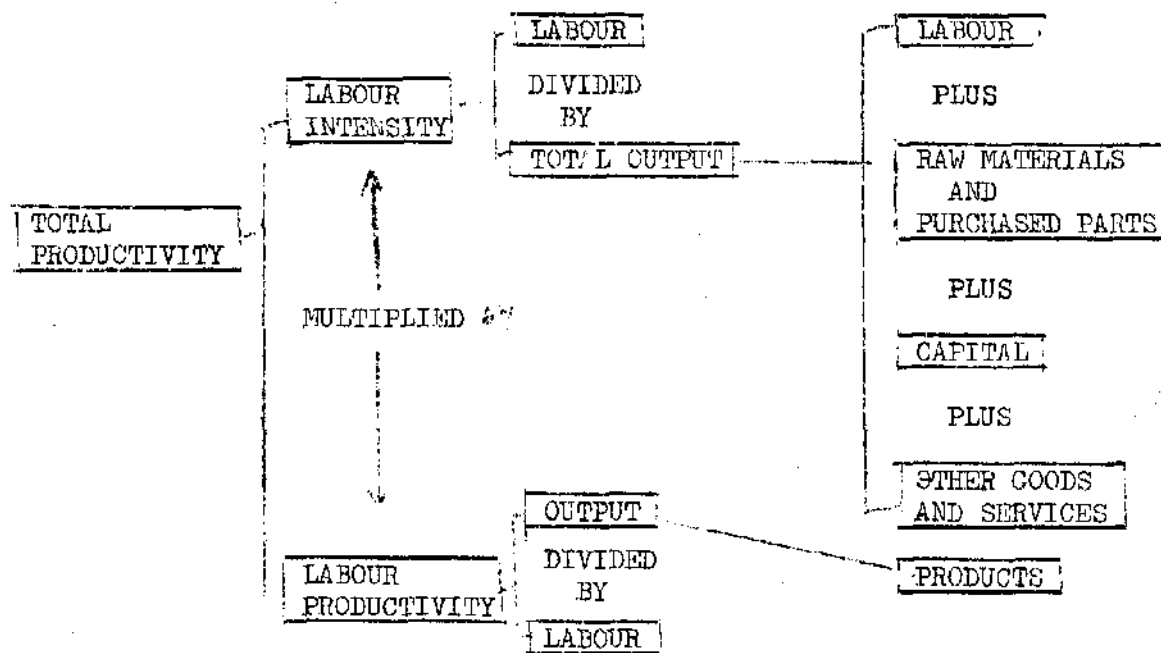


FIGURE 2.1 RELATIONSHIP OF FACTORS AFFECTING TOTAL PRODUCTIVITY

Although changes in partial productivity ratios are affected by factor substitutions reflected in changing input combinations, as well as productive efficiency generally, they are often used primarily due to lack of incompleteness of data for each of the other factors of production. In fact the term "productivity" is often used when it is actually "labour productivity" which is being assessed. Labour productivity is generally found by dividing total final output by the number of man-hours expended in the production of the output. This practice tends to increase the confusion surrounding productivity measurement and the interpretation of productivity indices.

Craig and Harris³ present a simple example that demonstrates just how misleading this can be:

Assume a company procures a higher quality of raw material that significantly reduces the man-hours necessary for processing. The output per man-hour index would naturally rise since a worker can now produce more of the same product in less time. However, suppose the improved raw material is more costly. To simplify the example, assume that the increase in material cost is equal to the savings from reduced processing man-hours. Using the labour productivity index as a guide, labour and stockholders would note an increase in productivity. Either group could take action to distribute this gain. Labour could bargain for increased wages, and stockholders could

bargain for increased dividends or at least a growth in profits. Customers might expect a price reduction. However, there has been no real gain to the company. The apparent increase in labour productivity has already been distributed to the raw material suppliers; there is nothing available for distribution to labour, stockholders or customers. Gains indicated by increased labour productivity may not actually be gains at all. The cost of generating the increased labour productivity must be considered.

This emphasises the point that whatever measures of productivity one chooses to use, expressing productivity as a simple ratio can be misleading. Care must be taken when using a productivity measurement, to analyse the underlying causes for the particular ratio determined. Thus it is clear that merely isolating any of the factors is not enough; each one must be carefully weighed in its own merit.

Thus far, the question of which of the factors warrants the greatest attention remains unanswered. A look at these factors and their adjudication in the literature will now follow to enable one decide upon this major factor.

2.3 FACTORS AFFECTING PRODUCTIVITY IN THE CONSTRUCTION INDUSTRY

- WHAT MAKES THE ELEPHANT MOVE

Paul Mali, in his book - IMPROVING TOTAL PRODUCTIVITY,⁴ relates a well-known folk story. In the story, each of three blind

men were asked to find out what an elephant was like. Because each man felt and analysed a different part of the huge and complex body, a heated argument developed among them. One had his hands on the tail and claimed the elephant was like a rope. Another had his hands on the body and argued that the animal was like a large, soft and flabby mass. The third had his hands on the legs, leading him to claim it was like the trunk of a tree. Each man was sampling one aspect of the totality, and each failed to grasp the totality in spite of his correct description of his individual sample. Asked to find out what makes the elephant move, another heated argument developed. The one who had his hands on the tail pulled it. The big elephant moved from side to side. The other one, who had his hands on the body pinched it and the big, large, soft wall moved away. The third who had his hands on a leg stepped on it, causing the the big leg to move up and away. Each caused the part they had hold of to move, and thought that that was the way to make the entire elephant move.

Let's portrays the complex processes of an organisation as the "elephant". Getting the elephant to move is analogous to improving productivity in organisations. Many managers have their own views of the factors affecting productivity and, because of the nature of the subject, whatever the view, one can probably find support for one's conclusion - like the blind men in our story. And although

any one of the factors mentioned in section one could be manipulated but to obtain a positive increase in productivity, what is called for is a move, real progress towards achieving total productivity in the organisation.

The low position of the construction industry in the productivity line up vis-a-vis other product oriented industries is obvious. Many solutions to this problem have been attempted, ranging from prefabrication to rationalisation or industrialisation in all its ramifications. These have met with varying degrees of success (and failure). There remains a need to find a way to "make the whole elephant move". This necessitates a review of the factors identified earlier in order to evaluate them for their effect on the overall or total productivity of the organisation. Here we must remember that what we wish to come up with is essentially an expansion of the awareness and understanding of the subject in a way that will give it prominence in the wide spectrum of concerns in management. In this, we shall not dwell on rhetoric but rather on the factors as they affect the performance of the firm. This is essential if we are to try and improve the industry from within the firm. This does not mean that we should refuse to recognise constraints imposed on the industry as they would definitely influence the behaviour of the firm. What we should avoid is wishful thinking and any attempt to look for excuses.

2.3.1 NATURE OF THE INDUSTRY

The complex nature and composition of the construction industry is recognised as a major deterrent of productivity in the industry. One of the problems the industry suffers from is the separation of the design and construction processes. No other industry suffers so much from this problem. This is because the design of a building, say, largely determines the nature and sequence of operations. These in turn determine the methods which can be adopted in carrying out the operations and subsequently, the manner in which the building resources can be deployed. It is obvious therefore, that there is a significant relationship between the design of the building and the use of building resources. The possibility of rational and economic use of these resources is therefore latent in the design and the implications of every design decision need to be evaluated at the design stage if one is to ensure rational utilisation of the resources at the construction stage. This need is not reflected in the present fragmentary composition of the industry.

A second problem is recognised by Donald Bishop,⁵ a quantity surveyor and civil engineer, who notes that the construction industry exercises much less control over its market than, say, the manufacturing industries. Firms in the industry are compelled to manage their affairs within an atmosphere of uncertainty and have to be

able to do this without incurring the cost of low utilisation of resources.

The result of these, invariably, is a lack of forward commitment and an ever present threat ^{that} resources will have to be redeployed if completion of current projects is frustrated. These in turn depress utilisation of resources, especially those committed to fixed ends. In order to minimise or escape the consequences of low utilisation, the industry has evolved a fragmented structure by specialising by tasks rather than project types because this leads to greater continuity of work.

The uncertainty further drives firms to seek to obtain more work than would be required if the timing envisaged in programmes of design and construction were realised. Thus one is confronted with a vicious circle whose consequence is that the design and construction process proceeds more - much more - slowly than justified by the amount of work to be completed in the time allowed, each organisation having a stockpile of work to be drawn on when projects are delayed. This has been a successful tactic for coping with variability, especially as the industry's clients have become conditioned to relatively slow progress. Its effect on productivity in the industry, however is questionable considering the fact that too slow a pace invariably results in higher construction costs or, lower productivity.

Bishop emphasises that these responses to uncertainty have the undesirable effect of reinforcing the uncertainty from which management seeks to escape. This, he says, is because sub-contracting, and the lack of commitment of resources to specific ends, makes it difficult for any organisation to exercise effective control over progress and hence over the commitment of resources.

With the interwoven composition of the construction team seeming to encourage the strategy of transferring non-productive time from one member to the other in the construction process, the existence of a stockpile of work makes it attractive for all organisations to "hold back", so that activities are commenced at their latest rather than their earliest start time, so that others would have completed their tasks and removed obstacles to completion. This has the effect of transferring the variability of all activities to the project and not merely those activities on the critical path.* This lack of control and enhanced variability combine to reinforce the uncertainty of the market, further reducing utilisation, and frustrate the industry. Bishop recommends conscientious pursuit of a policy that will lead to better control of the timing of events so that resources may be committed with confidence. But for

* The critical path is the path through a network programme which governs project duration.

effective control to be obtained, accurate planning is vital to ensure that deviations can be suitably resolved while maintaining control over original objectives - this, of course is a task for management. The industry cannot "heal" itself.

2.3.2 THE LABOUR FACTOR

Construction, even in more advanced countries than Nigeria, remains largely a labour intensive industry. An estimated 40% of all construction cost is incurred on labour. Of this, it is estimated that about 15% - 20% (or about 6% - 8% overall) is a waste cost of unnecessary or unperformed labour. On a basis of a ₦2 billion annual volume, that puts the tab at ₦120m - ₦160m a year. It is obvious therefore that the effect of labour utilisation on the productivity of the industry is very substantial. Labour therefore appears to be one of our biggest untapped resources.

There are a lot of conflicting opinions about the role of the workforce in the productivity improvement process. Joel Ross,⁶ a professor of management, who is also a prominent writer on the subject, says that many executives feel that militant labour unions restrict improvements in productivity. In this, BUSINESS WEEK⁷ seems to agree with him. The journal accuses the construction industry of having "the worst reputation for cost-inflating work rules and practices", citing a list of abuses such as deciding what

trade does what work, what tools can be used, how much work a man can perform, when overtime must be paid. More specific and particularly costly examples include the limiting of paint brush width - and the ban on paint rollers - unless there is premium pay. Masons set a limit on how many blocks a man can lay in a day. All these, according to Robert E. Nielsen, chairman of a contractors' association in Chicago, amount to "feather bedding" and "a curtailment of management's right to carry out construction in the most efficient manner possible."

Ross points out the fact that some managers blame politicians for stirring the feeling of workers on "egalitarianism" and "the nation owes me a share of its (oil) wealth" attitude of workers. These reports, coming from America which is generally recognised as one of the most productive countries in the world, reflect quite accurately the same gloomy picture that obtains in the Nigerian industry today.

Since the advent of politics, the country has been faced with series of demands for higher and higher minimum wages. The construction industry has been one of the hardest hit by the inability to pay the one hundred naira minimum wage imposed by the Shagari administration, which led to a spate of strikes on sites all over the country. The extent of this attitude was revealed by E.T. EFEVWIE,⁸ deputy general secretary of the Nigerian Union of

Construction and Engineering Workers, who accused Nigerian contractors of "enriching themselves at the expense of the workers". He also made note of the fact that the construction industry recorded the highest number of strikes in 1980 with an average of 3 strikes a month in which a loss of 74,484 man days was incurred.

The question now is - just who is to blame for this appalling and highly unwelcome reduction of workers' productive capacity? The labour unions, for encouraging workers to strive and agitate for better conditions? Or is it the government, for its interference and its patronising attitude to workers' demands? Or management, for not evolving and implementing programmes to improve productivity?

Happily, there is a growing awareness among union leaders of the need to rethink traditional ideas about productivity and job security. Many union leaders are prepared to bargain and take part in productivity improvement plans if these can be shown to be beneficial to them either in terms of better conditions, or enhanced security. It now falls on management, therefore, to find ways of "selling" productivity to labour.

Early advocates of "Scientific Management" such as Taylor and Gilbreth felt that managers hold the responsibility of employing, training and equipping men for the job so that they can do it in the best way possible. According to Taylor labourers, skilled or unskilled, are incapable of and unsuited to the task of finding and

improving on methods of doing work. Neither are they self-motivators. He held the belief that the worker who discovers a better way of doing his work would probably hide it from others so that he can use it only for his own betterment. Widespread use of improved methods demands management intervention.

Management should be active in seeking out the best methods of work, selecting people who are capable of learning these and teaching them these methods so that the worker can benefit from increased earnings (as a result of his newly acquired ability) and the organisation itself can benefit from the increased profits that it would get as a result of the workers' improved productivity. To quote the slogan of Texaco (Nigeria) Limited, "You cannot blame them if you do not train them". The onus is on management to improve on labour productivity.

2.3.3 THE ROLE OF TECHNOLOGY

The global search for productivity improvement has led to the development of new products, methods and plant to aid industries in advanced countries to improve their output. Nigeria, probably because of its oil money, has not been too slow to adopt some of these by means of the belaboured "transfer of technology". Unfortunately, effectiveness of this solution in the Nigerian context has not been as high as one would have wished.

The nation has been accused by well-meaning analysts of blindly adopting methods and equipments whose use under our present conditions is highly questionable. It has been suggested that our decision makers - managers - whose task it is to select equipment and decide on production methods do not bother to study and understand the equipment they intend to buy. Clement C. Onyemelukwe, a former assistant general manager of the National Electric Power Authority, says that those who acquire these plants and equipment "have very little knowledge of the working of the machines they intend to purchase".⁹ Others accuse them of being helped towards their decision with a little "kola". This sparse knowledge of the machines extended to the operatives and other construction workers thus telling badly on their productivity.

Another problem is that most of these machines are designed abroad with the disposition of the manufacturing country's worker in mind. The local worker, unfortunately, is expected to adapt to these imported machines which were originally designed to suit people whose physiological and mental characteristics are, to say the least, different. Thus one finds that most of these mechanical plants are operated by expatriates recruited specially. The usual "technology transfer" package is that these expatriates come here, install the machine, teach an indigene how to operate it, and

leaves with a fat wallet. About all the new operator learns, however, is how to start and stop the machine. He does not know how it works or what to do if it fails to work. Thus, in a couple of months, the machine is reduced to scrap and has to be written off. The resulting low utilisation coupled with the high capital cost (and loss of foreign exchange), according to Onyemelukwe, "puts the capital-output level of most firms at a low level". He suggests that many firms here make profit only because they are hiding behind tariff wall. It is this researchers' contention that a lot of firms invest in plant simply to convey the impression that they are "major contractors", this erroneous impression being buttressed by the authorities whose criteria for registration of contractors in the highest categories include the number and kind of equipment the aspiring contractor owns.

In his book (Men and Management in contemporary Africa), Onyemelukwe cites the case of a manufacturer whose entire handling and processing system was mechanised. Only when this system broke down was management forced to train labourers to do the job and then it dawned on the firm that manual handling was actually more economical. In another instance, management complained about inefficiency of their workers and maintained that low output of the plant was due to this factor. Upon investigation, it was discovered that the plant was sold to the firm from abroad on the basis of a given output at

certain conditions of temperature obtainable in Europe. This plant could not normally produce more than 75% of this capacity under the temperature obtaining here. This severe loss in output, coupled by an investment which was already twice what was reasonable, clearly meant that the business was from the start a low productivity venture.

Onyemelukwe suggests certain areas of action which have to be taken before the blame for inefficiency and low productivity can be put on the African worker. The first of these is the choice of production methods which would take the local worker into consideration. This is as opposed to the current practice of choosing the methods first and expecting the worker to adapt to them. Here he suggests that the central emphasis in choosing production methods should be on work simplification by organising work to eliminate unnecessary built-in complications.

Managers have to realise that unlike the United States, say, the most considerable part of the cost of production is capital which is largely expended in importing machinery from abroad. Yet because of ineffective utilisation and poor motivation of the Nigerian worker, managers (many of whom are supposed to be experts in the profession) boldly claim that labour is more costly because of its low productivity. This sad fact was brought to light in the wake of the recent minimum wage debate when many managers threatened that they would be forced to counter any increase in wages by retrenching workers and

substituting with machines.

While it may be admitted that for the construction industry the appropriate use of the new technology may result in quicker completion of projects, it must be realised that unless these new projects are cheaper or at least no more expensive than buildings constructed in the traditional way, the productivity goal remains as elusive as ever. Generally the marginal utilisation of plant and industrialised building systems has meant that projects constructed in this way tend to be even more expensive than traditionally constructed projects. Bishop suggests that low utilisation has probably been the death knell of many of the more industrialised building systems in Europe. It is not unlikely that having goofed with these systems, the "advanced" countries are desperately trying to underwrite their costs by selling them to us as the solution to our desire for "technological advancement".

Bishop reiterates the fact that any organisation, in order to make the best of its circumstances must plan its operations in such a way that the resources it employs are utilised to the maximum. Thus even if mechanisation were to be efficient (and this has not been known to be the case in Nigeria) it cannot be economic unless employed sufficiently to generate an adequate income. "Low utilisation", says Bishop, "is the bogey of mechanisation, of

industrialisation, of commitment of resources to fixed ends".

Jack Foster,¹⁰ argues that industrialisation is not necessarily concomitant with highly capital-intensive, factory-type production (often going together with other technological problems such as transport, co-ordination of components and erection on site). He points out that industrialisation can just as well be applied with more or less equal success to both traditional and "industrialised" methods to introduce the characteristics of the more highly productive mechanised manufacturing industries. These characteristics he lists as:

1. Continuous "flow-line" production;
2. Standardised production;
3. planned production;
4. mechanised production.

The first of these is aimed at speeding up construction and reducing labour requirements, the second to reduce costs and facilitate continuous production and a properly integrated system of design, fabrication and assembly to speed up the whole building process to enable the designer to make improvements leading to reduced costs and higher productivity. Triebel¹¹ emphasises that in the rationalisation of building, "it does not matter whether the buildings are constructed in accordance with revised traditional processes or according to new processes. The results are similar".

The United Nations Conference on HOUSING IN AFRICA¹² held in 1965, noted that "..... in a century where technical progress creates more needs than it does resources, while it is necessary or even indispensable to invest and innovate, it is still more essential not only to halt, but to eliminate the great waste of time, energy, money and human strength that results from poorly planned operations, badly organised work, badly run work sites and a poorly utilised labour force". The conference also noted that abundant unskilled labour in developing countries can be utilised through work simplification and training and mentioned a number of advantages that would be gained thus.

Ross, in his book MANAGING PRODUCTIVITY, mentions the results of a survey conducted by the American Management Association. In the survey, out of 6,000 managers, only twenty seven percent ranked capital investment as very important and only thirty five percent ranked technology as very important. The overwhelming choice for IMPROVED PRODUCTIVITY was BETTER MANAGEMENT".

Onyemelukwe sounds off with the observation that it has not always seemed that "sufficiently serious thought was given before businesses spent money on machinery in an area where labour with appropriate incentives could be cheaper".

2.3.4 WORK ORGANISATION (PLANNING)

As Nigeria attempts to move rapidly along the path of development, construction projects become larger and more complex. Productivity lowers as work becomes more complex. This results from diffused and unco-ordinated work procedures. Efficient organisation and planning of the work process become more and more important with increasing project size and complexity.

However this "fact seems to have been lost on many in the industry and this has led to a situation where the industry is well known as one in which time is often misappropriated due to lack of efficient planning and foresight.¹³"

Onyemelukwe asserts that when work is not planned, difficulties are accentuated because the worker is faced with many issues on which he is expected to take decisions which may be wrong. As Roman philosopher Seneca put it, "when a man does not know what harbour he is heading for, no wind is the right one". Thus, while a few people make port by accepting any wind that blows, this is attributable to good luck rather than good management. However, barriers to organisation and planning seem numerous. The reasons why managers resist planning include the time, thought, paperwork, procedures and commitments it entails. To many, planning seems so time-consuming that they would rather forget it and get on with the "real work". Thus ironically, dealing with today's problems often

takes priority over planning for the future, thus making certain there will be problems to tackle tomorrow. Although lack of time is claimed, it should be remembered that planning involves "taking time to save time". Management responsibility in this regard cannot be compromised if higher productivity is the goal.

2.4.0 EXTERNAL FACTORS

As indicated earlier, the construction industry exercises only very little control over its market when compared to most manufacturing industries. From the point of view of a main contractor, many external problems can be pinpointed, ranging from the clients' relative ignorance of the nature and processes of the industry and its products, to governmental regulation of the industry. Other problems arise from the fragmentation of the industry and the attendant problems of co-ordinating and controlling independent members of a "team" each of which, as well as working towards construction of a project, have varied interests to protect; labour unions often controlled at a central level remote to the organisation and; the least controllable factor of all, nature - to which the construction site is wide open. All of these factors affect productivity in one way or the other to a considerable extent and while management cannot regulate them directly, it may be realised that some measures of control can be effected if more interest can

be taken to examine their influence. These factors are described below:

2.4.1 CLIENT INFLUENCE

As mentioned above, the client himself often has very little knowledge of the products and processes of the industry. In many cases, he does not even know what he wants. To bring his objectives through, therefore, the client normally works through an architect/engineer who designs and helps to supervise the contract as well as representing the client in negotiations pertaining to the job. The relationship between the client and the architect is therefore of paramount importance to the success of the project. Where a representative of the architect is on site, he will be responsible for ensuring that the work is being done correctly and to notify the contractor if it is not. He is also responsible for interpreting plans and specifications as necessary.

Secondly, because of the limitations of the client himself, he might change his mind about some parts of the work after commencement of the contract, or the architect too might decide on something else. It is often the case, therefore, that as construction proceeds there will be variations in the scope of the job. Some of the reasons for such variations may be:

1. Differences in existing conditions of the site;
2. Changes in owner's requirements;
3. Changes due to co-ordination problems
4. Changes due to unavailability of certain materials or equipment;
5. Mistakes.

These changes buttress the general uncertainty surrounding the project and will invariably affect the programme and planned progress of the work and sometimes lead to frustration or dispute, under which productivity is bound to be less than maximum. Although the contractor can sometimes make claim against such change orders, it is in his own interest to attempt to minimise their disruptive effect through improved relationships with the architect engineer as well as using his experience and planned judgement to anticipate likely conflict or change problems.

2.1.2 SUB-CONTRACTORS

Sub-contracting, evolved as a means of promoting the positive values of specialisation in an increasingly complex industry, unfortunately creates co-ordination and control problems as well as generating further uncertainty because of the number of separate and independent organisations. This is because sub-contracting makes it difficult for the organisation to exercise effective control over progress and hence over the commitment of resources.

Construction involves the co-operation of main and sub-contractors but because many of the latter are nominated by the client, are likely to look to the client rather than the main contractor for future work. This invariably reduces the contractor's ability to manage work on site.

Often, while the main contractor tries to press the sub-contractors to come into the project as early as possible, the sub-contractor finds it attractive to hold back as long as possible. Lack of direct control over the sub-contractor therefore creates reduced effectiveness and efficiency in the project.

2.4.3 SUPPLIERS

Few materials suppliers can be said to provide a reliable source of supplies for the construction project. Their problems are compounded by governmental control, transport problems, etc. Admissibly suppliers would not wish to be a source of frustration to contractors since individual suppliers rarely control the market - their efficiency determines the likelihood of repeat business. However, it is essential that contractors recognise their problems and act positively in ways that would benefit both parties while ensuring that their own interests are fully protected. Only the contracting firm can decide whether it is paying the most favourable prices and obtaining the best services possible. A contractor for instance, who does not seek quotations from other suppliers should

not complain of being cheated since it cannot decide the supplier's pricing policy, neither is he compelled to buy them from this supplier. He also retains responsibility for taking advantage where possible, of trade discounts, asking for quantity discounts (where not offered) and generally getting the best terms possible.

Good relations between the contractor and his suppliers are also called for if a good working relationship is to be maintained. The contractor's management staff, more than any other persons, can help to ensure this. The importance of the supply process is paramount as apart from the high percentage which material costs make up, the project cannot even begin to be constructed if materials are not available.

2.4.4 GOVERNMENT INFLUENCE

The government has a crucial role not only in determining supply and demand for construction services but also because of the effect of its regulations on the industry. In the first instance it is important to note that over 90 percent of civil engineering and 50 percent of building construction work is carried out by the government. Because of this dependence on the government it has often been suggested that the economic "pulse" of the nation can be measured by the amount of construction work going on.

Furthermore, the economic measures adopted by government

influences the direction of private investment in construction. Over the years, government need to restrain or stimulate the economy has resulted in a "push-pull" effect and subsequent inefficient deployment of resources. Nasir Ahmed El-Rufai¹⁴ notes that the introduction of "austerity measures" of the Obasanjo administration such as the banning of the importation of some "key" construction materials resulted in sudden price hikes which could not be foreseen by contractors at the tender stage. Without a provision for such variations in most government contract forms, such changes create problems for the contractor. In addition to these, governmental restriction or imposition of interest rates and taxation can adversely influence the overall productivity of the construction firm.

A number of suggestions have been made as to the best way of countering or minimising the influence of negative aspects of government on contractors and other business organisations. While admitting that government and its regulations are an important aspect of our lives, managers (like everyone else) have to attempt to exercise some influence or control on these. In fact so much concern has been shown about this factor that a comprehensive review of the literature would be difficult within the space available here. Incidentally, either by coincidence or as an indication of the awareness of this point, I have right here now

as I am writing this bit, a feature article in this morning's DAILY TIMES discussing the subject. The author of the article, Joseph Omorotionmwana,¹⁵ emphasises the need for businessmen's interest and participation in government either directly or indirectly in order to cultivate the best conditions for their survival.

2.4.5 LABOUR UNIONS

The construction industry, like almost every other industry or profession, tends to create a sort of fraternity in which members or associates co-operate for everyone's gain. The construction industry however, seems to go further; people in the industry not only help others in the same company, they try to help all construction people. This is probably because the helper (in an industry of uncertainty) would like to be able to count on help at a later date from someone else or from the person he helped¹⁶. This is probably the reason for the strength and bullishness of labour unions in the industry. These labour unions extend beyond the confines of the firm, and a firm can sometimes be faced with sympathy action which it can do nothing about.

Some of the problems that are caused by Union bullishness have already been outlined in section 2.3.2. and the potential management has to reduce the effect of labour union problems indicated. Firms

do not have to submit meekly to labour "agression".

2.4.6 THE OPEN FACTORY - CLIMATIC FACTORS

The construction industry is an out-door industry and is exposed to all the elements to various degrees of fury depending mainly on the geographical location of the project. "Acts of God" can destabilise a firm's productive capacity and most of these cannot be covered by any insurance policy. While most of these natural events cannot be curtailed, the contractor should be able to work under the normal vagaries of weather - heat, cold, rain or drought.

He cannot prevent these elements from taking their course but he has (or should have) enough knowledge about them to minimise their disruptive effects on his operations.

2.5.0 THE MANAGEMENT LEVERAGE

During the course of the foregoing discussions we have tried to pinpoint or at least suggest management prerogative to "take charge" and steer the firm in the course towards higher productivity. Thus despite the tendency to blame other factors (or are they just lame excuses?) and the popular belief that the biggest roadblock to productivity is people (particularly labour), the evidence seems to indicate otherwise.

While the improvements resulting from better management are not easy to identify or quantify its multiplying effect must not be overlooked. Failure to apply good management can result in disaster¹⁷.

To quote John Patton, a management consultant who has been studying the subject for thirty years, "declining productivity is not entirely the fault of organised labour or our patronising, interfering government or the shifting attitudes of our generation the real fault lies squarely at the feet of management for not siezing the initiative to take remedial action". At this juncture, one would like to take the reader back to the arguments propounded in Chapter One.

Ross calls for planned, organised and controlled management of input resources. While noting the existence of paradox among managers, he reiterates that there is a growing consensus that the most important factors in improving productivity depend on management. He emphasises management responsibility for developing and disseminating a strategy that will guide each member of the organisation in a unified sense of direction. Managers and supervisors, he says, need to stop thinking in terms of performing activities and think instead in terms of results, of motivating sub-ordinates and managing the work process.

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CHAPTER 3.0

PRODUCTIVITY ON THE CONSTRUCTION INDUSTRY

- VIEW FROM THE INSIDE

The previous chapter has dwelt largely on the subject of productivity from the largely theoretical viewpoint of scholarly texts and periodicals. There still remains an underlying need to "hear (the story) from the horse's mouth" if a meaningful treatment of the subject is to be achieved. This need is further enhanced when one considers the fact that much of the literature available on the subject is foreign to us and the conditions which they describe may well be different from those obtaining here.

It is for these reasons that a survey was conducted to enable an "inside view" to be obtained, of productivity in the construction industry. This was done by means of a questionnaire designed to bring out the views of the people in charge of construction work around some of the many different construction sites in the country.

3.1.1 THE QUESTIONNAIRE

The questionnaire was designed to be as simple as possible, taking cognisance of the varied literary backgrounds of the prospective respondents. It was also necessary to minimise the time required to respond to the questions in view of the effect this would have on the response rate. Because of these considerations, it was

rather compromissory and perhaps, some may argue, too simplistic for a subject as complex as productivity. In spite of this, however, quite a few respondents suggested that some of the questions were "difficult". However, by and large, it will be agreed that it could not have been otherwise if meaningful responses were to be obtained. Fortunately, not too many of the questionnaires returned were unuseful and it was interesting to note that those who suggested that the questionnaires were difficult were the ones who seemed to really grasp the issues at stake. One is inclined to believe that what they really meant was that the subject was being too loosely treated in the questionnaire. Fortunately, though, this problem was taken care of in a section which called for far-reaching comments from the respondents. Also, in most cases, since the questionnaires were administered personally, one was able to discuss issues arising from the questions asked. By this means, a lot of useful information was garnered that proffered a greater insight into the subject than would otherwise have been possible.

3.1.2 THE SURVEY

Because it was necessary to restrict the interviews to only those site agents deemed capable of providing meaningful responses to the questions asked, not too many questionnaires were administered. Nevertheless, every effort was made to ensure that responses were

obtained from many parts of the country and a good geographical coverage can be claimed. However the nature of the responses received did not indicate a need for geographical classification.

3.1.3 SIZE OF FIRMS COVERED

For the same reason indicated above, responses appear to have (not deliberately) come mainly from the bigger firms, or at least some of the bigger projects, since only these had the right calibre of site agents one felt could respond meaningfully. Thus most of the respondents were working on projects worth over £5 million. A handful of the respondents (five out of the 36) who were in the £3 - 5 million class were working on housing projects at the new federal capital.

3.1.4 THE RESPONDENTS

Below is a breakdown of the respondents according to their qualifications and experience (Tables I and II respectively).

QUALIFICATION	NO. OF RESPONDENTS	PERCENTAGE
O.N.D.	3	8.33
H.N.D.	12	33.33
B.Sc.	7	19.44
A.I.Q.S.	3	8.33
OTHER*	6	16.67
M.Sc.	4	11.11
Ph.D.	<u>1</u>	<u>2.78</u>
	36	99.99

* Professional qualifications

TABLE I

TABLE II BREAKDOWN OF RESPONDENTS ACCORDING TO YEARS OF EXPERIENCE IN CONSTRUCTION

EXPERIENCE	NO. OF RESPONDENTS	PERCENTAGE
3	8	22.22
4-7	17	47.22
8-10	5	13.88
over 10	<u>6</u>	<u>16.67</u>
	36	99.99

3.2.0 PRODUCTIVITY ON THE CONSTRUCTION SITE

- A SELF APPRAISAL

Earlier, the reader has been acquainted with the notion that the concept of productivity is such that many different views and measures can be embraced convincingly. It is because of this and the fact that this study cannot even claim to possess the facilities to resolve the issues involved, that the task of appraising their own level of productivity was left to the respondents of the questionnaire.

Two questions were asked in this regard. One to determine the number of respondents that felt satisfied with the level of productivity in their firms; the other to determine those that felt there was room for improvement. The results obtained are shown in table III. It may be interesting to note that while only 33% of the respondents expressed dissatisfaction with the level of productivity in their firms, fully 100% of them agreed that there is room for improvement.

RESPONSE	NO. OF RESPONDENTS	PERCENTAGE
SATISFACTORY	24	66.67
NOT SATISFACTORY	<u>12</u>	<u>33.33</u>
TOTAL	36	100.00

ROOM FOR IMPROVEMENT	36	100
NO ROOM FOR IMPROVEMENT	<u>-</u>	<u>0</u>
TOTAL	36	100

TABLE III ASSESMENT OF PRODUCTIVITY LEVEL

The latter finding is in consonance with the contention advanced in earlier chapters that the level of productivity in the construction industry leaves much to be desired (see especially section 1.3).

Recognising the fact that any one of several productivity indicators could have been used in the assesment arrived at above, respondents were asked which one(s) (of profits, turnover, time period or employee rewards) was (were) considered before arriving at their conclusion. Four respondents declined to answer this question (although one of these indirectly pointed to time as his criterion). The responses indicated a predominance of the profit level (39%) followed by personnel emoluments and time (28%). Turnover was least considered (17%). Although more than one indicator could have been applied, only four of the firms listed

more than two and none indicated all four.

MEASURE ADOPTED	NO. OF RESPONDENTS	PERCENTAGE
PROFITS	14	38.89
TURNOVER	6	16.67
TIME	10	27.78
WAGE LEVEL	10	27.78

TABLE IV PRODUCTIVITY LEVEL INDICATORS AS USED BY RESPONDENTS.

To some, it may seem contradictory that high profits can be recorded while one is clamouring for productivity improvement. It may therefore be pertinent to note that an improvement could lead, not only to even higher profit but also lower costs to the client without jeopardising current profits. Also it can be pointed out that in an industry geared towards low productivity, estimators price contracts to reflect the prevailing level of output while allowing for desired profit. If productivity is higher, output is higher and unit costs move inversely. Then, of course, one cannot afford to forget the ever present allegation that government contracts are nearly often loaded and that our project costs are among the highest in the world.

That the majority of respondents should express satisfaction with their productivity level while admitting that there is room for improvement may well be a pointer to the suggestion that they have ceased to work on the problem and have neglected or are

ignorant of the uniqueness of their position in the productivity improvement process. Apparently these managers are satisfied with the effort they have put in and feel they can do no more. The question then is who should take it from there? To answer this question, one can take a look at a list of factors affecting productivity and how our respondents feel these factors affect their firms.

3.3.0 FACTORS AFFECTING PRODUCTIVITY

- THEIR ORDER OF INFLUENCE.

A list of those factors which are known to influence productivity directly or indirectly was included in the questionnaire and respondents were asked to rank these according to their order of significance as experienced in their firms. Unfortunately not all the respondents took time to do this - ten of our 36 respondents simply indicated those factors they considered significant. From the other 26, various responses were received. These are shown in Table V which shows the number of respondents assigning the different positions to each of the factors. To aid analysis of the responses to arrive at a master order, the positions were awarded points inversely related to them. Thus the first position was given 13 points and the 13th position only one point. The factors were ranked by summing up their weighted points according to the number of respondents awarding them the different positions.

The weighted scores are given in the column under "score". The order that emerged is as follows:

1. Workers' skill
2. Supervision
3. Availability of materials.
4. Availability of plant
5. Availability of funds
6. Availability of labour
7. Contract conditions
8. Government regulations
9. Weather conditions
10. Variation orders
11. Labour Unions
12. Company policy
13. Others

This order is quite interesting and some comment is inescapable. It will probably not be surprising to note that worker skill tops this list considering the fact that traditional construction, dominant in the building sector, still depends largely on skilled craftsmanship for production. The productivity of the worker would therefore depend largely on the degree of skill he has acquired, the time he has spent on the work, etc. The effect of worker skill in the labour intensive areas of construction (in

POSITION AWARDED	RANKED													SCORE	RANKED POSITION
	1	2	3	4	5	6	7	8	9	10	11	12	13		
GOVERNMENT REGULATION	3	5	-	-	-	2	1	4	-	5	-	4	2	176	7
PLANT AVAILABILITY	4	-	4	4	2	2	-	6	2	2	-	-	-	224	3
CONTRACT CONDITIONS	2	2	2	-	1	-	5	-	8	2	4	-	-	176	7
WORKERS' SKILL	8	5	3	6	4	-	-	-	-	-	-	-	-	293	1
AVAILABILITY OF FUNDS	2	2	-	4	4	4	6	-	-	-	4	-	-	212	5
AVAILABILITY OF MATERIALS	-	4	8	5	-	4	-	-	-	3	-	2	-	224	3
SUPERVISION	7	1	4	4	-	6	-	2	-	-	2	-	-	253	2
VARIATION ORDERS	-	-	-	1	6	3	3	4	5	2	2	-	-	172	10
BAD WEATHER	-	-	3	-	2	3	4	6	4	2	2	-	-	173	9
LABOUR UNIONS	-	3	-	2	-	-	-	2	4	6	5	4	-	135	11
COMPANY POLICY	-	-	2	-	-	-	2	2	3	1	4	8	4	99	12
AVAILABILITY OF LABOUR	-	4	-	-	7	2	5	-	-	1	3	4	-	183	6
OTHERS	-	-	-	-	-	-	-	-	-	2	-	4	20	36	13

TOTAL 26 26 26 26 26 26 26 26 26 26 26 26 26 26

TABLE V FACTORS AS RANKED BY RESPONDENTS

which 83% of our respondents fall) is therefore of primary importance.

Not surprising too is the high position occupied by the supervision factor (a factor which is largely determined by management). Because of the role which supervisors can play in guiding workers to enhance their skill, ensuring they are working on the job, and motivating them in various ways, this researcher had actually felt that this factor would take the leading position. In retrospect, though, one realises that no matter how one supervises him, a worker cannot do any skilled work well unless he has been taught how to do it.

One important point revealed by the ranking of the factors above, is the fact that materials, plant and labour interrupted only by funds (itself a production resource), all of which are production resources for which the managers are responsible, are held by the managers as more significant than the other factors. Thus unwittingly, the managers have themselves accepted the argument that they, more than anyone else, are in the best position to improve productivity within their firms. Managers retain the greatest potential for improving productivity. They cannot transfer the blame for low productivity in their firms to the board of directors, to government, or to labour unions unless they have fulfilled their role in making the most of the more significant factors under their control. Unfortunately many

managers continue to overlook this fact and try to look on others to improve on productivity for them. So far, in Nigeria, the worker has been the scape-goat but one must remember - "if you do not train them, you cannot blame them".

3.4.0 MANAGEMENT ATTITUDE TOWARDS PRODUCTIVITY IMPROVEMENT

- COMMENTARY ON RESPONSES

Having decided the order of significance of the factors influencing the productivity of the firm, one would wish to know what steps are being taken or considered worth taking towards productivity improvement in the construction firm. From a prepared list, respondents were asked to indicate those actions which would help improve productivity in their firms. An itemised discussion of the responses received follows:

3.4.1 TRAINING WORKERS

Only about 11% of the respondents felt that this would not help them. All other respondents indicated that training their workers would boost productivity in their firms. Yet surprisingly, only a handful of these offer any form of training. Even where some form of training is provided, it is not accorded the kind of formality that would encourage workers to take it up. It was discovered that persons working as apprentices invariably have smaller take home

pay than their counterparts, manual labourers, who often benefit from overtime allowances. Moreover, since the training is usually not formalised nor any certification given, a labourer who comes onto the site and is apprenticed to a mason, say, would often not be up-graded even after many months spent learning the trade. He remains an apprentice until he leaves the job or goes to another site to be tried out. This situation itself aggravates the undersirably high turnover of labour experienced by many firms. It is also one of the reasons why firms in the industry find themselves unable to retain trained manpower. Besides under such an arrangement, or lack of it, there is no incentive for workers to strive to improve their ability.

3.4.2 SUPERVISION

Only one respondent felt that his firm would not experience an improvement in productivity by supervising the work more closely. The general problem of the others is that of getting and retaining enough good supervisors. This appears to be one area where the industry could do with a little help from outside. There appears to be an urgent need to step up supervisory training efforts and to achieve the desired level the government and other professional and technical training institutions need to lend a helping hand. Presently only the bigger firms are able to get the much needed supervisory staff and even these do not get enough -

they then resort to importing expatriates to do the job. These are hampered by communication and other social and psychological problems. Another alternative that has been explored is the selection of suitable supervisory personnel from among craftsmen and grooming them for the job. This does not augur well for the job, however, since skilled workmen are scarce and there is a real need to encourage them to remain on their jobs.

3.4.3 MATERIALS MANAGEMENT

This is one area where respondents are unanimous in their expectation of positive results. The question now is how many of them work at it? Approximately 53% of the respondents admitted that material shortages are among their major productivity frustrations. Yet material management, as the name implies, is a management task and one for which no outside help can be counted upon. Controlling of the supply and inventory function as well as cutting down waste are among the responsibilities of managers. They, too, can be expected to minimise losses due to spoilage in the store and theft. It would be admitted, therefore that management attention by way of planning and control is called for here.

3.4.4 PLANT AVAILABILITY

There is no disputing the fact that judicious use of

mechanical plant can go a long way towards boosting productivity on the construction site. Note, however, that the operating word here is JUDICIOUS.

Of the 36 respondents, only two respondents felt that procuring more mechanical plant would not help them and they may well be right. The one revelation that was surprising here is that most of those respondents (86%) who admitted that they suffer from underutilisation (30%) still felt that they could benefit from acquiring more plant. This would indicate an obsession with plant unless where the plant they have now are unsuitable for the job they now have to do. In which case they can be accused of not taking into consideration the prospects of future use when they acquired the plant in the first instance. Short of this consideration, any further acquisition of plant, one can imagine, would only aggravate the already frustrating problem of under-utilisation. Two suggestions can be proposed and these are as follows:

- (a) Where plant are unsuited to the job, they can be replaced and, if feasible, more suitable plant acquired.
- (b) Subject to the contractor's plant stock, in any given situation only the best plant (that are likely to find continued use) for the job should be acquired.

Both of these suggestions, of course, are decided upon by the management taking into consideration the methods of work to be adopted and the machines that will be used. It is up to them to select the best in any given situation subject to the limitations posed by that situation. This presupposes familiarity with plant on the market, their specifications, etc. and then planning for their use and maintenance during the course of the project. Where several different plant are required to complement each other, the project manager also needs to ensure that they are well matched.

3.4.5 SHORT TERM BORROWING

The nature of the construction business is such that large sums of money can be expended over fairly short periods and it may not be feasible or even wise for a contractor to tie up his funds in one project. This is why most contracts provide for payments to be made to the contractor at regular intervals for the work completed during that period (subject to the deduction of a retention fee). However, it is a sad fact that, because of the general inefficiency and bureaucratic inadequacies of our system, Contractors (especially those working on government projects) often experience delays in getting payments for work done - it is not uncommon for half

a dozen valuation certificates to be on hand awaiting payment. This situation inevitably poses problems for the contractor who has to pay for the work as soon as it is done. Such payments may even run to the tune of several million Naira. Since very few contractors can afford to continue financing their contract under such conditions, work is often held up resulting in loss of productive capacity - machines left idle and men temporarily laid off (some of whom would be difficult to recall when they are required again).

A possible solution to this problem is to negotiate overdraft facilities (or other suitable arrangement) based on the average time which, in the firm's experience, it would take for valuation certificates to be honoured. However, most of the respondents, it would seem, do not favour this approach - only one respondent felt that short term borrowing could help in the push towards higher productivity. Of course it would cost the firm a little in interest charges and, in the case of credit from suppliers, loss of cash discounts. However, this must be weighed against the (waste) costs of remaining idle or slowing down work below optimum (planned) level while awaiting payment. In this regard, short-term borrowing may well prove a sensible alternative. In any event, one can easily estimate the costs to the company of either alternative and, should

borrowing prove cheaper, it should be exploited. While the site manager may not be in a position to decide on this alternative, it is his duty to acquaint his head office of the best alternative and ensure that they are fully aware of the cost to the company of operating below the optimum pace simply because of a shortage of funds.

3.4.6 HIRING MORE WORKERS

From the responses obtained in the survey, availability of workers is, seemingly, not the problem. The real problem is the suitability and capability of the workers. Unskilled workers are not too difficult to get - what is needed is to train them for the jobs they are required to perform so that they can do these efficiently. This, of course, we have already pointed out in section 3.4.1 as an important area where greater interest could yield rewards.

3.4.7 PROJECT PLANNING

This seems to be another area worthy of consideration because of the common problem of project over-runs (admitted by 34% of our respondents). Managers certainly cannot pass the responsibility for this task to any other party. The present attitude of managers who view time taken to plan as time wasted is unjustifiable and needs urgent reconsideration.

3.4.8 OTHER FACTORS

Other suggestions, such as providing medical and other welfare facilities, planning for safety on the site, etc, were accorded varied but scanty consideration as far as their role in the productivity improvement process was concerned. Many felt that these could help but not appreciably.

Comments put forward by respondents included a call for improved communication and transportation facilities (not mentioned in the questionnaire); and some elaboration of policy problems mostly in the case of proprietorships where the proprietor of the company has no regard for best practice procedures but rely on the undesirable and "... uninformed advice of friends and relations". Such proprietors rely on their connections to get highly inflated contracts which will give them some profit no matter how low their performance level is.

Of all the respondents, only one was of the opinion that pay increases could help the drive for higher productivity. 53% felt that banning labour unions would not help, either. None discussed further the problem of overhead experienced by 50% of the respondents, except for the manager who bitterly pointed out that "there are more people looking after this job than are working on it". This respondent blamed these costs on the excessive regard given to consultants and other people inspecting the work for the client or government authorities. Apart

from these, control of overheads is of course the responsibility of Management - from the head office, of course.

3.5.0 SUMMARY OF FINDINGS

Earlier, in chapter one, the problem of low productivity was outlined and it was suggested that, more than anyone else, managers in the industry can be held responsible for not dealing with the problem. It was also pointed out that there is a proliferation of views, theories and techniques on productivity which, though important, do not provide a logical framework that can be applied for "productivity management".

We then set out to identify those factors that affect productivity in the industry after recognising the limitations posed by the multiplicity of views and the problem of measuring the effect of these factors (which was declined for reasons stated in section 1.3). The identification of these factors have been achieved in this and the previous chapter by, first, reviewing available literature on the subject and then questioning managers on several sites in different parts of the country. The interviews, based on the factors identified in the literature, have yielded the following points.

1. Productivity in the industry is certainly not as high as it could be. Our respondents were unanimous in their acceptance of the suggestion that there is (a lot of) room for improvement.

2. Many different factors influence productivity in the industry to different degrees and any of these factors can be manipulated to improve productivity in the industry to various extents.

3. The most significant factors affecting productivity are those that come directly under the control of management. These factors, according to the order of significance arrived at in section 3.3.0, are workers' skills, supervision, materials, plant, cash and labour. It can therefore be concluded, in complete consonance with the suggestions advanced in chapter one, that managers retain a high leverage potential for the improvement of productivity from within their firms.

4. Other factors exist which are externally induced and which affect the firm to a lesser extent than the factors listed above. These factors, though externally induced, can still be manipulated (or their effects can be regulated) or planned for in such a way that productivity is increased (by minimising the negative effects of these factors). The means by which this can be done may not be immediately obvious but an attempt will be made to outline these in chapter six.

With the foregoing revelations we can now proceed to discuss the role management can play in the productivity improvement process. The next part of this thesis will include discussions of the factors that have been found to affect

productivity as well as descriptions of the various methods and procedures which can be applied by the construction manager to boost productivity in his firm. The factors are treated under three major classifications - labour, the construction process and external factors - evolving a system of productivity management.

MANAGING THE WORK FORCE - IMPROVING LABOUR

PRODUCTIVITY

Construction, in spite of continued trends towards mechanization, remains largely a labour intensive industry with roughly 40% of its costs being attributable to this factor. It follows therefore that even small gains in labour productivity could go a long way to improving the overall productivity of the firm. The fact that labour is responsible for putting together all the different parts of the project mean that any effort towards improving productivity necessarily starts here. It would not, in fact, be an understatement to say that the motivation and management of people to improve productivity offers the greatest untapped potential for increasing productivity within the organisation.

In fact the prominence accorded to workers' skills, supervision and supply of labour in the list featured in section 3.3.0 lends support to such contention.

The modern construction Manager may well be advised that no aspect of this factor can be left untouched if his organisation is to achieve the best performance possible in productivity improvement. The purpose of this Chapter is to identify the means by which Managers can boost-Labour productivity in their firms.

4.1.0. FACTORS AFFECTING LABOUR PRODUCTIVITY IN THE CONSTRUCTION INDUSTRY.

Before we can attempt to improve the productivity of labour, we have to determine the relevant factors in order to assess their effect and to identify the best means to be adopted in each case.

For the Nigerian worker, these factors, as identified by a national Seminar (1) on productivity held in 1963, are as follows

1. Worker skills and facilities available for improvement and acquisition of experience.
2. Adequate and proper supervision as well as the relationship between management and workers.
3. Wages and incentives.
4. Demand
5. Security
6. Factory organisation and Layout
7. Health and proper nutrition of workers.
8. Availability of transport and sundry fatigue reducing facilities
9. Trade Union activity.
10. Increasing family commitments associated with rise in incomes.
11. Lack of skill and industrial experience.

To facilitate treatment, these factors may be broken down and reclassified under the following main titles which deal directly or indirectly with them.

- (a) Health and Nutrition.
- (b) Climatic factors.
- (c) Cultural and mental factors
- (d) Incentives
- (e) Human relations
- (f) Organisation and Management.

This last factor may be further broken down and considered under three main aspects viz, recruitment and training; supervision, site organisation. These factors may be analysed in a practical way as follows:

4.2.0 HEALTH AND NUTRITION: There is no doubt that the capacity to work depends on health which is itself largely determined by diet. This has however been a basic handicap not only to workers in Nigeria, but in most developing countries all over the world where these basic necessities are less than adequate.

Malnutrition manifests itself in the following ways;

- (a) by Lowering resistance to endemic disease
- (b) by an avoidance of effort which is the body's natural defence mechanism. Since food is the source of the energy expended in doing work, it follows that the construction worker, especially when he is involved in heavy manual labour, requires more food than those on light tasks such as the clerk. The quality of the food is equally important as any type of dietary deficiency results in avoidance of effort—a natural tendency of the body to conserve its resources, which results in an absence of initiative and drive.

It has been found⁽²⁾ that

- (1) the traditional Nigerian (or African) diet, though adequate for tribal life requiring little sustained effort, is insufficient for a worker from whom considerable regular output of effort is expected.

2) Current social and economic trends have had a deleterious effect on tribal diets in many areas.

With (a) the introduction of cash crops reducing food crops and (b) Migration to towns decreasing agricultural production in many areas.

It has been suggested (3) in the Nigerian context that "no medical or social provisions will promote improved productivity where the physique of the worker is continuously being undermined by a sub-standard diet".

SUGGESTIONS from the foregoing, it follows that management interest in the nutritional and hygiene habits of the worker would not be out of place. The provision of catering facilities is therefore of primary importance as a means of ensuring adequate and affordable supply of the right kind of food. The use of the "luncheon voucher" system here is highly recommended as these would ensure that workers would take advantage of catering facilities provided.

The practice whereby provision of catering facilities is neglected and the feeding of workers on site left in the hand of "Mammies" who usually sell food of the wrong kinds and without the nutritional requirements of the worker, under less than hygienic conditions must be discouraged.

The canteen where provided, should concentrate on high energy food like yams, rice, peanuts, etc, - while ensuring that the workers' protein and mineral requirements are adequately supplied.

Sale of heavy foods such as "Fura da Nono" or beans which tend to weigh the worker down requiring him to rest after eating should be discouraged as these would lead to general sluggishness in the worker immediately after the break period. In this regard high roughage content should be encouraged in the meals to aid quick digestion and Liberation of the energy content of the food so that the worker can perform as vigorously after the break period as when he started the day.

The foregoing efforts may be supplemented by educating the worker about his food and health needs so that efforts at work can be supplemented and good habits are extended to the worker's home for maximum benefits to be gained.

4.3.0. CLIMATIC CONDITIONS AND WORKER COMFORT.

The construction industry is generally an outdoor one and the effect of climatic conditions on the performance of the worker is therefore one that cannot be completely ruled out.

Performance is necessarily less than normal where weather is very hot or very cold. At the lower temperature level, activity tends to slow down even more although this need not be so. Though there is no conclusive evidence of the effect of less than extreme weather variations on worker performance, efforts aimed at minimising inconvenience to the worker are not likely to go unrewarded.

High caloric food, provision of warm clothing, etc are recommended during the cold season. While in the season, the number of rest periods should be increased though their duration may be reduced correspondingly.

4.4.0 CULTURAL AND MENTAL FACTORS

Studies carried out as far back as the early '60's have abilitated the myth of any inherent attitudes or capabilities of the Nigerian worker. These studies point out the fact that the modern Nigerian worker is as susceptible as his counterparts anywhere else to the modern scientific approach to management. Modern thinking of worker needs as well as motivational and relevant organisational factors would be just as appropriate here as anywhere else in the world. There is no doubt that westernisation has gradually and surely played down many of the cultural factors affecting the African worker perhaps only to the exclusion of the familial aspect which remains a strong force but one which cannot be directly assessed for its influence. However this, too, is gradually reducing as government is gradually taking over provision of some health and educational facilities.

One area this researcher feels may be worth considering is the rhythmic flavour of the traditional African work atmosphere. For as far back as can be remembered, communal work in Africa has been organised along festive lines with drummers and singers encouraging the workers. In fact so strong was this influence that it followed slavery across the Atlantic Ocean where it retained a strong motivating element even in the face of forced labour and permanent cut-off from home and country. It has remained in the American negro from generation to generation as a rich source for the black american entertainment industry.

A major stimulating factor in these activities is the provision of worker recognition as a stimulus of achievement where the best workers are praised publicly in song.

4.5.0 WAGES AND INCENTIVES.

Recent studies have buttressed the conviction that money is one of the most significant means of motivating employees. The international labour office ⁽⁴⁾ points out that "there is evidence that payment by results is often associated with relatively high productivity". The Polish economist, Pohorille ⁽⁵⁾ writes that in any society, "the best way to raise Labour productivity is through a wage system in which wages depend directly on work and its results. It has been suggested that the best incentive schemes are those which aim at bringing individual objectives into accord with organisational objectives; workers then strive to maximise the objectives of their firms. This approach to motivating the worker is termed the behavioural approach.

Both of these approaches are tied in by a third function, often termed the managerial approach.

These three approaches may be distinguished as follows:

THE ECONOMIC INCENTIVE APPROACH which dwells on the use of rewards and incentives to get the worker to perform well.

THE BEHAVIOURAL APPROACH tallying the needs and aspirations of the worker to that of the organisation and improving the quality of the job.

THE MANAGERIAL APPROACH which tries to meet the needs of the people and the organisation and to set incentives to benefit both. This approach also reflects on how to 'fit' people and organisational goals into the situation at hand to select the best approach for workers and the organisation.

4.5.1 THE ECONOMIC INCENTIVE APPROACH stems from the contention that money is the most attractive incentive available and is based on the belief that there are many things that many people want and which money can buy. This, however, does not mean that undue emphasis should be placed on money as over-generosity would be demeaning and would border on bribery. This is the case as for example; with politicians whose plans to award pay hikes have no relationship with worker achievements but serve as a means of getting the electorate to vote for them.

Also, using money on a large scale may encourage corruption and the art of blackmail especially by trade unions.

Adam Smith ⁽⁵⁾ has suggested that monetary rewards should be set in steps with Levels and amounts based on the results contributed to the organization.

Frederick Taylor ⁽⁷⁾ advocated a job situation where work is broken into standards to which rates are assigned together with an easy procedure for reaching these standards.

A third contributor, Hugo Munsterberg ⁽⁸⁾ suggested the setting up of a stepped job structure with rates being assigned to each step and provision of a merit evaluation when these jobs have been well achieved.

All of these suggestions have the "dangling carrot" approach based on the view that workers will be eager to maximise their monetary status, power and prestige and will therefore be more productive if visible rewards are set out.

In fact, it has been proved (9) that when payments are related to performance, the average labour cost is smaller than on contracts where standard wage rates unrelated to output are paid.

4.5.2 THE BEHAVIOURAL APPROACH TO MOTIVATION

This is based on the view that workers work to meet their needs. Their presence in the organisation is an attempt to meet those needs. ABRAHAM MASLOW (10) established a hierarchy of needs which drive individuals toward fulfilment and satisfaction. According to him, the higher needs become a driving force only after basic needs have been satisfied.

4.5.2.1 THE HIERARCHY OF NEEDS (IN ASCENDING ORDER)

1. Physiological needs - food, water, shelter, sex
2. Safety needs - protection, safety, freedom from fear.
3. Love needs - belongingness, acceptance.
4. Esteem needs - respect, recognition, status.
5. Self-actualisation needs - filling one's potential growth.

Maslow emphasised that a need, once satisfied, ceases to be a motivating factor. The satisfaction of lower needs will lead to the worker striving to satisfy higher ones.

These needs overlap and interact and although the lower needs are more lasting and effective as motivators. Maslow's approach therefore suggests provision of a work situation where workers' needs can be fulfilled.

DOUGLAS MCGREGOR's ⁽¹¹⁾ THEORY X AND THEORY Y APPROACH, is developed from two sets of contrasting assumptions about human beings and their perceptions about work.

THEORY X ASSUMPTIONS.

1. Workers inherently dislike work and will avoid it whenever possible.
2. Workers are unambitious, shun responsibility and have to be directed.
3. Workers want security
4. Workers have to be coerced, controlled and threatened to attain organisational objectives.

THEORY Y ASSUMPTIONS.

1. Workers will seek responsibility when conditions are favourable.
2. Workers want to direct and control their own commitments.
3. Workers want rewards commensurate with their commitments.
4. Workers want opportunities to make significant contributions to organisations' objectives.

According to McGregor, people cannot be motivated directly.

Motivation has to come from within and it expresses itself when conditions allow it.

4.5.2.2 FREDERICK HERZBERG'S MOTIVATION-HYGIENE (12) THEORY

APPROACH - identifies certain job elements that generate positive feelings as satisfiers and others that generate negative feelings as dissatisfiers. The satisfiers are called motivators because they are effective in motivating employees to greater productivity. Dissatisfiers are called hygiene factors because they prevent dissatisfaction from occurring though they do not induce people toward extra-effort. The following five job conditions stand out highly as determinants of satisfaction :-

1. Achievement.
2. Recognition.
3. Work in itself.
4. Responsibility.
5. Advancement.

These satisfiers, claims Herzberg, can motivate individuals to long-term superior performance and effort. He also identifies job conditions that rate highly as determinants of dissatisfaction. These may produce changes in attitude and productivity, but they are only short-term in nature. These factors are:-

1. Organisation's policies
2. Administration
3. Supervision

4. Salary
5. Interpersonal relations
6. Job security
7. Working conditions

Herzberg argued that managers tend to create conditions of stressed environmental dissatisfiers while ignoring the potential value of the satisfier factors. He suggested that the way to motivate is to give workers motivators within the job content that will lead to satisfaction.

4.5.2.3 DAVID McCLELLAND'S (13) ACHIEVEMENT MOTIVATION

THEORY APPROACH surmises that high levels of accomplishment at work are due to the fact that a high level of "achievement needs" exists among people and that those who accomplish large undertakings are turned on by the accomplishment. Money, position, status and power are secondary considerations. This sense of achievement is imbued in enterprising individuals.

The high achiever is one who has ^{the} following characteristics:

1. Assumes responsibility for solving problems.
2. Reaches for goals in spite of high risks
3. Develops situations that offer frequent feedback of results.

The interesting thing about McClelland's achievement motivation is that entrepreneurial behaviour can be developed. Once learned entrepreneurial activity usually results.

The essential characteristic here is a desire to undertake tasks in which there is reasonable chance for success while avoiding those that are too easy or too difficult. McClelland therefore suggests that workers be given entrepreneurial development opportunities in order to attain high levels of achievement.

4.5.2.4 VICTOR VROOMS⁽¹⁴⁾ EXPECTANCY THEORY APPROACH. Is one of the more popular versions of expectancy theory and is based on three concepts.

1. VALENCE the value or importance that a specific outcome has for a worker.
2. INSTRUMENTALITY: Worker's view of how high performance will help him get promotion
3. EXPECTANCY Worker's feeling of whether his efforts will lead to high levels of performance.

The expectancy theory model assigns mathematical probabilities to predictions about work behaviour. In a given situation human behaviour is a joint function of the degree to which that behaviour is instrumental to attaining an outcome and the subjective probability or hunch that the outcome will be forthcoming. Individuals will choose the behaviour and its attendant motivation - that they feel will lead them to the things they want.

The theory suggests that people tend to expend more effort towards reaching goals when both the probability of receiving a reward and the magnitude of that reward are known in advance.

Motivation is then a function of the magnitude of the reward given by $M = PX$, where M is equal to the level of motivation, P = probability of obtaining reward and X = magnitude of reward. Giving workers, in advance, opportunities where the rewards are great and the probability of achieving them are great, will cause them to be highly motivated.

4.5.3. THE MANAGEMENT APPROACH

This is based on the view that there is no one best way to motivate. Different organisations with different tasks and different competitive environments and different worker needs require different approaches. The Managerial approach therefore is that blend of other approaches that will best fit the given situation. This is because it is the manager who must deal with the realities of the situation. One must realise that people are only one component of the system. The organisation is the other. The manager must act and react in such a way that both the needs of the people and the organisation are taken care of either simultaneously, or in a complementary manner. Managers are no doubt aware that people come to work to meet their personal needs. These needs are continually changing, are very complex and often beyond the manager's control. The Manager does not have time to be a behaviourist - he can concern himself with behaviour only on the first level - getting the person to do a job that meets the needs of the organisation.

Monetary incentives have a high influence on behaviour and workers see salary reviews as an important feedback on appraisal of their performance. The manager cannot, however, raise or lower salaries whenever he wants to. The best he can do is to try to find a compromise between the organisation and the individual. The Manager should make every attempt to find where "Coincidence of needs" can occur. This is difficult to find in non-financial areas - it is true that the more money the organisation has or can make, the more of the employees' needs it can meet. The firm's profit is a way of meeting its present and future needs. There is no doubt therefore that money is a motivator with which a host of present and future needs of the organisation and the employee can be made to coincide. The problem with money as a motivator, however, is that it is the most expensive of all motivators. To reduce costs in motivating employees, managers have to seek nonfinancial motivators hence the blend of financial and non-financial motivators. Intangible rewards can be as important as tangible rewards since both will influence behaviour. Thus the managerial approach is an eclectic approach in which three techniques are prominent. These are:

1. The contingency approach which suggest motivating by analysing the situation and selecting elements from the vast array of possibilities to form a model that will work for the given situation.

It is based on the idea that there is no one best way to handle the various management functions and problems. It recognises the substantial differences between organisations and, their constituents. Thus inasmuch as there is no one best way to plan; ~~no one best way to plan~~; no one best way to control; so there is no one best way to motivate. The best way is developed after careful research and analysis of the particular situation and applying a planned effective approach to the problem.

2. Systems approach. Here a model is developed for the organisation in which the current motivational process is identified. The model can be used to predict the effect of any change agents and thus identify those which would result in improvements.

3. The expectancy alignment approach. This approach, which is the most popular, is based on the theory of expectancy alignment - the greater the alignment of employee expectancies with organisational objectives, the greater the motivation to accomplish both. The less the alignment, the more difficult the motivation. Motivational intensity therefore depends on how well the manager can align the needs of the parties involved.

$$MI = f(NC)$$

where MI = Motivational intensity

NC = Needs coincidence.

This suggests that one should plan to obtain the closest possible alignment (needs coincidence) between employee expectancies and organisational objectives. Appendix B describes this approach for motivating workers in more detail.

4.6.0 HUMAN RELATIONS

The construction industry relies a great deal upon the $\Rightarrow$ co-ordination and cooperation of groups of people. If the project is to be successful not only in making a profit, but also finishing on time, all those concerned will have to work together in good-will and harmony. This depends largely upon the ability of the manager to stimulate a contagious enthusiasm in his men and show confidence in their ability to perform the task well. $\underline{\underline{=}}$

Unfortunately, many managers unintentionally treat their subordinates in a way that leads to lower performance than they could normally have achieved. This reflects the principle that one person's expectations can influence the behaviour of another. This concept, known as the pygmalion effect* states that when one predicts an event, the expectation of the event changes the subject in such a way that the event is more likely to occur.

This notion, long recognised by behavioural scientists and physicians, is known among the latter as the "placebo effect". (The placebo is a harmless preparation given merely to humour the patient but if the patient believes it will help, it will).

The christian reader may also recall Jesus Christ's recognition of this effect which he labels 'faith' - which, though small it may be, "can move mountains".

Dr. Robert Rosenthal, a Harvard University behavioural scientist, who coined the term "Pygmalion effect", conducted a number of experiments to test this hypothesis. One of these was conducted in an elementary school. He randomly chose children from eighteen classrooms and labelled them "intellectual bloomers". Teachers were told that these children could be expected to show remarkable gains during the year. Actually, the only difference between these children and the rest was solely in the minds of the teachers. Eight months later the "intellectual bloomers" showed an overall IQ gain of four points over the other, "normal" children. More remarkable was the attitude of the teachers. They thought the brighter students were appealing, more affectionate, and better adjusted. The conclusion: the higher performing and better liked students had superior performance because it was expected of them.

There is an important message for managers in these findings - "supervisors/managers can instill high performance into their workers."

- * After Pygmalion the sculptor, in Greek mythology, who carved an ivory statue of the ideal woman. Because his creation was so beautiful and lifelike, he fell in love with it and his steadfast belief led to the statue being brought to life.

4.6.1

WORKER - WORKER RELATIONS.

One cannot say too much about the need for coordination and teamwork among the workers on the construction project. For the project to be successful in all aspects, all members of the team have to work together in harmony. Unfortunately tribal and ethnic multiplicity poses a problem for the manager in the Nigerian construction industry, especially in the northern parts where craftsmen from several different tribes have to work together. The problem is one of historical attitudes and relationships of the groups concerned and is influenced by their degree of evolution. This can be a major destabilising factor which may be aggravated by political considerations - especially as party affiliation as at now is mainly along tribal lines. Managers have to deal with the problem of ensuring that the feelings, personalities, likes and dislikes of, not only individual members of the team, but also different ethnic groups are balanced.

While it may not be possible (nor indeed wise considering the need to encourage and evolve a national, rather than tribal, spirit) to obtain an ethnically homogeneous work group, there are ways to encourage and foster team enthusiasm in the work group. The following general rules or principles should be borne in mind when dealing with groups or individual members of a group:

1. No favouritism or discrimination should be shown.
2. Patience is important. It may not be easy, but the passage of time and the inter-action of members of the work group could of its own lead to individuals accepting one another and their different beliefs.
3. Be prepared to see things from other peoples' points of view.
4. Encourage social inter-action between members of the work group. A positive effort on the part of management such as formation of a sports club could unite workers towards a common goal - their team's success over other teams. Such team spirit would eventually manifest itself on the work site.

4.6.2 MANAGEMENT-WORKER RELATIONS.

The nature of construction work is such that site supervisory staff can directly influence the workers as they have almost continuous face-to-face contact with them. For this reason, supervisory training programmes have to give due attention to leadership problems. It has already been accepted that next to the workers' skill, the most significant determinant of labour productivity is supervision (section 3.4.2). The personality and capacity of the supervisor as well as the role he plays are all-important to high productivity. Team spirit depends, to a large extent, on the ability and personality of the supervisor.

Good relations and a clearly defined communication system would be second only to motivation as a concern of the productivity - conscious manager. This is because productivity is directly affected by the relationship and mode of communication between management and workers. A breakdown in communication can be as costly as the breakdown of machines, the loss of sales, poor design, or material shortage. Only by communicating his expectations can a supervisor have a positive influence on attitudes, self-confidence, and self-development.

The average construction supervisor will be concerned mainly with informal communication because it is the face-to-face oral communications that get the job done. It is also the way to overcome formal organisational "trappings" which would be too slow for construction processes.

Communication may be verbal or non-verbal. The first pre-supposes understanding or availability of a lingua-franca. Unfortunately, this is not always the case although whenever possible, it may be important to hire only those with whom oral communication would be possible. However, the buck does not stop there. Non-verbal means such as eye contact, tone of voice, body posture, facial expressions and even silence can convey real messages to subordinates. These nonverbal messages can be as frustrating as they can be helpful. "silent treatment" from a cold and uncommunicative boss as a sign of displeasure can frequently be more effective than a verbal or written reprimand.

One appropriate gesture can convey more than a hundred words.

It has been suggested that the African worker favours a paternalistic relationship between his employer and himself and appears to be much happier under such circumstances.¹⁵ Those favouring this approach contend that "if anything can happen to transform the employe into 'father' or 'chief', personal loyalty would follow and within the limits of this understanding, the servant will do his best for him." Thus the supervisor who is prepared to spare a few minutes from his duties to chat with a worker, find out a little about his background, interests and general character would be rewarded with improved performance from the worker. This does not mean that the supervisor should let informality overcome him, familiarity, remember, breeds contempt. His approach should always be firm but fair, whilst he should be prepared to listen to grievances at all times.

4.7.0 ORGANISATION AND MANAGEMENT

The function of organising is essentially that of creating in advance the basic conditions that are a pre-requisite for the successful execution of a particular project. This is because competitive effectiveness is not possible unless the conditions governing effective, economical operations are planned for. Careful study of operational requirements, recruitment and training of personnel, etc. are essential to enhance the productive capacity of the firm.

The organisation structure is the structure of the relationships between similar functions, physical facilities and the personnel set up for the execution of the project. Its purpose is to promote co-operation and facilitate the exercise of leadership and development of the organisation. It may be broken down into many sub-functions but we shall concern ourselves here with only the major ones:

1. Recruitment and training.
2. Supervision.
3. Site organisation.

4.7.1 SELECTION, TRAINING AND RETENTION OF (TRAINED) WORKERS

One basic fact that has been recognised in this study is that a skilled work-force is of primary importance to the productivity of the construction firm. Now, developing a good work-force, admissibly, starts first and foremost with selecting the most suitable men for the job. The importance of the selection process cannot be over-emphasised.

The manager must appreciate the fact that, even for purely manual work ^{not} requiring any skill, strength may not necessarily be the only criterion to consider - there is the kind of man who would suit the job and one who wouldnt, even though they may both be equally strong. This fact was noted by Frederic Taylor who recognised that the nature and mentality of a man suited to purely manual labour as a regular occupation would be such that he is "..... so stupid and so phlegmatic that he more nearly resembles in his mental make-up, the ox than any other type".¹⁶

The purpose of the selection process is to identify those subjects who are most suitable for the kind of work. It is essential not to over-rate the capacity - that would lead to mis-direction of effort and resources, ending in frustration; nor to under-rate it - that would waste potential skill (the supply of which is still far short of demand) and create feelings of frustration.

Once selected, it is the employer's responsibility to develop the capacity of the employee to the full. Training serves, not only as an effective motivator for performance (and the self-satisfaction incidental to it), it also fulfills the need for workers to keep abreast of new knowledge and avoid obsolescence. Additionally, workers who are engaged in the learning process tend to be much less resistant to change - in fact they may even recommend innovation and change.

Unfortunately, in spite of its obvious benefits, training has remained a neglected aspect in our construction industry. Although most managers agreed that training workers could aid considerably in the drive for higher productivity, few firms even want to consider spending (which they'd rather call wasting) the time and money needed to train workers - they would rather hire already trained and experienced workers. Managers do not seem to appreciate the fact that since few opportunities exist for training outside the industry, the only way they can meet most of their manpower requirements is by supplementing the efforts of the limited number of vocational institutions with their own "on the job" training efforts.

As it is, most of the new entrants to the skilled grades of the various trades are those who have been lucky enough to apprentice themselves to small labour-only sub-contractors whose activities are mainly limited to small, usually private, housing projects which are hardly challenging enough to afford the trainee the maximum possible development of his newly acquired skill. The training thus acquired is therefore very limited and usually unaccredited. It is sad to note that most people who go to work as labourers on projects controlled by the larger firms (which ^{one would} expect to operate some sort of training scheme) leave such sites, even after several years, as labourers still.

This situation has been caused largely by the inordinate consideration given to the cost of training as opposed to its benefits. Many firms are afraid that workers, once trained, would leave the firm for greener pastures. The fact, however, is that the well-organised firm providing such opportunities as training is likely to maintain the greenest pastures. Workers will not only be appreciative of the training opportunities, they will also see it as a sign of managements' interest in them. It must also be realised that training should provide an opportunity for advancement to the worker. The worker does not find full satisfaction with training unless management formally recognises it by promotion or increased pay.

One other point is that training as a continuous process supported by the considerations mentioned above, will be seen as an ever present source of advancement which would in itself serve as inducement for retaining a stable work-force. In the area of supervisory training where remuneration is variable (as opposed to fixed wage rates for most worker grades) and competition for the best supervisors is high, it may in addition to the foregoing suggestions, be worthwhile to either enter into formal agreement with the worker, or with other firms - not to tempt them away. Such "anti-piracy" agreements could eliminate, or at least reduce the problem of competitors inducing trained workers from the firm which has borne the cost of their training but is not immediately able to offer a higher pay. A forum already exists in the Federation of Building and civil Engineering contractors which can be used to implement a suitable agreement that would alleviate the fears of firms interested in training their workers.

Training efforts are best organised as a mixture of on-the-job training with formal lectures designed to acquaint the worker with the theoretical aspects. This would speed up the learning process and enable knowledge which may not be easily acquired on the job to be introduced. The advantages in terms of manpower supply to the industry and increased productivity that will result from such training efforts can be staggering and managers would do well to seriously exploit this path to improved productivity. Remember, "if you don't train them, don't blame them."

4.7.2 SUPERVISION.

The importance of good management-worker relationships and humanistic modes of communication have already been emphasised. We have also noted that one of the greatest secrets of productivity is supervision. It therefore follows that the selection and training of supervisors should be carefully and meticulously carried out. The personality of the construction supervisor or foreman is very important. It must be noted that the supervisor or foreman will often be responsible for selecting and training his own men. Too much care cannot be taken in his selection as the quality of the workmen is directly tied to his capability.

In searching for the 'ideal' supervisor, the following points should be taken into consideration:

- (a) he should have superior knowledge of the job he is to supervise.
- (b) he should have strong drive and motivation.
- (c) he should not be apathetic; his attitude will be mid-way between too-energetic command, and too-benevolent paternalism - strict but only just so.
- (d) he must be personable (i.e., he should not have too much trouble in getting along with people).
- (e) he must be honest and dependable.
- (f) he must be prepared to accept the values of his workers; he is confident of their ability and does not hesitate to show his men how to do their work.

4.7.3 SITE ORGANISATION.

The organisation is an essential part of the productivity improvement process. Firms are organised, presumably, to facilitate the pursuit of their objectives. To achieve any appreciable increase in productivity, the firm needs to establish an environment that enables all employees to improve their skills, knowledge and values for the progress of themselves and the firm. It is this concept that should be the basis of the design of the organisation structure.

The organisation structure is essentially the breaking down of the task force into groups or sections each of which will be responsible for certain tasks or objectives as laid down in the objectives and policy of the firm.

Such organisation structure is usually on formal lines as should be the case if the objectives are to be attained. Each member or groups' duties and responsibilities must be clearly defined in writing so that actions and decisions can be laid at the correct point quickly, enabling answers to be given in a short space of time for maximum effectiveness, leading to better overall performance rather than the feeling of frustration usually generated by delay.

Although the organisation structure should be rigid its composition, simplicity and effectiveness should not be compromised. Management must resist the temptation to complicate the organisation pattern by adding un-necessary activities and inflated titles.

Unnecessary "branches and twigs" should be pruned so that the "tree" can yield bigger and better fruit. Any temptation to over-staff must be resisted as, not only do too many cooks spoil the broth, they tend to increase costs unnecessarily (Note that many of the respondents of our survey complained of excessive overhead costs). This is because too many levels in the organisation will have a negative impact on productivity; with management effort being fragmented or duplicated, coordination becomes difficult, communications slowed, and decision making delayed, not to mention the extra costs in payroll and fringe benefits.

A simple organisation structure will allow informal relationships to develop between members of the organisation. This should be taken into consideration when adopting any of the various ways of organising for construction as it will boost the much-desired team-spirit necessary for successful project execution. Figure 4.1 illustrates a simple organisation structure for a medium sized construction project.

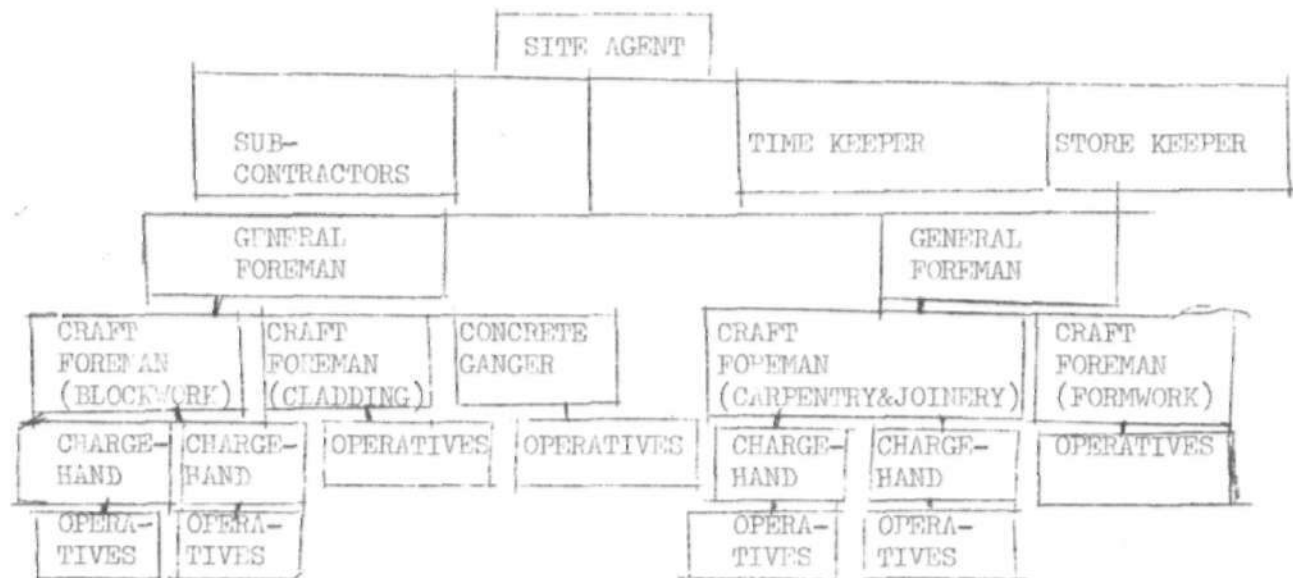


FIG. 4.1 TYPICAL ORGANISATION CHART.

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CHAPTER 5

MANAGING THE WORK PROCESS

5.1 RATIONALISATION OF THE CONSTRUCTION PROCESS

As emphasised at the beginning of this report, the construction industry in Nigeria is faced with increasingly heavy demands for its products particularly to provide the necessary physical infrastructural facilities - Roads, factories, institutions etc - necessary for the level of industrialisation we desire. To meet these demands, there is an implicit need to improve not only labour, but, total productivity in the overall process of construction. This is because skilled labour itself is a scarce commodity and foreign technology being difficult and expensive to use, has to be approached rationally to complement any effort aimed at boosting labour productivity. New methods to reduce the amount of site labour involved have to be sought to simplify construction work and generally increase productivity in the industry. In this search, consideration may be given to the methods of organisation and production characteristic of other highly mechanised industries where productivity is high and products are relatively cheap.

In these industries production is carried out in factories and this, taken together with the difficulties of building on open sites in all weather, has resulted in emphasis being placed

on the idea of building parts of the building in a factory for on-site assembly only. However because of the relatively high capital costs involved in this type of production, it has thus far found only limited use in the industry especially in developing economies such as ours. For the Nigerian industry the concept of industrialisation as an organisational process appears to be where emphasis should be placed. In this case it would not matter whether the buildings are constructed in accordance with traditional or according to new processes. Whichever method is used rational organisation will show us problems such as ^{plant} lying idle, production errors and obstacles can be avoided and more productive level of work attained.

The industrialisation of the construction process has as its aim the introduction of the characteristics of industrialised production which make for high productivity in other industries. This can largely be achieved by organising the following:

1. An efficient layout of site
2. A practical, orderly sequence of work
3. Serial working
4. Rational use of plant
5. Rational use of prefabricated, standardised components.

5.1.1 SITE LAYOUT

This is particularly important for rational construction and must be considered in advance so that the flow of materials and work will be orderly and will involve the minimum movement of operatives and materials and the least double-handling of materials during the progress of the work.

An example taken from practice may show the effect of the form of planning. On a large site two identical rows of houses were commissioned from two different firms.² One of the firms planned its site rationally. The materials of construction were transported over a distance of 20m from the place where they were stacked to the place where they were used. The other firm's planning was not rational. A distance of 50m had to be covered. Bricklaying required 3.6 hours per cubic metre for each site. The transportation of the materials required 0.9 hours per cubic metre on one site, and 1.9 hours per cubic metre on the other, thus bringing the totals to 4.5 and 5.5 hours per cubic metre, a difference of 20%.

This is a difference caused only by site planning. There is no fixed pattern for a perfect site as the best plan would depend on the nature and location of the site. However, there are clear rules that can be followed everywhere. A satisfactory flow-line

relationship between materials, plant and work must be achieved. For example, aggregates, concrete mixer and the building should be so related that aggregates and cement feed directly into the mixer on one side and the concrete is discharged on the other side towards the building so that the shortest route, with no obstruction by stacked materials, has to be travelled in its transport to the final position on the job (Fig. 5.1). A good roadway is essential to permit easy delivery of materials to stacking areas which should be correctly positioned relative to their place of use on the job.

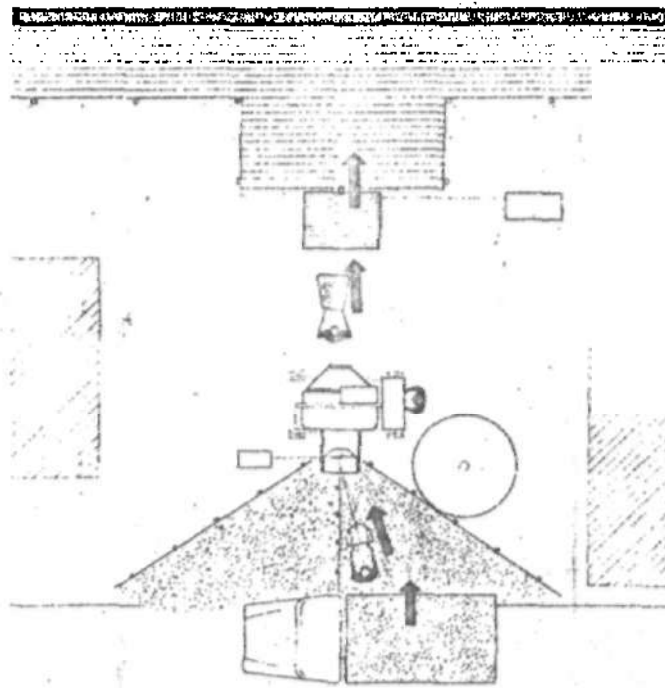


FIG. 5.1 EXAMPLE SHOWING A METHOD OF PRODUCTION OF CONCRETE ON THE SITE.

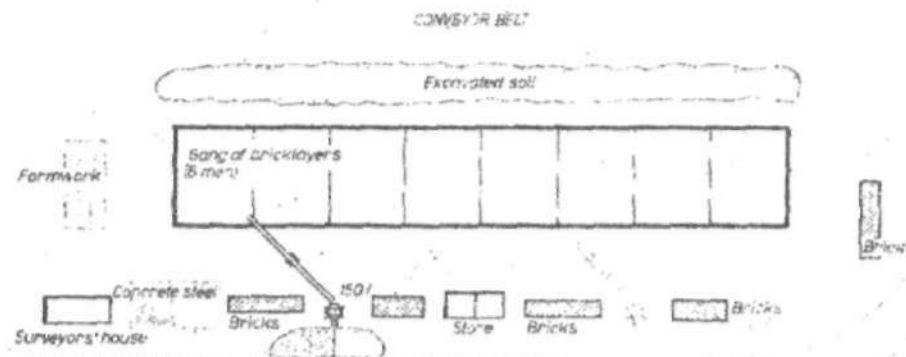


Fig. 5.2 Typical arrangement of a site provided with a conveyor belt.

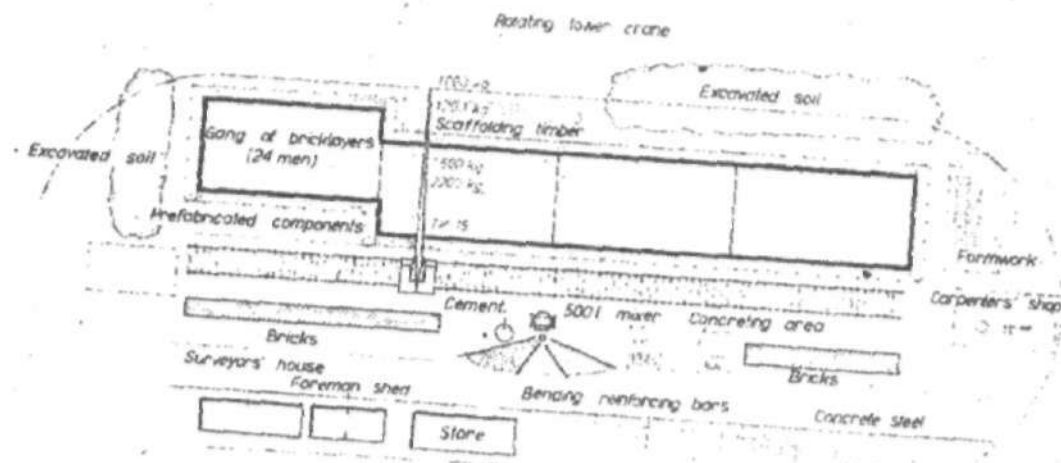


Fig. 5.3 Typical arrangement of a site provided with a crane.

5.1.2 SEQUENCE OF WORK

The nature of construction is such that the operative and plant have to move to the work instead of the other way round as in the assembly line. However, by planning an orderly sequence of operations, which is facilitated by a good site layout, the characteristics of normal manufacturing flow-line production can be developed on the building site to enhance efficiency. Here the main aim is to ensure continuity of work to minimise delays and unproductive time for men and machines and the attendant increase in overhead labour and plant cost due to decreased production. An orderly sequence of operations ensures necessary continuity of work.

Delays may be caused either during the course of work at one particular workplace or in commencing operations at a new work-place. The first type of delay is due to interruption of the work of one trade at a particular position while work in another trade is carried out in the same position, such as the delay in block-laying caused by the casting of a concrete lintel over a window opening in a block wall. This form of delay can be avoided by separating operations, especially those of different trades and those of fabrication and assembly. The second type of delay occurs when some operations at a work position take longer than others, thus holding up the commencement of following operations. This can

be done by planning the sizes of gangs so that the time required by each for its own particular operation is the same. Each gang can then proceed to its different work places and commence work without being held up while a preceding gang completes its work at that place.

5.1.3 SERIAL WORKING

This means the successive repetition of the same operations by a team of workers so as to benefit from the "learning effect"* in order to reduce production time. It has been shown that the repetition of the same operation results in ¹increased skill gained from the experience provided by repetition (Fig. 5.4). In order to achieve this, it is necessary to break the whole job down as far as possible into sections each of which involves only one type of operation, or a group of similar operations, for its completion, and to plan the job so that the same gang moves from work-place to work-place to carry out the operation.

* A term used to describe the reduction in time that results from experience gained in the repeated operation of a task.

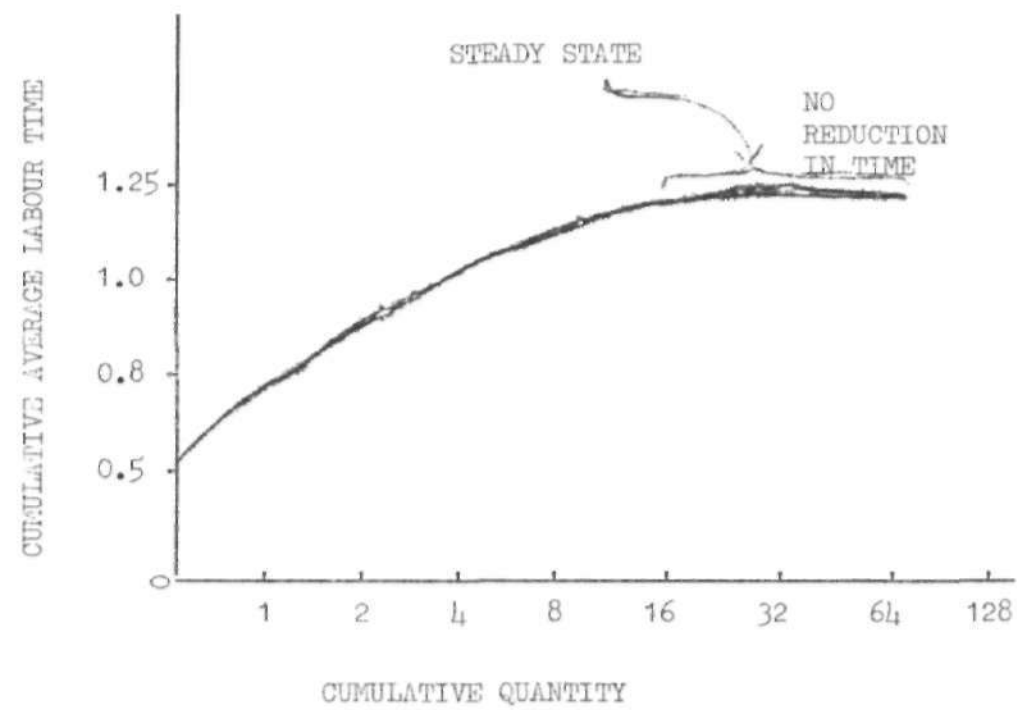


FIG. 5.4 A TYPICAL "LEARNING CURVE" GRAPH

5.1.4 RATIONAL USE OF MECHANICAL PLANT

The use of mechanical plant for construction is permanently on the increase from year to year as a substitute for human labour. This is because of the speed at which operations can be performed using these plant and of course in large post-traditional building work, their use is considered essential to facilitate performance of these operations which cannot be successfully performed manually.

Careful consideration must be given to the relevance and economics of plant use on the particular job. If a piece of plant can be used for only one or two operations it may be cheaper not to

adopt it and even if reasonably continuous use is anticipated it may be found, particularly on very small jobs, that the traditional methods of man-handling materials and components is the most economical because of the greater flexibility of labour they permit and because of the greater amount of double handling often involved when mechanical plant is used.

5.1.5 RATIONAL USE OF PREFABRICATED STANDARDISED COMPONENTS

Used rationally, with due consideration of the effects of their introduction on the work as a whole, prefabricated components can reduce the requirements for skilled labour, simplify construction by reducing the number of separate operations to be carried out and can facilitate continuity in the remaining operations. However, in order to achieve these results, careful consideration must be given to the possible effects of prefabricated components upon related parts of the work both in respect of labour and plant involved. The use of these components may not necessarily result in quicker or more economic building. For example, the use of pre-cast concrete wall panels requiring lifting plant could be uneconomic if the plant could be used for no other purpose on the job. Studies on the introduction of large prefabricated factory-made panels into buildings of otherwise traditional construction⁽¹⁾ have shown that unless these replace the whole of the corresponding trade operations, the number of operations necessary to complete what is left of the traditional work is likely to be increased, each change of operation

resulting in unproductive time so that little economy in overall cost or time is achieved.

To illustrate the practical success of rationalisation, we can take a practical example of what the effect of a number of measures aimed at economic construction was on operating costs and the cost of new buildings, and the degree to which the buildings have actually been made less expensive by these measures. In 1952 the Housing Ministry of the Federal republic of Western Germany had groups of 50 dwellings built in accordance with identical plans in ten different towns.⁴ The choice of the materials and the form that the construction was to take was left to the local authorities.

Figure 5.5 shows in ten columns the costs of construction of these ten groups. Although the plans were identical the costs of construction are different. This was the result of the differences in materials used and in organisation. These results were analysed and passed on to the participants in all the towns. Two years later, the same groups of dwellings were built again in accordance with the same plans, using the same architects, firms and job superintendents. The experience gained in the first construction period was then applied. The ruled columns show that in most cases identical dwellings were built at less cost, with one exception - the second column from the left. In that case other circumstances prevailed. The greatest saving was achieved in the third example from the left, with nearly 30 per cent. The total number of working hours differed from town to town. However, for rough

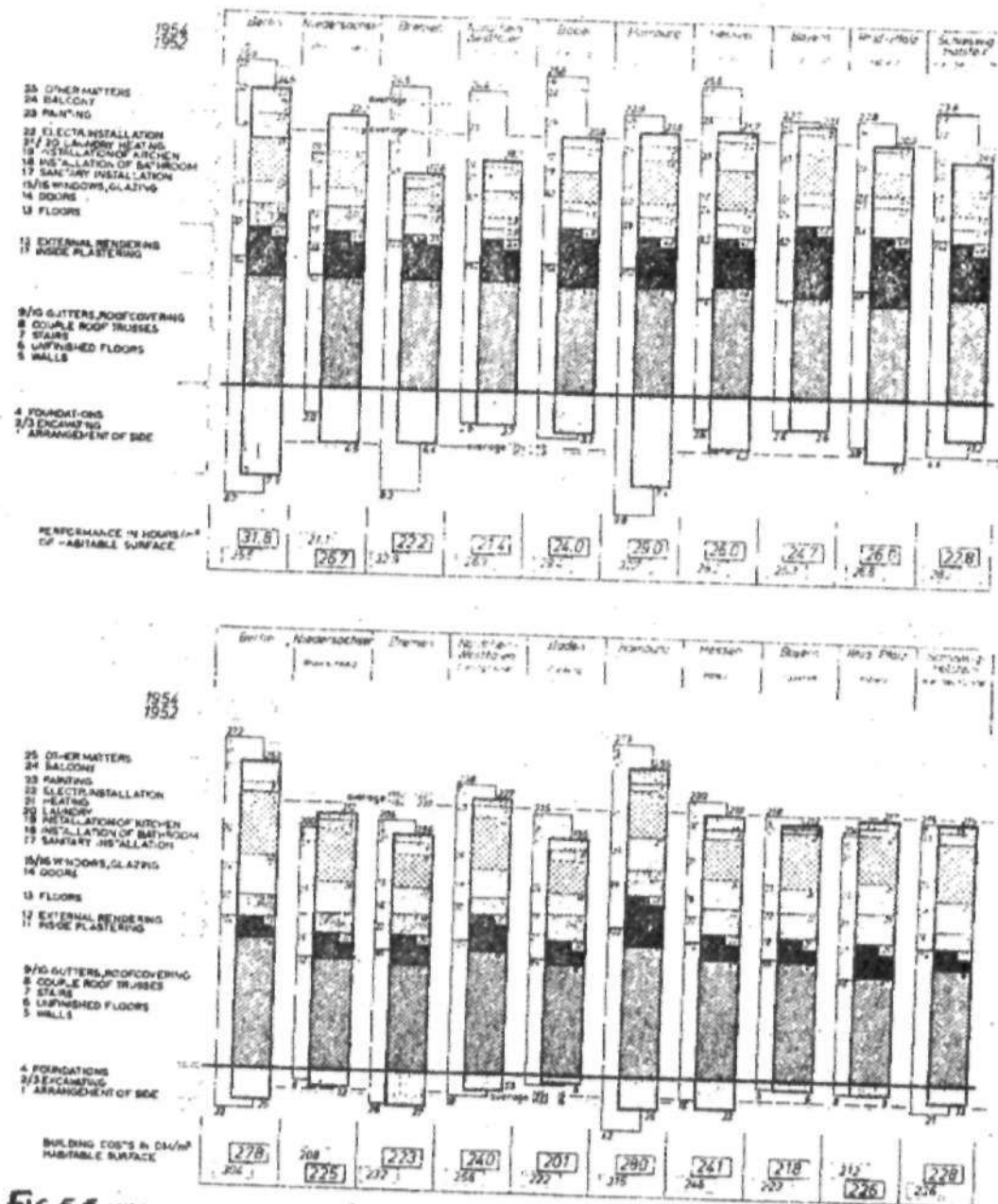


FIG 5.5 White columns: operatives top and costs bottom for the construction of 10 groups of houses built in 1952 in ten towns in West Germany. Shaded columns: the same indications for 10 groups of similar houses built in the same towns in 1954 on the basis of the experience gained during the first execution.

construction the same number of working hours was achieved in all cases. It may therefore be presumed that in this respect, a peak of rationalisation had already been reached.

These few examples taken from among a large number of results of scrupulous research clearly illustrate that both traditional and non-traditional techniques can be developed more rationally. They also illustrate that efforts to achieve rationalisation and industrialisation in building are definitely rewarded with increased productivity.

5.2.0 PLANNING THE WORK

Many managers in this country are of the opinion that conditions are so uncertain that planning is only a time wasting exercise. This should not be so, for how can one exercise control over the progress of the work if the work is not planned? Admissibly most firms plan their work in some form or the other but few do so on much detail and commit these plans to paper. Now however increasing complexity of construction work means that proper management and control of costs during the construction process is essential if the building is to be carried out efficiently in terms of time and money.

Only through proper planning can aids to productivity such as mechanisation, incentives and efficient use of labour prove to be effective. The construction programme can be used as a basis for organisation, performance appraised and control. The primary

function of the programme therefore, is the promotion of satisfactory organisation and flow of the various construction operations during the course of erection by planning in advance the times and sequences, labour, materials and equipment requirements.

5.2.1 ADVANTAGES OF PLANNING

A good plan offers the following advantages:

- i) it will show the quickest and cheapest method of carrying out the work consistent with the available resources of the contractor.
- ii) It will ensure continuous productive work for all operatives employed and reduce unproductive time to a minimum (by proper phasing of operations with balanced labour gangs in all trades)
- iii) Permit the establishment of equitable bonus targets thus ensuring effective operation of incentive schemes (by facilitating assessment of level of productivity of all trades).
- iv) Highlight likely problems so that ~~the~~ steps may be taken to correct or avoid them
- v) Determination of attendance dates and periods for all sub-contractors' works.

- vi) Provide information on material delivery dates, quantity and capacity of plant required and period.
- vii) Provide a simple and rapid method of measuring and controlling progress.

All these result in overall speed and economy of operations - substantially increasing productivity.

5.2.2 PLANNING METHODS AND PROCEDURES

Planning involves a realistic assessment of the job; determining the sequence and timing of the operations and the labour content of each. This then has to be communicated clearly to the users as a master programme by means of:

1. Bar chart
2. Network or critical path diagrams
3. Line of balance

and whichever method is adopted, it should:

1. be based on clearly defined objectives
2. be simple to understand.
3. be flexible, to facilitate revision
4. provide standards, so that control can be maintained
5. provide a suitable balance of work, so that labour, once off the job need not return.

6. make for maximum utilisation of all resources and reduction^{of} idle time.

5.2.21 THE BAR CHART

This has found widespread use in the industry because of its simplicity and the ease with which it can be prepared. In its simplest form it consists of a number of bars depicting the different activities of the construction project and their duration times (Fig. 5.6).

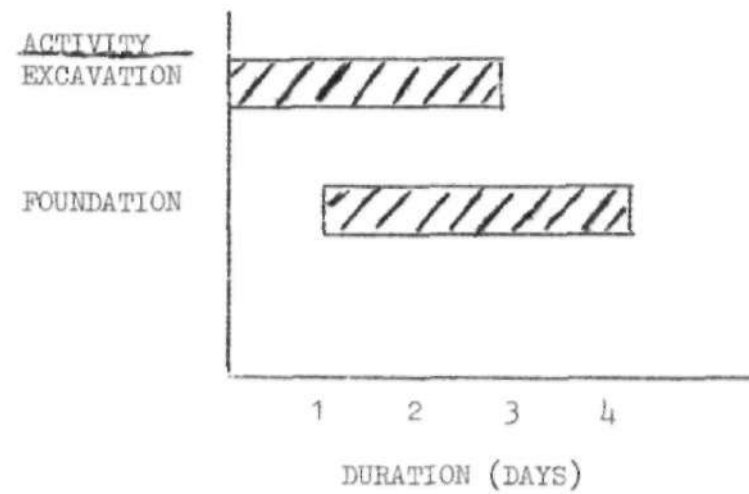


Fig. 5.6

5.2.22 NETWORK DIAGRAMS (THE CRITICAL PATH METHOD)

This is a relatively new form of planning used in the building industry. First developed in the United States to

ensure successful completion of the "Polaris" submarine project, it proved so successful on this mammoth task which called for the control and co-ordination of hundreds of main and sub-contractors, that the submarine was in service three years ahead of schedule.

The "critical path method (CPM)" is only one of various types of network available, but is the one that seems to have found its mark in the planning of construction work.

Although the critical path method does not solve all the problems of the contractor, it does help to spot and highlight some of them so that corrective measures can be taken. In application, it offers the following advantages over the bar chart:

- (a) It separates the time element from the sequence of operations at the preparatory stage of the plan.
- (b) It shows those activities whose timely performance are critical to the overall duration of the project.
- (c) enables optimal resources allocation while ensuring that critical activities are not disturbed.
- (d) it clearly shows the inter-relationship between all the activities comprising the project.

Fig. 5.7 shows a simple network diagram showing only the sequence of activities comprising the project. The dotted line (arrow) from (7) - (8) and (10) - (11) are called dummies, and are used to show the inter-relationship between the activities, giving a logical sequence. They are not real activities and therefore have no time duration. Dummy (7) - (8) for instance is used only to indicate that 1st fix cannot start until both partitions and roof structure are completed.

The network diagram, when fully developed will indicate activity durations, earliest start times and latest start times. It can then be analysed to identify the critical path or paths. The completed network programme can be presented in bar chart form to take advantage of the latter's simplicity of presentation.

5.2.23 THE LINE OF BALANCE

This method, though long used in factory production line situations, has only been adopted for construction work as recently as the early 1970s. It has since proved effective in application to repetitive construction work, particularly in planning for the construction of housing and flats with similar floors.

Its aim is to eliminate non-productive time, thus substantially reducing the period taken to build units. It is

achieved by ensuring that identical operations are carried out repeatedly on successive units by, if possible, the same operatives thus ensuring a continuous flow-line type of production with the attendant advantages of rationalisation described earlier in this chapter.

Figure 5.8 shows a line-of-balance chart for six small factory blocks to be erected on an industrial estate with one unit being handed over every four days, the total project period being 54 days.

5.2.4. THE PLANNING PROCESS should normally begin at the tendering stage. This is because the plan of work affects the estimate and could therefore determine whether or not the contractor gets the job. Planning at this stage involves determination of the nature of the work and its labour content in order to decide the methods to be adopted, the type and number of plant that will be required and the time periods involved. Upon acceptance of the tender, an overall working programme will be prepared. The planning process can therefore be broken down into the following steps:

1. Pre-tender planning
2. Method statement

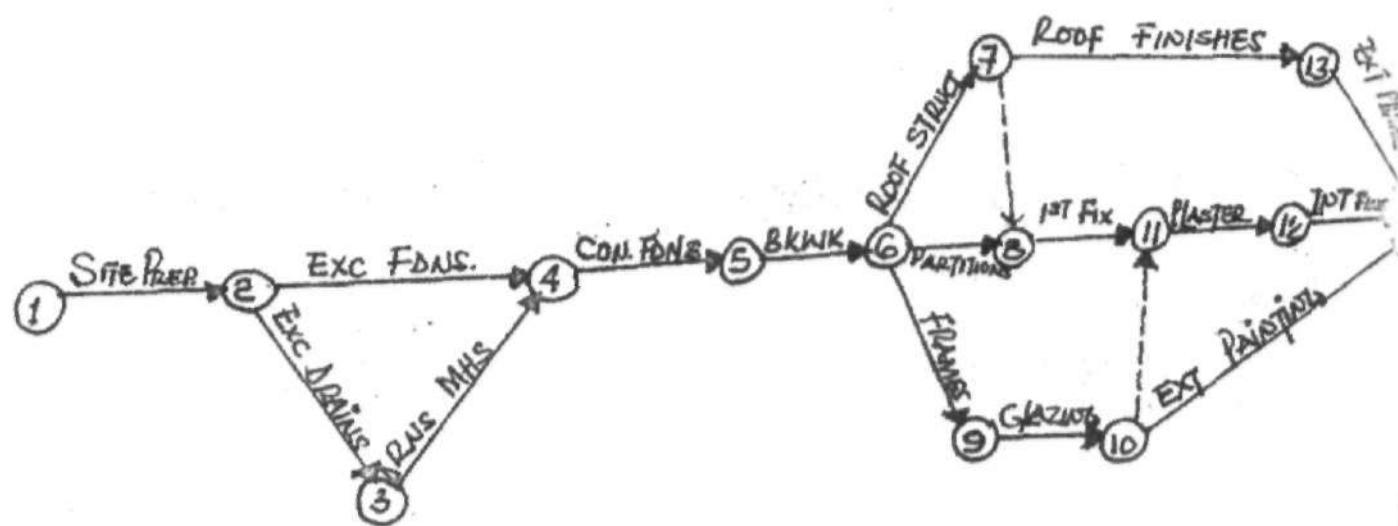


Fig 5.7

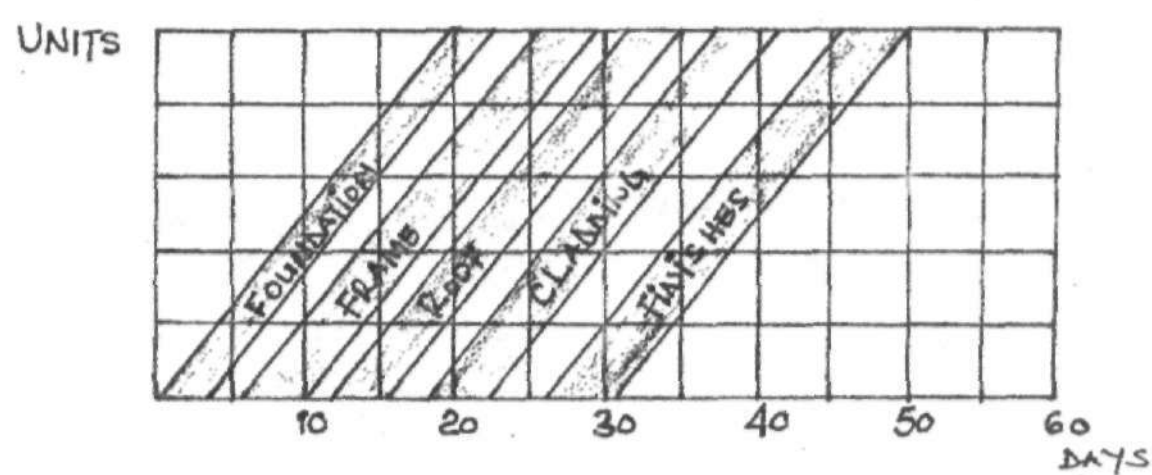


Fig 5.8

3. Plant schedule
4. Outline or overall programme
5. Short-term planning

The last one, short-term planning, is necessary to smooth out deviations from the overall programme, which are likely to occur during the course of the project, as well as to ensure satisfactory allocation of resources as the work proceeds. It is usually carried out in two stages; monthly and weekly, the latter being prepared with the greatest degree of detail to ensure that labour, materials and plant will be available when required and that steps are taken at the earliest time possible, to bring back in line those activities deviating from planned progress.

The method statement involves examination of the methods available for each operation, taking into consideration whether the cheapest or the fastest method is required, and the resources at the contractor's disposal. This does not mean that decisions must be made concerning the alternative ways of doing every operation - these will have been decided, for the more common operations, by custom, experience and equipment available. However, there are often choices to be made concerning operations that are important enough to justify the making of detailed comparative studies.

The plant schedule is prepared on completion of the method statement and is essentially a summary of all the plant and equipment required for the construction of the project including as much relevant detail as possible.

5.2.5 CONTROL

For any programme to be successful, some form of control is essential to ensure that actual performance on the job is as close to planned performance as conditions will allow.

This can be done by regularly reviewing progress on all operations and checking actual performance against planned performance. Weekly review and planning will help to ensure early detection of deviations from the plan so that corrective steps can be taken. Regular site meetings will facilitate early identification of and settlement of problem areas since timeliness is essential for maintaining adequate control.

5.3.0 MATERIALS MANAGEMENT

Many different materials and components varying in sources, physical and other characteristics go into the construction of any building or civil engineering project. These materials and components constitute about 60% of the cost of the project and

their differing characteristics have therefore made the supply and control function an important part of the construction management function. These characteristics as well as the numerous methods of handling and processing the raw materials to make up the project also necessitate careful control of the methods of handling, storage and use. The materials management function thus consists of four basic aspects all of which influence to some extent, the rate at which work can proceed, the cost of materials used and the cost of processing these raw materials into the finished project. These aspects are:

1. The supply function
2. Store-keeping and inventory control
3. Materials handling
4. Control and reduction of waste

5.3.1 SUPPLY

No construction project can proceed without an adequate supply of raw materials. Careful phasing and planning of material requirements is essential if the project is to be constructed successfully. The main objective of a good procurement programme is to purchase materials at the minimum overall cost consistent with suitable quality and availability. Firms in the construction industry are

handicapped in this regard by acute material shortages caused by politically induced fluctuations in activity, and the general inability of builders' merchants to stick to fixed prices for a reasonable period of time. Nevertheless, since the contractors' expenditure on materials amounts to about 50% of the cost of a project, careful control must be kept of material purchases.

The best practice will involve enquiring from suppliers or manufacturers, as the case may be, about prices, delivery dates etc. for use at the estimating stage of the project. This would be used by the estimator to prepare the tender, and if successfully bid, for the contractor to place orders with the supplier, chosen on the basis of the following considerations:

1. Previous experience with the supplier, if any.
2. Reliability
3. Suitability of the material to be supplied
4. Adequacy of available supply
5. Delivery schedule
6. Price, including:
 - (a) Trade discount
 - (b) Cash discount
 - (c) Bulk discounts
7. Do materials meet required specification?
8. Other, special, considerations.

Even after a contract is entered into with a supplier, it may be necessary to keep checking on him to ensure and expedite delivery. To enable quick checks to be made on delivery or non-delivery of materials, a card index system is recommended to enable the buying department to keep a constant eye on supplies. These cards should contain all necessary information and be filed in date order for easy reference. The extra time and trouble taken to write out a card for each delivery substantially reduces the chance of losing sight of the delivery date as regular checks can be made on the file. (Fig. 5.9 illustrates the general material supply procedure).

5.3.2 STOCK CONTROL AND STORAGE

This is necessary not only to ensure that materials are ordered in good time, but also that a close watch is kept upon planned delivery dates. Schedules will be required so that reference can be made quickly as to when and from whom deliveries are required. Material in short supply or late delivery should be chased up immediately, with possible alternative materials or suppliers being sought.

A competent storekeeper is a necessity on any sizeable contract, both for the adequate control of bulk stocks and the identification of receipts and issues, the operation of minimum

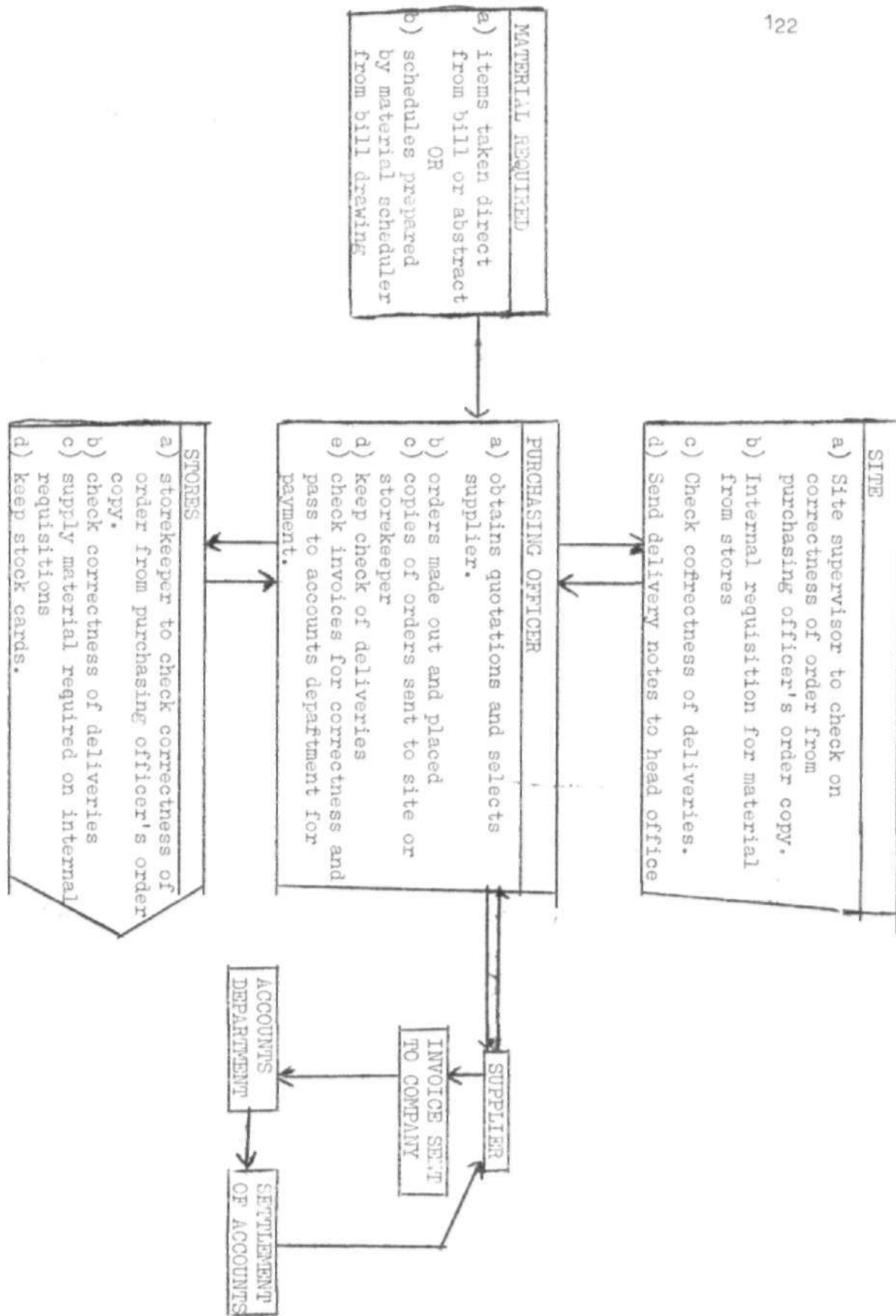


FIG. 5.9 THE MATERIAL SUPPLY PROCEDURE

re-order levels, accounting for returnable packages and empties, transfers between contracts, and loan issues to site personnel, disposing of scrap, annual stock-taking, and security arrangements.

5.3.3 SECURITY

Many items of building materials are stolen each year from construction sites. It is unlikely that any contractor can claim to be completely free of the destabilising effect of these losses. Loss may be suffered not only to outside persons; materials and small hand tools are lost through pilfering by operatives. Such disruptions of productive capacity can be controlled by adopting some basic security procedures:

- (a) Small items such as door furniture, plumbing, fittings, etc., should be issued by storemen, the foreman or other responsible person and records kept.
- (b) Maintaining accurate stock control with regular checking.
- (c) Keep compounds and storage sheds locked.
- (d) Vehicles should be allocated space away from the construction so that 'loot' cannot be easily transferred to them.

Site security can be a problem and it is difficult to lay down hard and fast rules and precautions that may be followed on

MATERIAL	METHOD OF STORAGE						STACKING	REMARKS
	Open Site	Hard Standing or Divided Bins	Lock Up Ground or Compound	In Partially Completed Building	In Weather Proof Lock Up Shed	Delivered As Required For Use	Open Site with Protection From Rain	
CEMENT					X	X		Off Ground 5' Use in Rotation First in First
AGGREGATES		X				X		Prevent Deterioration and Separation
CONCRETE BLOCKS							X	Near to Point of Use
CLADDING TIMBER							X	Raise of Ground Seal Ends
WINDOW AND DOOR FRAMES			X				X	stack in sizes Support Evenly
GLASS			X				X	Stack in Sizes off Ground
GLASS				X				On Bearers in Bundles
GLASS				X				Tie in Ends of stacks
GLASS				X				Leave in Packing Cases In Boxes
GLASS				X				Upright on Bearers in Sizes & Types
GLASS				X				Near to Point of Use
GLASS				X				Tie Ends

Fig. 5.90 Storage and Protection of Materials on site.

all sites. It is necessary to ensure that professional criminals, vandals and curious visitors who may ignorantly cause damage are kept off the site. This may be achieved by constructing a hoarding around the perimeter of the site. When this is adopted, it is advisable to use open hoarding such as chain link fencing with a few strands of barbed wire on top. This will ensure that the seasoned criminal who could break in does not get the chance to work undetected as he would if the site were enclosed.

On the site, movable items and small items of plant should be locked away so as not to provide temptation for the weak-minded operative. Careful ordering to ensure that stock on site is kept to a minimum so as to deter would-be thieves who would consider a "dry" site not worth breaking into. Floodlighting is advisable where valuable items have to be kept on site overnight - this would help deter night marauders.

5.3.4 MATERIALS HANDLING

Much of the work of operatives on site has to do with the handling or movement of raw, worked, or prepared materials. When materials are received on site, they have to be moved from the cars or trucks in which they are transported, to their storage point. After they have been checked they may be stored or transferred to their point of use. Consequently, construction operations

have to do with or are directly affected by materials-handling. As illustrated in section 5.1.1, careful consideration of materials handling problems can reduce construction time by as much as 20% or even more. Materials handling should therefore be seen as an important factor ~~in~~ productivity on the construction site.

A good materials-handling arrangement will make possible faster movement of raw and processed materials to their point of use. This results in shorter erection times. Careful or proper handling will also help to reduce damages or wastage. These can be facilitated by a rational organisation of the site and using appropriate mechanical devices to aid in the handling process. Work study techniques such as string diagrams (described in Appendix C) can be used to evaluate alternative arrangements of the site to reduce ~~to reduce~~ handling and storage requirements. Careful phasing of supplies will also help to reduce double handling if materials can be brought to site as and when they are required so that they can be taken straight to the point of use.

5.3.5 CONTROLLING WASTE

Since the search for higher productivity calls for a critical appraisal of all resources, the problem of waste materials cannot be ignored. Admissibly, some amount of waste

cannot be avoided in construction work. Nevertheless, the large amount of construction material which, due to varying circumstances become classified as waste, represent an intolerable reduction of facilities. It is a problem which calls for control through careful watchfulness on the part of the supervisor.

Operatives have to be educated on the importance and value of materials and, if necessary, they may be fined for any malpractices which result in avoidable waste through individual carelessness or mischief.

Ironically, it is the small everyday items which are the biggest cause for concern; valuable items are generally handled and stored carefully. Because such small items each cost very little, sight is lost of the fact that if a large number is wasted, the cost can be very high. For example the block - though costing only about 70 kobo each; if the number that are broken in handling, lost through bad storage, thrown under lorries that get stuck, buried under piles of aggregates, etc. are considered, this adds up to a high percentage of the total and thus a considerable drain on resources. When one then considers the fact that this applies to many other such materials, the need to reduce waste becomes obvious. This may be done by:

- (a) Ensuring that materials are only delivered as required so that site storage time is minimised. This will entail careful phasing of deliveries between site and supplier. This eliminates the false impression of over-abundance created by the availability of large quantity of a material on site.
- (b) Ensuring that materials supplied are those specified for the job.
- (c) Issuing just the right amount of material with only a reasonable allowance for inevitable waste.
- (d) Ensuring that excessive amounts of "offcuts" are not being produced.
- (e) Preparing and allocating storage areas. This may be done by marking the exact positions of material storage areas on the site plan. These can then be marked with pegs or similar signs to enable drivers locate their off-loading points. As discussed in the preceding section, one should try to ensure that materials are re-handled as little as possible and that they are placed as close to the final position in the structure as room allows.
- (f) Making sure that stored materials do not deteriorate (A material storage schedule is given in fig. 5.10 as a guide).
- (g) Collect waste material which is likely to be re-usable.

5.4.0 MECHANISATION

The object of mechanisation is to increase production, reduce costs and reduce or even eliminate the heavy manual labour which is characteristic of many building operations. By replacing manual labour by machine operation, one can achieve the triple advantages of increased labour productivity, speed and, in favourable circumstances, improved quality and reduced costs.

How this can be achieved involves mainly organisational and terotechnological considerations. In simple cases, the mere substitution of a machine for a number of men may produce all the desired effects; eg. in large earthmoving operation and concrete mixing. More often though like in the introduction of machinery into manually based skilled work, planned or organised mechanisation is called for. This implies a rational use of plant in order to ensure continuous or full utilisation of the plant in order to justify the usually high initial cost of mechanisation.

Furthermore, the introduction of machines into the building process requires an understanding of their limitations and how they can assist the building process. One must understand that mere savings in manual labour will not necessarily produce an overall saving.

Nevertheless, the introduction of suitable mechanical aids, by replacing unskilled labour in particular, can result in

reduced labour costs and, by increasing the speed of construction, can result in earlier completion, enabling the building owner to occupy the building and recover his capital at an earlier date. It may also enable the contractor to carry out operation for which manual labour is not available or is in short supply or to carry out work which cannot be done either economically or physically by manual labor. Its introduction can also reduce the effort required to be made by the operative in carrying out his work and can improve his working conditions.

However, haphazard mechanization will not necessarily meet the objectives stated above. Efficient utilisation of mechanical plant depends on a number of factors which need to be given careful consideration at the outset of each job. Careful planning of the whole job, therefore, is essential and the following are the factors which must be dealt with.

- (a) Nature of job and site.
- (b) Relationship between operations of plant and those of men
- (c) Careful planning and programming of the whole contract.
- (d) Suitability of the design.

5.4.01 Nature of job and site

On large sites, provided work is satisfactorily planned, mechanisation will usually be advantageous. However, this is not necessarily so with smaller contracts which are likely to be carried out by traditional method wherein a large proportion of the work is skilled craft work which is difficult to mechanise. Also, ~~the most~~ ~~the~~ machines are usually highly specialised compared to operatives who are extremely versatile and can readily be moved from one type of operation to another within their competence with little loss in productivity. A large contract would normally have sufficient work of various types to justify introduction of specialised machines and enable them to be used economically.

Nonetheless, there are available a number of small plant designed primarily for the small builder which make it economic for him to employ them on many contracts.

Site considerations also have considerable influence on the choice of mechanical plant and site conditions must be suitable for its safe, efficient and economic use.

5.4.02 Relationship between operations of plant and of men

It is important, especially in mechanical handling, that

the number of men working on any operation be correctly related to the output of the mechanical plant serving them. This is necessary in order to avoid the plant being idle from time to time while men use the material already delivered to them. For example, concreting gangs must be related in size and numbers to the size of concrete mixer used so that each load of concrete can be received and placed by the time the next load is ready for delivery. Since the number of men that can work efficiently on any one site is limited by the size of the job, the nature of the structure and other considerations, this would limit the size of mechanical plant capable of being used to advantage.

5.4.03 Careful planning and programming of the whole contract is essential in order that the plant is occupied to the maximum extent while on site. Rational planning and organisation of the work enables the cost of the machines to be spread over the maximum amount of work. This would in itself also lead to greater productivity.

Ideally, the sequence of all operations throughout the job, mechanised or manual, should be so arranged that no plant on the site is ever idle. This requires careful consideration in the choice of plant for each particular set of operations to ensure

that it will always be working to full capacity, though neither too quickly nor too slowly for the manual work to which it is related.

5.4.04 Suitability of the design of the building

For full benefit to be derived from the use of mechanical plant, all aspects of mechanisation and building methods should be considered at the design stage so that when the contractor takes over, the work can be arranged in a manner suited to mechanical rather than to wholly manual operations. The architect should be aware of the nature and capabilities of various types of mechanical plant and of the factors which are likely to make their use of greatest value. These include continuity of operation and the use of plant maximum capacity every time it is operated. For example, where precast concrete panels can be small or large units, a crane would be more economically employed in lifting them if the panels are designed as large units whose weight is almost the maximum lifting capacity of the crane likely to be used for the job. The cost of hoisting the large or the small panel will be pretty much the same so that the relative cost of hoisting a number of the small panels equivalent in area to one of the larger panels will be high.

Simplification in design, particularly in constructional detailing is also necessary to assist the mechanisation of

building and should be a normal process in architectural practice if greater advantage is to be taken of commonly used plant.

5.4.10 PLANT MAINTENANCE

The maintenance of mechanical plant is essential if maximum efficiency and utilisation is to be obtained. Breakdown of machinery during construction work can disrupt production, and in some instances result in spoilage of partially processed materials and idle time while men wait for the machine to be repaired or replaced. Thus the cost of non-maintenance is really more than just that of repairing the plant and restoring it to good condition after it has broken down. In addition there is the risk of defective plant causing injuries or even death. Thus it can be seen that the consequences of non-maintenance are multiple, so the need for preventive maintenance is not just to prevent breakdown of the plant.

In addition, since productivity of mechanical plant depends on the level of utilisation, the plant has to be kept in good working condition through proper maintenance. There are two approaches to maintenance; preventive maintenance and breakdown maintenance.

5.4.11 PREVENTIVE MAINTENANCE (PM), as the name implies, aims at preventing or at least minimising the frequency and cost of breakdowns. The fewer the number of breakdowns, the greater the efficiency of the plant or its utilisation. Two aspects of preventive maintenance may be distinguished. The first aspect is PM - inspection through which many malfunctions can be discovered and corrected before they develop into breakdowns or emergencies. The aim of PM - inspection should be to discover and diagnose incipient failure - a breakdown just about to occur. The breakdown may be only a few days or weeks away. PM - inspection involves looking at, feeling, listening to or testing the machine or parts of it. It should aim at finding something wrong rather than finding something right.

The other aspect of preventive maintenance is often termed "routine maintenance." It includes lubricating, adjusting, tightening, cleaning and the routine overhaul or replacement of parts. An important consideration in routine maintenance is to make sure it is done according to a definite time schedule prepared for the equipment or facility on the basis of experience or the recommendations of the manufacturer. The procedure must be specified and rigidly followed. If this is done, the frequency and severity of breakdowns will often be reduced.

5.4.12 BREAKDOWN MAINTENANCE (BM) This approach involves foregoing preventive maintenance and using the plant until it breaks down. Only then is maintenance undertaken.

Although this may seem irrational, those who favour this approach cite savings in time and money over preventive maintenance. They are interested in maximum utilisation of the plant while it works or "can't afford" the naira cost of preventive maintenance. Moreover, experience shows that despite all preventive maintenance efforts, breakdowns will still occur - then breakdown maintenance becomes necessary. The aim of the breakdown maintenance approach is to postpone the costs of maintenance as much as possible or, at least, till there is a breakdown.

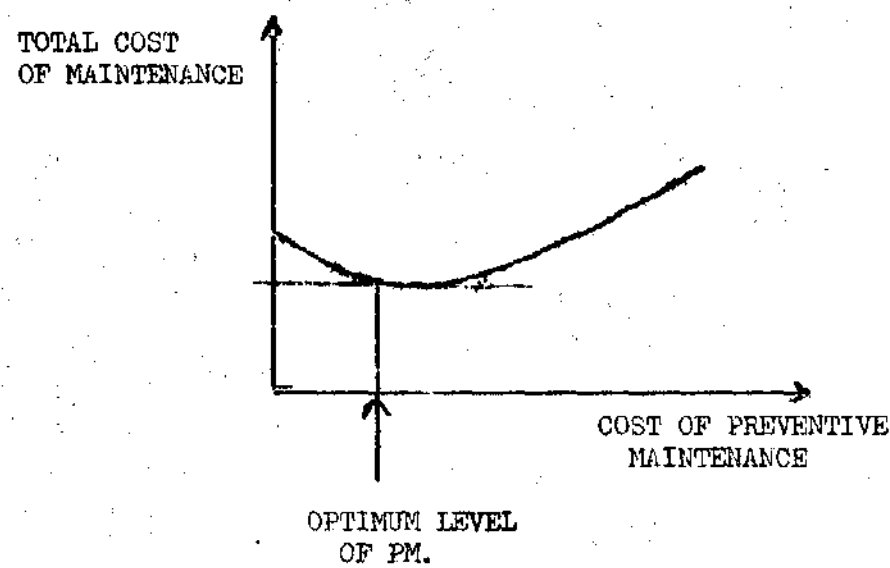


FIGURE 5.11

5.4.13 MINIMISING THE COST OF MAINTENANCE.

Since our aim is to maximise productivity of all resources at our disposal, we would want to strike a balance between preventive maintenance and breakdown. There would be no point in spending more than the minimum time and money necessary on preventive maintenance especially if some breakdown maintenance remains inevitable. The question, therefore, is what amounts of preventive and breakdown maintenance to undertake so as to lower the total cost of maintenance.

Generally without preventive maintenance the cost of breakdown is very high. As the amount of preventive maintenance is increased from zero, there is a decrease in cost of breakdown. The result is a decrease in the total cost of maintenance. As the saying goes, an ounce of prevention is better than a pound of cure. However, as the level of preventive maintenance is further increased, a point is reached beyond which the cost of preventive maintenance outweighs the reduction or savings in breakdown costs. Beyond that point, the total cost of maintenance increases as the level of preventive maintenance is increased. (Figure 5.11). There is therefore an economic limit to the use of preventive maintenance. To determine this limit, it is essential to assess, as accurately as possible, the following important factors;

1. The mean time between failures (MTBF).
2. The costs of breakdown
3. The cost of preventive maintenance

The mean time between failures is the interval between failures or breakdowns. This may be measured in hours for plant, or in kilometres for vehicles. Data on this can be obtained from the manufacturer of the equipment or other, more experienced users.

5.4.2 PLANT MATCHING

Where the nature of a job warrants the use of various types of plant in conjunction with one another (for example, lorries with an excavator, concrete mixer and wheelbarrows), careful matching is essential for the plant to be kept working at maximum efficiency. E.g. Transport units must be such that output plant is not delayed by having to wait for an empty one, thus number of transport units required is:

$$\frac{\text{Output per hour}}{\text{Carrying capacity of transport unit}} + \text{one extra}$$

transport unit to ensure maximum productivity - No waiting. The carrying capacity of the transport unit is given by:

Effective load per trip X number of trips per hour. Time of trip is made up of: (a) Loading time (b) Unloading time (c) Travelling times which includes (i) outward haul (loaded)

(ii) return haul (empty) (iii) manoeuvring in position at both ends.

It will be useful to keep records of plant progress to ensure that planned output is being achieved. Plant requirements should be controlled by preparing a plant schedule from the pre-contract method statement.

5.5.0 SAFETY ON THE CONSTRUCTION SITE

The importance of safety and accident prevention measures on the firm's productivity may not be immediately obvious since an attempt to estimate the cost of accidents would probably be inaccurate. Apart from losses to the injured person, the employer suffers losses from the following:

1. Wages or benefits paid to the injured employee.
2. Cost of replacing the employee
3. Damage to plant, materials, or structure caused through the accident.
4. Working time lost through helping the injured person
5. Production time lost through other operatives stopping work because of curiosity or sympathy, especially if the accident is fatal, when morale on site would be seriously affected and work can eventually come to a stop, causing the site programme to be delayed.

6. Time taken to investigate and report the accident.
7. Increased insurance premiums, and other such items.

Considering all these points, the importance of safety on the construction site cannot be over-stressed and must be given due regard from top management through to operative level. On top of legislative requirements, a well planned and neat work site, well-maintained equipment, first aid facilities and safety training is essential to cut down on and minimise the effect of accidents on the job site. On large sites, employing a full time safety officer or engineer could well yield dividends to the productivity conscious firm.

5.6.0 WORK SIMPLIFICATION

"Waste in unnecessary fatigue is not only an economic waste, it is a waste of life, and it calls for the immediate attention of everyone of us, whether interested in the individual, the group, or the economic prosperity of our country" - Frank Gilbreth (1869 - 1924).

The present search towards higher productivity has been preceded by man's struggle since the dawn of history to lighten the burden of his daily effort - to simplify the work process. Wherever work is performed, there is the problem of finding the most economical way of doing it.

'Work study' has evolved over time as a means of finding ways to improve, to simplify ways of doing work. It is concerned essentially with the human aspects of work and it encompasses not only human relations, but also a good number of work simplification techniques. Its scope is such that detailed treatment is not possible here. It may, however, be worthy to note that the purpose of work study is to provide factual data to assist management in making decisions and to enable them to utilise available resources (i.e. labour, plant, materials, etc.) with maximum efficiency by applying a systematic approach to problems instead of using intuitive guesswork.

Work study has two main aspects method (or motion) study and work measurement (or time study). The latter, work measurement, originated by Taylor, was used mainly for determining standard work times while method study, developed by the Gilbreths was employed largely for improving methods, or simplifying the work process.

5.6.11 METHOD STUDY

This is the study and recording of existing or proposed ways of doing work so that careful and critical examination can be applied to evolve easier and better ways of doing it.

Figure 5.12 shows the outline of the procedure with the various stages in order of study.

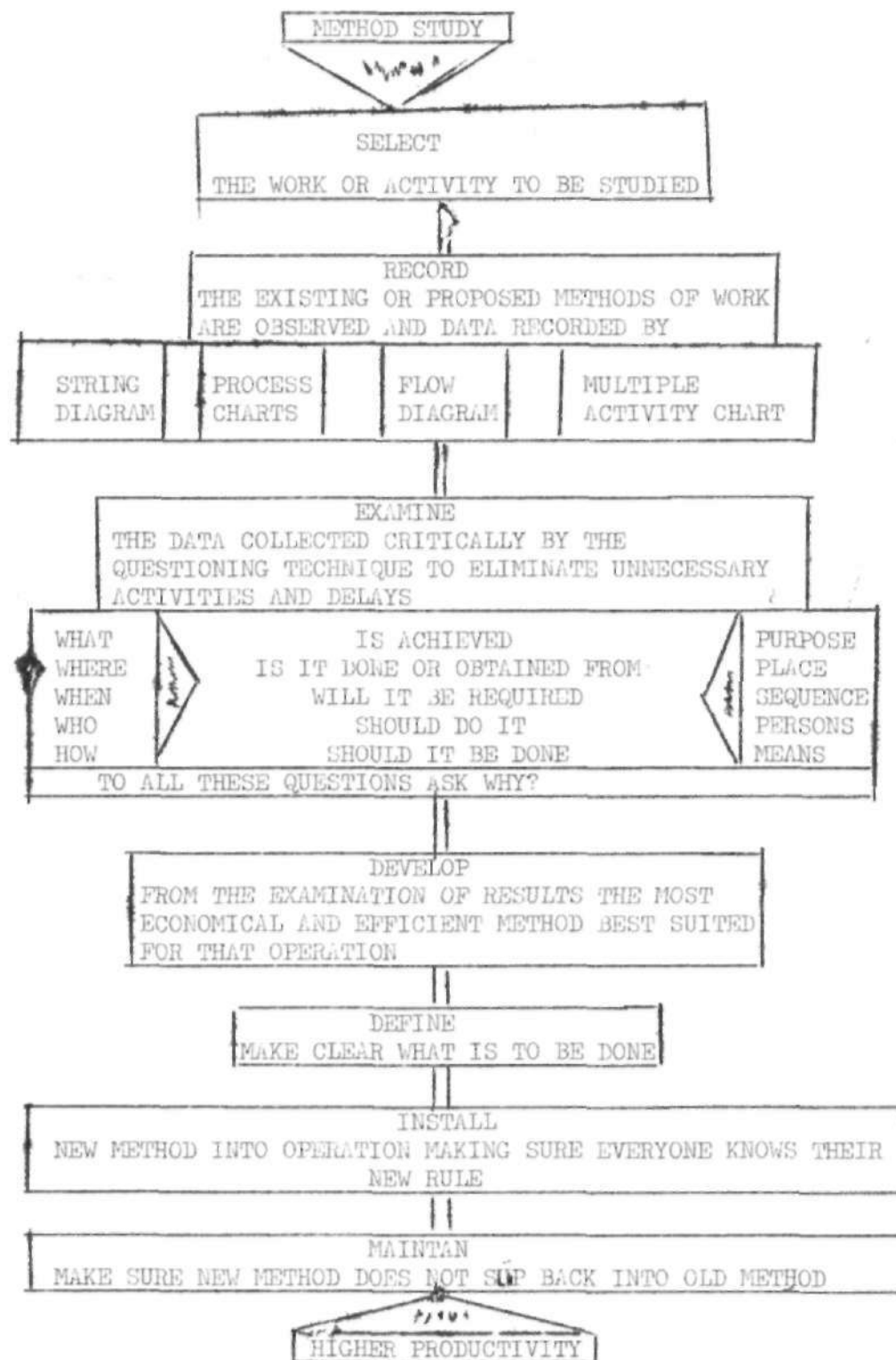


FIG. 5.12.

5.6.12 **TECHNIQUES OF METHOD STUDY.** Three main groups of recording techniques are available for setting down method study problems. These are charts, diagrams and/or models, as well as photography. A short description of some of these techniques is given in appendix C.

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5.6.12 **ILLUSTRATIONS.** Three main groups of recording techniques are available for setting down method study problems. These are charts, diagrams and/or models, as well as photography. A short description of some of these

CHAPTER 6.0

MINIMISING NEGATIVE INFLUENCE OF EXTERNAL FACTORS

We have already acknowledged the fact that the construction industry exercises much less control over its market than do most manufacturing industries (Section 2.2.1). Many of the factors that affect productivity are imposed from outside the construction organisation. Happily, these externally induced problems are not the greatest influencers of productivity (Section 3.3.0). Nevertheless, organisations in the industry must be able to manage their affairs in such a way that the effects of any external intrusions on their productive capacity are accommodated with the least disruption of their activities. External influence on the organisation must be tackled squarely and if possible, harnessed to work for the benefit of the company. How this can be done may not be immediately obvious but one can at least take a close look at the problems involved and attempt to analyse them in order to evolve a workable line of action which would at least reduce their negative effects on the organisation's level of productivity.

To do this, one must first look at those of the more common external factors affecting productivity. Only then can one attempt to introduce managerial practices for minimising their negative effects.

These external factors are:

1. Government (regulations)
2. Labour unions
3. The client
4. Sub-contractors
5. Weather conditions

6.1.0 GOVERNMENT REGULATIONS

The expanding role of government in nearly all functions is probably one of the most significant factors influencing productivity of the firm from the outside. It is infact listed by our respondents in section 3.3.0 as the most influential (coming before weather, variations, unions, etc.). There is no doubt that government regulation of business as well as stringent control of labour and the importation of materials adversely affect many organisations. While government intervention is not a new or entirely unwelcome experience, recent trends and government encroachment into new regulatory areas can, and have had, an unsettling effect on the productivity and well-bding of some firms in industry. What with import restrictions, austerity measures and, with the advent of politics, new labour laws, minimum wages, etc. There seems to be no going back.

The most obvious solution open to contractors and other

businessmen is to be more active politically, more vocal and quick to express their opinion on matters pertaining to their operations, lobbying where necessary to influence those decisions that concern them. It would not be out of place for the industry's giants to encourage and aid candidates, who are aware of and sympathetic to their problems, in their bid for election. Unless this is done, the industry may continue to be plagued with policy decisions that are not in their best interests and which can adversely influence internal efforts aimed at improving the industry's productivity level.

7.2.0 LABOUR UNIONS

- MAKING THEM WORK FOR YOU

We have already discussed the ways in which labour unions can retard productivity in the construction firm (Section 2.3.2). We also recognised that no construction project can proceed successfully without satisfactory labour relations. There is no doubt that labour unions exercise a great deal of influence; the point is that such influence does not need to have a negative connotation.

Happily, the Nigerian construction industry does not appear to be troubled so much by union influence as some other industries (such as the railways for instance). Except

in the largest organisations, workers have little or no union affiliation probably because of the high mobility of labour in this industry. Managements can, infact, exercise much more influence on labour than is immediately obvious to them. Apart from the usual motivational incentives, direct management-worker relations is possible, even on the largest sites. For one thing supervisors, at least, will be in close contact with both top field management and workers. Additionally, Onyemelukwe points out that, interest in unions appears to be "negative rather than a positive participative action."¹ He notes hunter's observation that "workers pay their (union) subscription in order to conform and (no doubt) to avoid an element of intimidation in some cases". Observing that workers prefer to take their personal problems to the manager or supervisor, Onyemelukwe also suggests that "recourse to the union (only) came when there was a question of having to face the might of management's arbitrary use of power." According to him, "the wide gulf that exists between the ordinary worker ... and his union clearly indicates that one cannot get to him through the union." Perhaps the abject failure of the recent "nation-wide" strike organised by the Nigerian Labour Congress (NLC) lends credence to this opinion. This is a pointer to the fact that workers can readily grasp management's problems and aspirations if these are properly put across to them.

Nevertheless, unions do have some influence and it is this influence that managers need to curtail or harness for the mutual benefit of both the organisation and its workers. Here the task is made easier by the increasing awareness among union leaders, of the relationship between productivity, living standards and job security. The effectiveness of collective bargaining can be enhanced and union leaders encouraged to take part in productivity improvement plans if these can be shown to ~~be shown to~~ be beneficial to them - motivating them through expectancy alignment or by productivity bargaining. This approach, labelled "selling productivity" to workers (section 2.3.2) may be adopted by widespread use of appropriate incentive systems or making labour part of the "productivity team" - getting workers more involved in the planning and selection of production techniques. A productivity bargaining process which would relate compensation gains to increases in efficiency and productivity can also be used. Management should be able to convince workers that when it speaks about improving productivity it is not just talking about "speeding up" the work but also about more rewarding and meaningful jobs.

Finally, no effort (short of boot-licking) should be spared to ensure that the relationship between management

and union is harmonious. Problems can be discussed better in a cordial atmosphere than where dispute already exists. Union officials and management should be encouraged to interact freely so that an atmosphere of cooperation and trust can be generated.

6.3.0 CLIENT PROBLEMS

Essentially the role of the client is normally fulfilled, at least on site by a consultant architect or engineer who would have been responsible for the design. The consultant and/or his technical staff are responsible for checking and approving work, material samples and following up the project to ensure that it is constructed in accordance with the design-intent of the drawings and specifications with due consideration to the contract between the client and the contractor. Thus, although primarily, the contract for the construction of the project is between the contractor and the owner, the consultant has an important role to play particularly in protecting the client's interest. His activities, while essentially aimed at furthering successful completion of the project, can make or break it.

As pointed out in section 2.4.1, the client himself often knows little or nothing about the design and construction

of the project. His activities may therefore be so clumsy as to frustrate or at least cause some inconvenience to the party responsible for the construction work. The architect, who represents him, has traditionally alienated himself from the construction activity and very often cannot, himself, grasp the full import of his decisions as they affect efficiency of the construction process. Thus, as the contract progresses, there are changes in the scope of the project for various reasons (annotated in section 2.4.1). Such changes may or may not cause a change in the cost or capacity requirements of the contractor; however, they have to be documented to guard against any likely misunderstanding that may arise in the future.

It may be necessary to advise the architect of the implications of his change orders not only when they affect the price of the contract but where complications are introduced or likely to be introduced that will disrupt the smooth running of the project. This will not only ensure that misunderstandings are avoided, but the architect will also appreciate attempts to make his job easier for him as well as the contractor's genuine concern for the well-being of the project - all these adding up to generate goodwill towards the contractor.

The project manager should also not hesitate to seek out ways in which the consultants can aid him in his drive for

maximum productivity. In doing so, he should avoid creating the impression of being a critic of the designer's job. Diplomacy should be the keyword here. He must try to be seen as putting his practical experience to work not only directly, for his firm, but also at the disposal of the designer. He alone is aware of the methods and facilities at his disposal and he must constantly seek out the best means of putting them to work to achieve the design objectives of the project.

Site meetings convened regularly will help the project manager to put his ideas across. He should not hesitate to adopt a very forward approach to putting his ideas across. Consultants should be shown round the site to see how these ideas will be put to work. The common attitude of viewing consultants' visits to the site with misgiving should be avoided as it only serves to further alienate them from the problems of the site. The project will run better if there is full cooperation between the contractors' and clients' representatives. Besides there is no reason why the contractor should not be able to sell himself on site as well as, if not better than, at the tender stage. The site is where the contractor can put his expertise to work and there is no reason why he should not point this out to those who do not quite understand his methods and procedures of work.

Architects present their works with fanfare, politicians hail themselves loudly at rallies on behalf of the "down-trodden masses", manufacturers loudly proclaim the virtues of their products on radio, T.V. and other media. The contractor too should be able to proclaim himself, advertise, by demonstrating or explaining his work to those who know so little about it. The rewards to be reaped through efforts in this direction will boost, not only his productive capacity but also obtain for him, by virtue of the respect and acclaim gained thus, many more jobs in the future; further enabling him to enhance his productivity.

6.4.0 (GETTING THE MOST OUT OF) SUB-CONTRACTORS

With construction projects becoming more and more complex, the sub-contractor has emerged as an important member of the project team. Offering specialist services which the main contractor is not likely to be able to perform himself, there are usually several on any big job. These range from electrical and mechanical sub-contractors to foundation or roofing specialists. The main contractor as the person responsible for the completion of the whole project, is responsible for co-ordination and control of all sub-contractor works. He prepares the master programme and is held responsible not only for fitting sub-contractors into the programme, but also for ensuring that they stick to it.

In this, his task is not made easier by the fact that the sub-contractor often does not feel responsible to the main contractor (even though the agreement is between sub and main contractor). This is because many of these specialist sub-contractors are appointed by the client and so do not normally look up to the main contractor for future work. The whole situation is further aggravated by the fact that the sub-contractor usually finds it attractive to hold back his work till the latest time possible when things might be much smoother for him rather than early in the programme when others would be getting on his feet".

Unfortunately, traditional methods of handling sub-contractors are often inadequate and, in some cases, counter-productive. The sub-contractor can therefore be a source of frustration on many projects. Usually three main sub-contractor problems confront the construction manager. These are:

1. Compliance with the master programme or progress schedule.
2. Delivery of machinery and equipment on time.
3. Co-ordination and control of the many different sub-contractors on the project.

6.4.1 IMPLEMENTING THE MASTER PROGRAMME

If the construction manager makes the mistake of allowing sub-contractors to run the project to fit their individual

problems, he soon loses control of progress on ~~the~~ the whole project. The construction manager must keep a careful eye on progress and should firmly insist that sub-contractors working under his direction have enough men on the job to complete their work on time. Right from the word go, he must make it clear that he will be running the project and that the job will run according to schedule.

Meanwhile, he should get together with the sub-contractors' management personnel and let them know that he expects to do everything he can to co-operate with them and that he would expect them to do everything in their power to co-operate with him. He **MUST** show that he means business by keeping the project on schedule right from the very beginning since if this is not done, extra effort on everyone's part would be required to get it back on schedule.

Daily assesment of the progress of everyone involved in the work should be undertaken and the sub-contractor informed when he is not doing as much as he should. If the project manager waits several days until the next meeting before pointing out delays, the job would already be so many days behind. The delaying sub-contractor must be notified **IMMEDIATELY**.

The project manager should endeavour to acquaint himself with the sub-contractors' problems and try to help solve them. If a sub-contractor's sluggishness or poor workmanship is causing problems for others, the project manager should be able to take such steps as required to bring such sub-contractor back into line. It may be necessary to push one sub-contractor so that good working conditions can be created for all - however, this does not mean that the project manager should be looking for scape-goats, nor should he create such impression as this would only induce an uncooperative attitude into "problem" sub-contractors.

6.4.2 EXPEDITING DELIVERY OF MACHINE AND EQUIPMENT TO AID THE PROGRESS SCHEDULE

A common problem with some sub-contractors is that while the rest of the work may be on schedule, machinery and equipment may not arrive from manufacturers or suppliers on time. This problem is often difficult to deal with; the main contractor should therefore ensure that sub-contractors place orders on time for equipment requiring long lead-times. In addition, such contractors should be required to keep tabs on the progress of the equipment from the manufacturer's assembly (where applicable) and delivery schedules and report on same, when requested, at progress meetings.

Although most sub-contractors will try to ensure that the equipment they are to install comes to the project on schedule, sometimes, where they are small organisations, they may not have as much influence as a large general contractor or, sometimes, the client. For this reason, it may be helpful for the main contractor to obtain all pertinent information on orders, including order numbers so that he may expedite delayed orders. The sub-contractor may be required to pay expenses incurred on such expedition if a considerable amount is involved.

6.4.3 PROGRESS MEETINGS FOR CO-ORDINATION AND CONTROL

Basically, two separate teams exist on the construction project: The owner-consultant team and the main contractor-sub-contractor team. While meetings between the main contractor and the owner's representatives (the consultants) are necessary to ensure the smooth running of the project, the contractor will need to meet with his sub-contractors in order to bring all their problems in line before tabling them at the other, regular meetings. At such contractor - sub-contractor meetings, two-way discussions will be most useful; the project manager telling the sub-contractors' representatives where their companies are slowing the construction down while he in turn listens to complaints and/or suggestions from them as to how better co-operation from

others will help them and the project in general. If the problems discussed are caused by the main contractor or other sub-contractors, they may be solved at such meeting. If the problem lies somewhere else, the main contractor should note them down for prompt action by appropriate means. Such meetings will enhance co-operation from, and between, contractors and, together with the other suggestions discussed earlier, would enable sub-contractors contribute to productivity improvement, instead of constituting a source of further frustration.

6.5.0 WORKING (PRODUCTIVELY) IN BAD WEATHER

The usual approach to the weather problem has been to allow for a certain amount of time when construction will not progress due to bad weather or its effects. This approach does not lighten the fact that time, itself a productive resource, is being lost and will never be regained - not to talk of the payments that may have to be made to workmen reporting in such weather or materials that get damaged as a result of disruptive weather. Thus, even though the firm may plan for a certain number of "shut-down" days, it must plan for many more days when bad weather will not be allowed to shut down the project; that is, when the company will take measures to curtail the disruptive effects of rain

(or cold) and continue its operations.

For example pumps and tarpaulin may be made available on site. The pumps may be used for pumping out rain-water from foundations or other excavations as well as for surface drainage. During the initial stages of the project, the tarpaulin may be used to protect, stored materials and newly poured concrete. Later on, they may be used to surround areas where concrete or masonry operations need protection from rain or frost. Where the size or nature of the project warrants it, consideration may be given to the use of air supported transparent polyethylene structures to completely enclose the site or parts of it.

One new development that is likely to be of interest to the construction industry is being tried out by researchers of the Royal Signals and Radar Establishment, Worcestershire, U.K. This is a radar network that could make it possible to forecast local rainfall fairly accurately up to six hours ahead. Radars in different parts of the country can be used to scan the sky to measure rainfall over areas extending up to 125 miles from each site. Data from each radar, plus other information, are then passed to computers that work out how the rain front is spreading and which areas it is likely to affect. The result would be a rainfall map on which degrees of heaviness of rain are differentiated by shades of colours. This could enable contractors to

plan their operations with more confidence even in the rainy season taking consideration of more reliable scientific weather forecasts.

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1.1 CONCLUSION.

During the course of this study some of the many factors affecting productivity in the construction industry, as well as their inter-relatedness have been established (chapter 2). The significance of the effects of each of these factors as seen by construction managers was also determined (chapter 2). It has been possible, therefore, to infer the magnitude of management responsibility and leverage in the improvement of productivity in the construction industry (chapter 2 and 3). One can conclude, in the light of the findings that management does retain the greatest potential for improving productivity in the industry.

Management, it can be pointed out, ^{needs to} ~~must~~ "invest in productivity" just like it does in technology, marketing, advertising, etc., in order to attain the maximisation of the level of utilisation of resources that is concomittant with the highest level of productivity.

The need to achieve this objective is further emphasised by the fact that at this stage of our development, the very process of development creates more needs than it does resources. Thus it is necessary to halt, nay, eliminate the great waste of time, energy, money and human resources that result from poorly planned operations, badly organised work, badly run work sites and a poorly utilised labour force.

The managerial approach to productivity does not, cannot, stop at making a quantitative estimate of output. Managers have to stop thinking merely in terms of performing activities and think instead in terms of the results of these activities: in terms of maximising utilisation of resources, motivating workers - generally managing productivity. This they can do by paying close attention to the factors identified in the preceding chapters, as well as their underlying causes in order to facilitate adoption of the relevant recommendations outlined in the second part of this thesis.

Some specific conclusions and a summary of their attendant recommendations is given below. These include those areas which this study has found particularly worthy of attention.

7.2 SOME SPECIFIC CONSLUSIONS AND SUMMARY OF RECOMMENDATIONS.

7.2.1 WORKER SKILL AND THE TRAINING NEEDS OF THE CONSTRUCTION INDUSTRY -

SELECTION AND TRAINING: Organisations need to develop good selection programmes to obtain people with proper attitudes and abilities for the duties they are to perform. It is also necessary to develop job orientation programmes for new employees to show the importance of their job and how it ties in with the organisations' objectives.

It is disheartening to note that most workers lack the necessary training to perform up to the standard required of them. How can one expect to obtain much from the worker who leaves the village to work on site and after a few months of haphazard apprenticeship moves on to a job as mason, carpenter or plumber? It would be useless to require from him what he is incapable of doing; he cannot perform miracles.

It must be noted that training is the only proper way to learn a skill. Skilled staff are the building blocks of the firm, be they tradesmen, technicians, engineers, managers themselves, or even manual labourers - they all need training to do their jobs properly and as productively as possible. Training is important, not only in the skilled trades, but also in the basic skills required of even an unskilled labourer in, for example, the handling of a brick.

Worker selection must be such that the worker selected possesses inherently the aptitude and intelligence necessary for the task set for ~~them~~^{him}. In addition, workers need to be given instruction in the correct methods of doing their tasks so that they may be able to feel that they are doing a good job. New techniques and methods, changes in project types and materials, and growth problems within the organisation mean that training could be an essential activity even for basic survival.

7.2.2 SUPERVISION

This problem stems largely from inadequacy in numbers and quality of supervisors.

Firms in the industry would be well advised to meet their needs in this area by supplementing external efforts with their own in-service training programmes. The industry cannot afford to rely on imported manpower in this crucial area as this can further complicate issues because of the psychological and cultural problems that would thus be brought in. The importance of careful selection of the supervisor, too, is noted because of the determinative role he plays in shaping up the work force.

A programme of methodical training for supervisors known as T.W.I. (Training Within Industry) to meet the urgent need for supervisory personnel was noted by the Inter-African Labour Institute as far back as 1960.¹ It is based on analysis of the essential skills and knowledge required of the supervisor, viz;

Knowledge of the work: Technical skill, etc.

Knowledge of responsibilities: Familiarity with the firm's organisation, policies, etc.

Leadership skills: The ability to handle workers so that they are willing to give their best, and the ability to promote harmonious working relationships.

Skill in instructing: The ability to instruct new workers and to give clear directions to experienced workers.

Skill in improving methods: The ability of the supervisor to make the best use of his staff, equipment and materials.

T.W.I. involves development of these three skills in three training programmes:

1. Job instruction
2. Job relations.
3. Job methods.

Thus substituting traditional habits and attitudes with a methodical objective technique.

7.2.3 HEALTH AND NUTRITION.

It is another sad fact to add that most sites in this country are glaringly lacking in the provision of these basic welfare facilities. The importance of these facilities to improving productivity of the work-force may not be so obvious to those firms which do not provide them, but these may well have a bigger impact on productivity than meets the eye. In any case, provision of suitable facilities to ensure that the worker is well taken care of as far as these aspects of his welfare are concerned, could yield results in more ways than one.

It may also be recommended that in addition to the provision of adequate medical facilities; management should take such steps as are necessary to ensure that workers do not suffer from malnutrition and under-nourishment. It would also be advisable to use all possible means to educate workers on the use of proper diets and to ensure that the appropriate commodities for such diets are readily available.

7.2.4 MATERIALS MANAGEMENT.

The importance of this function is emphasised by the fact that material costs make up about half of the construction bill, so that savings made in this area could amount to a significant figure. Careful management control of the supply and inventory procedures is recommended along with waste reduction campaigns to ensure maximal utilisation of materials purchased for the job.

7.2.5 PLANT UTILISATION.

Low utilisation coupled with the extra-ordinarily high cost of mechanical plant constitute a considerable drain on resources. It is recommended that careful consideration be given to all relevant factors such as suitability, serviceability, costs and prospects for continued use before any capital equipment is purchased.

7.2.6 WORK SIMPLIFICATION.

Abundance of unskilled labour (noted in section 3.4.5) can prove to be an advantage to the firm that is prepared to invest in work-simplification programmes so that it can utilise low cost unskilled labour for many of its operations.

7.2.7 INCENTIVES.

Considering the effect these could have on productivity, it could be worthwhile for firms to increase their investment in this area.

In addition to psychological incentives, firms would do well to introduce rates of pay which take into account the degree of skill attained by the worker in his trade while all appropriate means are used to facilitate the technical advancement of the worker.

In order to align the worker's desire for his basic needs to the firm's drive for maximum productivity, introduction of productivity bonus schemes may also be worth considering. Where this is done, the worker should be made to understand the relation that exists between the bonus and the increase in productivity. To be effective, such a system would include attractive bonus rates and the worker should be informed of what he earns under this scheme as soon as possible after he has earned it.

7.3.0 SUGGESTED AREAS FOR FURTHER STUDY.

It is considered that further study and/or research in the following fields could further enhance the usefulness of this effort towards the total productivity improvement in our construction industry:

1. A critical appraisal of training needs in the construction industry and how these can be met.
2. A critical and comprehensive survey of equipment types and prospects for their application in the Nigerian Construction industry.

3. Evolution of a comprehensive work simplification programme for the Nigerian contractor.
4. The extent of union influence on labour productivity in the Nigerian construction industry.
5. The tendering procedure and productivity in the Nigerian construction sector.

Reference

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The Human factors of productivity in Africa a.b.

APPENDIX A: THE QUESTIONNAIRE

TO THE CONSTRUCTION MANAGER/SITE AGENT

Mr. A.A. OKWA, a staff of the department of building, A.B.U. (Zaria) is undertaking a study of productivity in the Nigerian Construction Industry (A managerial approach) He needs your help to get a feel of the problems of improving productivity (or efficiency) as experienced by you. Since your contribution is vital to the success of this study, careful response to the questions set out below will be highly appreciated.

Many thanks for your anticipated co-operation.

PERSONAL INFORMATION

1. AGE:
2. PROFESSIONAL/EDUCATIONAL QUALIFICATION:
3. YEARS OF EXPERIENCE:
4. NATIONALITY:

COMPANY DETAILS

TICK AS APPROPRIATE

5. TYPE OF COMPANY:

A. CIVIL ENGINEERING	☐
B. BUILDING CONSTRUCTION	☐
C. BOTH	☐
6. AREA OF SPECIALISATION (e.g. dams, bridges, housing if applicable):

7. AVERAGE SIZE OF CONTRACTS HANDLED: A. LESS THAN £1 MILLION ☒
 B. £1 - 2 MILLION ☐
 C. £3 - 5 MILLION ☐
 D. OVER £5 MILLION ☐

88. GEOGRAPHICAL COVERAGE (contracts in):

- A. LESS THAN 3 STATES ☐
 B. 3 OR MORE STATES ☐
 C. MULTINATIONAL - subsidiary of an
 international firm. ☐

MANAGEMENT APPROACH TO PRODUCTIVITY IMPROVEMENT.

9. Your firm is A. EQUIPMENT INTENSIVE ☐
 B. LABOUR INTENSIVE ☐

10.A. If you are in 9A or B above, do you feel a need to change?

YES ☐ NO ☐

- B. If you answered YES in 10A, which of the following benefits/
 advantages do you expect to gain from such change

(tick as appropriate)

- Better cash flow ☐
 Increased efficiency ☐
 Lower labour costs ☐
 Freedom from Union problems ☐
 No problem plant ☐

11. A. Are you satisfied with the level of productivity in your
firm? YES NO

B. Is there room for improvement?
 YES NO

12. Which of the following would you consider to be an indication
of the level of productivity in your firm?

High profits

High turnover

Completion of projects on time

Well paid employees

13. List in order of magnitude, those of the factors below which
directly or indirectly influence productivity in your
organisation (In the boxes provided, most influential,
1; least influential, 13)

Government regulation	☐	Variation orders	☐
Plant availability	☐	Bad weather	☐
Contract conditions	☐	labour Unions	☐
Workers' Skill	☐	Company policy	☐
Availability of funds	☐	Availability of	☐
Material shortages	☐	workmen	
Supervision	☐	Other(s)	☐

14.A. Briefly comment on the order adopted above

* 1968 1969 1970 1971 1972

B. The order adopted above is based on:

- Frequency of occurrence ☐
 Overall effect ☐
 Persistent occurrence ☐

15. Which of the following organisational functions are clearly defined in your firm?

- Targetted results ☐
 Resource needs ☐
 Planning ☐
 Output/input measures ☐

16. Which of the following productivity frustrations do you feel are experienced in your firm?

- Under-utilisation of plant ☐
 Excessive labour costs ☐
 Excessive overhead costs ☐
 Excessive material costs ☐
 Inability to complete work as scheduled ☐

17. Which of the following actions (listed below) would improve productivity in your firm? Which would reduced it?

(MARK A for "improve" and X for "reduced")

- | | |
|---|--|
| Work planning ☐ | Medical facilities ☐ |
| Materials management ☐ | Banning labour unions ☐ |
| Short-term borrowing ☐ | Hiring more workers ☐ |

continued on page 172

Procuring (more mechanical plant) ☒

Training workers ☐

Close supervision ☐

Increasing workers' pay ☐

Safety planning ☐

Provision of Catering facilities on site ☐

18. Please make any comment you consider relevant to the subject from point of view of the company or the construction industry in general. You may make this as lengthy as you wish.

APPENDIX B.

MOTIVATING WITH EXPECTANCY ALIGNMENT*

The basic problem in the motivation of employees is neither the lack of a framework for thinking about motivation or the lack of insight for understanding people and their needs. There are many good motivational concepts and principles useful for understanding human behaviour. The big problem is being able to translate these principles and concepts in a practical manner consistent and useful to the organisation for improving productivity. The complexity of motivational problems suggests that managers should acquire a strategy that works well and use it as they proceed to execute the responsibility of delivering results for the organisation. The strategy of expectancy alignment described below is an effective managerial approach for motivating toward productivity improvement. But first, some preliminary ideas.

NEEDS COINCIDENCE: A THEORY FOR GENERATING MOTIVATORS.

Employees work primarily for themselves and only secondarily for their employer. They work to meet their needs and personal goals. These needs and goals are termed expectancies. Worker expectancies do not usually fall within the framework of company expectancies. They may or may not coincide with the set of expectancies the organisation has for an employee.

* Collated from "Improving total productivity", Paul Mali.
Publ., John Wiley & Sons, New York, 1978. pp.270-279.

A disparity exists between these two expectancies (see fig. B.1). There is a managerial need to align those two packages of expectancies and to reduce the degree of disparity.

At the time of employment the disparity is diffused because employee and employer both role-play- that is, they behave in roles for trying to gain an advantage for negotiating trading and compromising toward a commitment for employment. During employment the disparity becomes clearer because role playing ceases. Each party pursues a path of action that primarily attempts to meet their own package of expectancies, even at the sacrifice of the other party. Employees struggle to reach their expectancies. Employers, likewise, struggle to meet their own. The result of

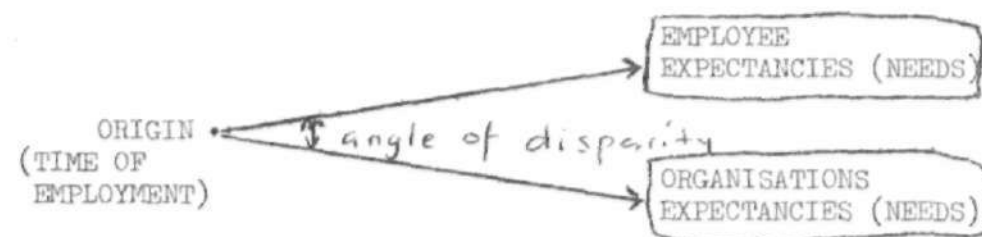


Fig. B.1. Disparity between employee and organisational expectancies.

this struggle is a compromise between the two for the situation.

This compromise represents the best "coincidence of needs" of wide array of complex needs by both employee and employer. It is the line of "fit" or "agreement" between two sets of expectancies. This line of needs coincidence between the two parties forms the basis of driving both parties search their packages of expectancies so that they both gain. This concept is illustrated in figure B.2.

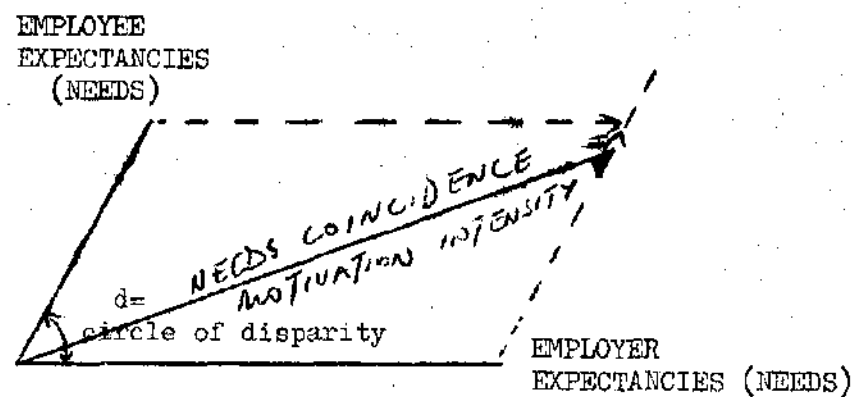


FIG. B.2

One can see from this concept that the greater the coincidence of needs of both parties, the greater the intensity of drive toward mutually established results. The less the coincidence of needs, the less the intensity of drive toward results. Thus the greater the alignment of employee expectancies with organisational objectives, the greater the motivation to accomplish both. The less the alignment, the more difficult the motivation. Motivational intensity (MI) in an organisational setting is therefore a function of needs coincidence (NC).

$$MI = f(NC)$$

Perfect alignment between organisational expectancies and employee expectancies is virtually unattainable. If it should be attained at any point, it will last only briefly. The changing nature of both parties makes coincidence of both vectors for a long period of time a highly improbable event. Managers should strive to move both vectors or states of expectancy to a closer alignment (as in case 1 of figure B.3). How the manager does this is with motivators which are

described later. The three cases described in figure B.3 indicate different positions of the vectors which will yield different motivational intensities. Employers who hire workers whose goals and expectancies can never be met within the confines of the organisation are most unfortunate. This type of employee has the most difficult motivational problem to solve. They are better left unemployed by the organisation concerned. The manager should strive to move both vectors or states of expectancy to as close an alignment as possible (case I). Motivational intensity increases as disparity decreases. The employee is accomplishing his own personal goals while at the same time meeting the employers' objectives. Conversely, motivational intensity becomes weaker as disparity increases (case III). The employee is attempting to meet his own expectancies but is in disalignment with the employer. When objectives of both employer and employee are brought into alignment both in substance and time phase, greater contributions to the organisation are made. Motivational intensity is high when the needs of the worker are in coincidence. Therefore managing motivation toward productivity is managing needs coincidence between workers and the organisation

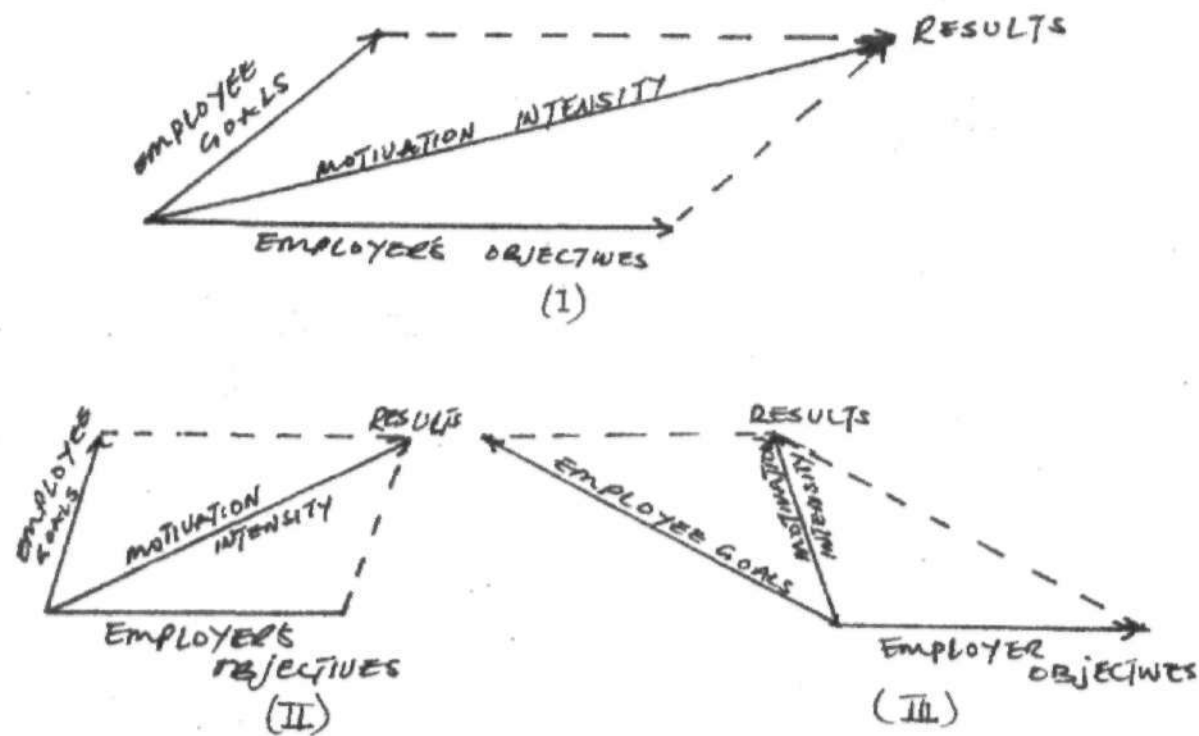


FIG. B.3. Motivation intensity caused by employer and employee disparity (I) close alignment, high results, strong motivation (II) wide alignment, moderate results, moderate motivation (III) very wide alignment, poor results, weak motivation.

MOTIVATORS: JOB CONDITIONS THAT PRODUCE COINCIDENCE

Motivators are job conditions which satisfy the needs of employees as well as the organisation. From a management stand point, a motivator cannot exist if the employees gains at the sacrifice of the firm. Similarly, a motivator cannot exist if the firm gains at the sacrifice of the employee. When job conditions are developed and arranged to allow satisfaction for both parties, a motivator prevails. In other words, when job conditions are arranged to meet the needs of both parties, a motivational intensity will emerge to drive both parties toward objectives.

Job conditions refer to how the work situation is developed, arranged, executed, measured, and controlled. It is structuring and restructuring both process and procedure with tasks and duties - for example, the organisational need to complete a task within a given period of time. If you combine this with employee's need to control time commitments that affect them on the job, a motivator emerges. When a process is developed so that both participate in agreeing on a commitment for time, a motivator is developed. In this case, the motivator is participation.

As a motivator, participation implies a process in which both parties can gain. It implies a process in which there is needs coincidence - in which ~~two~~ sets of expectancies are brought into alignment.

(Motivators are processes for arranging job conditions to enhance needs coincidence and satisfaction for a worker and his organisation).

Several non financial motivators that have the capability of setting up this process of needs coincidence have been developed over the years.

The following is such a list. It is presented to show how the needs of both parties are met. It is not intended to be ^{be} definitive, as additional motivators can be developed if needs coincidence can be identified. Financial motivators can also be developed.

MOTIVATOR	ORGANISATIONAL NEED	EMPLOYEE NEED
1. Challenge	to get improved results.	to be unique and to do things others cannot.
2. Independence	to delegate work and responsibilities.	for freedom to form individual judgement.
3. Recognition	to do important and significant work.	to project self worth to peers and family.
4. Participation	to get commitments to complete work even before it commences.	to know what is going on, why and to be able to exert influence.
5. Achievement	to see that extended resources are being used meaningfully towards large accomplishments.	to see that efforts and energy lead to progressive steps of advancement towards a long-range goal.
6. Innovations	new ideas, suggestions, and proposals to improve operations.	acceptance and use of ideas, suggestions and proposals.
7. Enlargement	maximum use of time as a resource.	to avoid boredom and fatigue.
8. Enrichment	to perpetuate organisation with management succession.	to feel job assignments are stepping stones toward advancement in the organisation.

- | | | |
|--------------|---|--|
| 9. Overview | to have individuals optimise to the organisation and not to themselves. | to see where ~~individual~~ individual contributions fit in the overall operations. |
| 10. Learning | to have capable personnel. | to generate fascination and interest in the work. |

GUIDELINES FOR USING MOTIVATORS.

1. Motivators are individualistic. They may work well for one individual but are not so effective for another. ^{if} ~~and~~ they are effective in mass applications, it's probably due to common conditions affecting many people in a similar way. Each individual may be like others in some ways, but difference is the rule, not the exception.
2. Motivators diminish in value over time. Motivators are set up on the basis of conditions prevailing at a given time. When conditions change, the value of motivators change. For example, note in figure B.4 how motivators change through employment tenure.

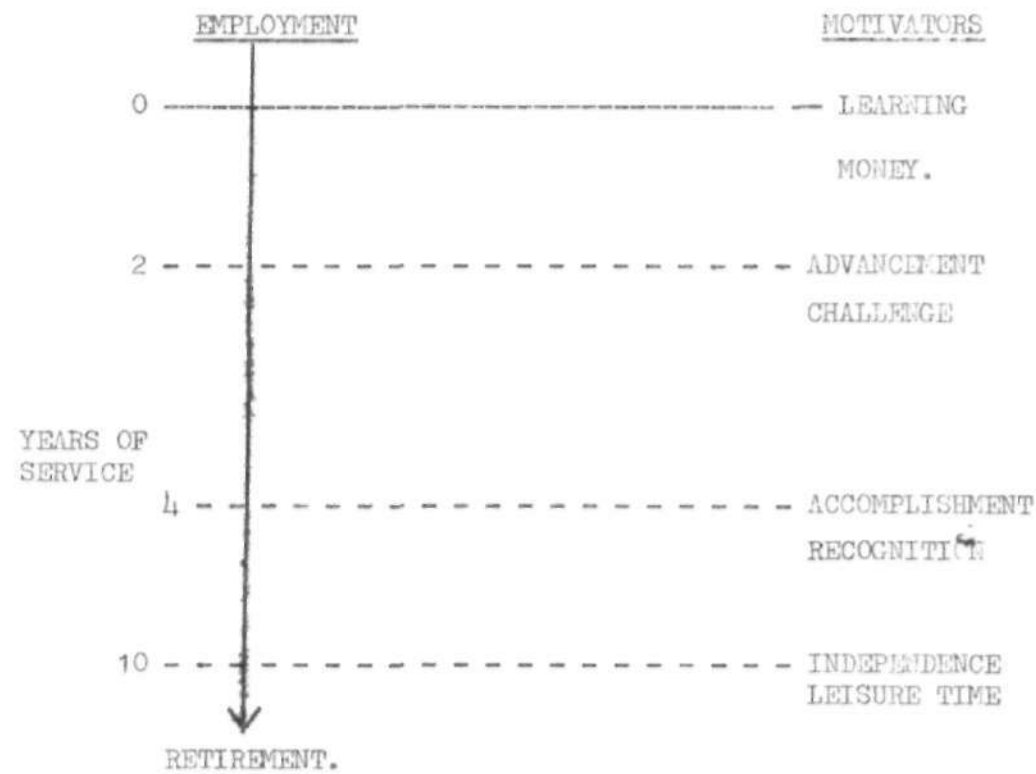


FIG. B.4 MOTIVATORS CHANGE WITH YEARS OF SERVICE.

3. Motivators in multiple sequence may be required.

It's naive to think only single motivators are required.

More often, multiple motivators over a period of time may be required because workers want to satisfy a range of needs rather than only one or two.

4. Motivators have varying effectiveness with different organisational levels. Motivators of intense value to top managers are of low value to foremen and vice versa. Each level in the firm will have its effective motivators.

5. Motivators must be planned for individuals as the level decreases

Top managers are in a position to plan their own motivators (self-motivation). Lower levels of management are less able to do this (see figure B,5). Job designs or organisational changes with appropriate conditions must be instituted or motivation will not take place in the lower levels of the organisation.

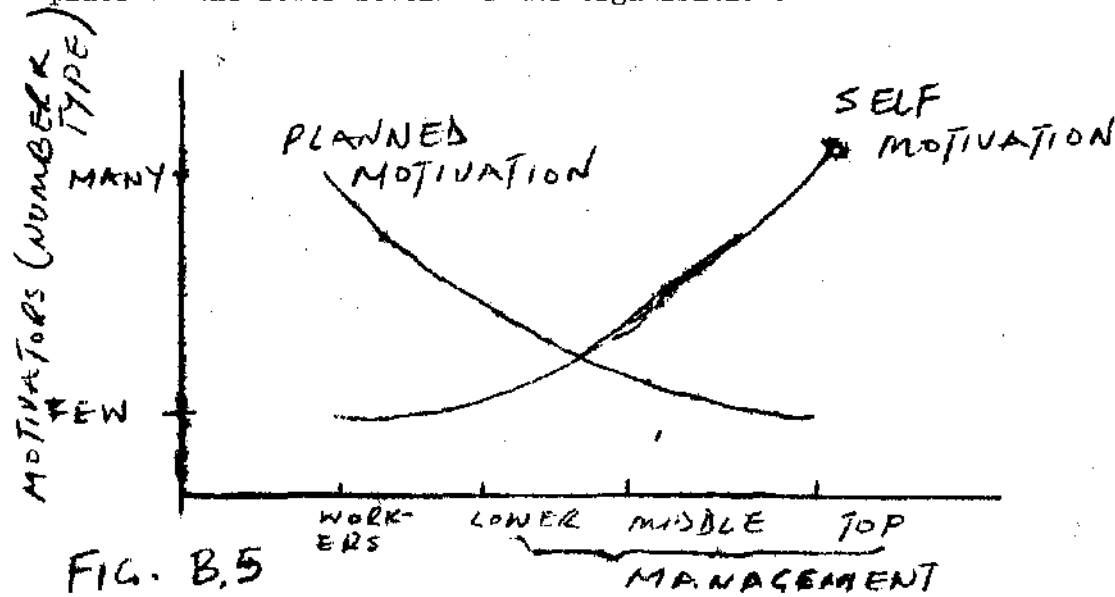


FIG. B.5

6. Motivators are highly effective when they project

a person's worth. In an affluent society where biological and safety needs are provided for, an individual looks to personal worth and fulfillment needs.

7. Motivators may be identified through careful assessment of individual and organisational needs. The need of the individual at a given time is the clue for the development of a motivator.

Since needs are driven or pulled by wants, the number of possible motivators are great. When the needs of both organisation and individuals are coincident, a motivator is identified.

8. Motivators can become demotivators. Too much or too little of a motivator will turn it into a demotivator. For example, too much or too little challenge causes problems.

9. Motivators are largely effective in the work processes itself.

The nature of organisational life prevents us from looking beyond the job where there is little or no control. The manager must be content with managing motivation within the boundaries of the work.

10. Motivators should be tested. Motivators change with needs and counts and managers have to use the experimental approach to check the validity of assumed motivators.

11. Motivators are highly influenced by the style of the boss.

Motivators will operate effectively only if they fit the style of the leader. There must be harmony or compatibility between the leadership style of the boss and the type of motivators in a work situation.

How different motivators are effective for different leadership styles is illustrated as follows:

<u>Leadership styles</u>	<u>Effective motivator</u>
1) Autocratic, "I" style	(a) provide challenges (b) schedule training and development. (c) set up "pride" system for work.
2) Integrative "We" style	(a) Allow participation. (b) enlarge job for variety. (c) Give an overview of the work.
3) Permissive "You" style	(a) Allow participation (b) Job for promotion (c) Delegate for independence.

12. Motivators vary in effectiveness with type of worker.

Different groups of workers have different sets of needs. This suggests that different motivators will be highly effective for one group but not so with another. This is illustrated as follows:

<u>Type of worker</u>	<u>Effective motivator</u>
1. Older worker	Sense of independence.
2. Contented employee	Challenging job assignments
3. Minority employee	Learning and training.
4. Young affluent employee	Job enrichment.

5. First line supervisor	Recognition
6. Middle manager	Participation in policy-making
7. Top executive	Opportunity for large scale accomplishment.

HOW TO MOTIVATE WITH EXPECTANCY ALIGNMENT

The challenge for managing motivation for greater productivity is not in understanding why people work or in developing models of human behaviour or in conceptualising a list of motivators for satisfying both organisation and employees. The challenge lies in implementing motivators in a practical way that results in greater productivity. Four steps are described.

1. Establish the productivity objectives you wish to achieve.

Motivation does not begin with people. It does not begin with the job. It starts with purpose, expectations, and the objectives the organisation is trying to reach. Defining expectations is the first step in bringing about the conditions for its fulfillment.

These objectives define the target and set the entire motivational process that follows.

2. Identify organisational needs from productivity objectives.

This is an analysis of the statement of objective into the human requirements that would be needed for its completion. There may

also be non-human requirements such as technical, financial, and procedural. The manager will find this step difficult without an understanding of organisations and the reasons for their formulation.

3. Acquire insights into employee needs. These needs represent employee expectations - the "whys" of employee behaviour. They are the purpose factors for employees seeking and obtaining employment in the organisations. They are motives for which a person's "will to work" is established.

4. Decide on the motivator to be used. The list of motivators suggested in the previous section is not intended to be definitive. It is suggestive only. There is no magic catalogue of motivators and one cannot expect a motivator to have mass applications. Once a manager acquires insight into what motivators are and how they are used, he or she should proceed to identify additional ones such as early time off, flexitime, discretionary decision making, pride system, and personal interest.

5. Establish an alignment between organisational needs and employee expectancy with motivators. The manager aligns the needs of subordinates with the productivity goals with the use of motivators so that both needs are accomplished within an expected period of time. When subordinates see that their work performance for the organisation also meets their personal needs, drive becomes intense.

APPENDIX C*

A NOTE ON THE APPLICATION OF WORK STUDY TO CONSTRUCTION WORK

The purpose of work study is the provision of factual data to assist management in making decisions and to enable them to utilise with the maximum of efficiency, all available resources (i.e. labour, plant, materials and management) by applying a systematic approach to problems instead of using intuitive guesswork.

C. 2 BREAKDOWN OF WORK STUDY

Work study has two main aspects, method study and work measurement. The first, method study, is the study and recording of existing or proposed way of doing work, and by careful and critical examination of the recordings, deciding upon an easier and more effective way of doing it. Fig. 5.10 page 142 shows the outline of the procedure with the various stages in order of study.

Work measurement is used to establish the time required to do a specific task. Its aim is to cut ineffective time, with the worker's effort, production and conditions of work being related to the necessary relaxations allowances to ensure that

* Culled from MANAGEMENT TECHNIQUES APPLIED TO THE CONSTRUCTION INDUSTRY. R. OXLEY and J. POSKITT. Crosby Lockwood and Sons Ltd, 2nd ed. 1971.

~~that~~ undue fatigue does not occur. Although it is complementary to method study, it is the former that will interest us here owing to its wider sphere of application.

C.3 RECORDING TECHNIQUES

Three main groups of recording techniques are available for setting down method study problems. These are:

- | | |
|--|--|
| 1. Charts | Outline process charts |
| | Flow process charts (man-type, material-type and equipment-type) |
| | Two-handed process charts |
| | Multiple-activity charts |
| 2. Diagrams and models
(Two-and
three-dimensional) | Flow diagrams |
| | String diagrams |
| | Cut-out templates (two-dimensional models) |
| | Models (three-dimensional) |
| 3. Photographic | Photographs |
| | Films |

Templates, i.e. silhouettes of plant, equipment, storage areas etc., are very useful when considering layouts, and it is also possible to obtain charting kits, which consist of translucent sheets and stick-on templates that may be used for die-line prints. This is an excellent method of recording when it is desired to compare one method with another.

C.3.1 Flow process charts

This technique can be useful in helping to solve problems of layout such as those in site workshop areas where the operations are likely to be repetitive.

All activities are shown by means of symbols with a description against each. This is a very simple method of showing a sequence of work, and employs the following symbols:

 Operation	 Storage e.g. stored for future use
 Inspection	 Temporary storage or delay
 Transport	

The movements of men, materials or equipment are followed through a process and the symbols are used to indicate what is happening at the various stages. The distance travelled may be shown on the transport activities and the time for each element can be given.

C.3.2 Flow diagrams

A flow diagram can be used in conjunction with a flow process chart to show where the activities take place. The same symbols that are employed on flow process charts are used but in this case they are superimposed onto a drawing and the descriptions are not necessary. All movements and distances can be clearly shown.

C.3.4 String diagrams

This technique is very useful in solving problems of movement. It is applied to repetitive situations and is therefore most useful in working areas such as factories producing industrialized components, machine shops, pre-casting yards, steel bending areas on site, etc. The diagram will show up points of congestion and any excessive distances travelled.

The procedure for improving a layout is to first draw to scale a plan of the area under consideration with the work places or stacking areas, etc. and all changes in direction denoted by pins. String or thread is then tied round the starting point and passed from pin to pin showing movement. Men, materials or machines can be denoted by different coloured string. If the string is then measured, any excessive distances travelled will be obvious and any points of congestion will be seen on the diagram.

Routes which are travelled regularly should be kept as short as possible, and alternative methods can be examined to obviate the faults of the first (templates can be very useful here).

C.4 Critical Examination

The step examine is the key step in a method study, and consists of a detailed examination of every aspect of the work.

The purpose is to:

1. Establish the true facts surrounding the problem.

2. Establish the reasons for these facts and determine whether they are valid.
3. On this foundation to consider all the possible alternatives and hence the optimum solution.

Examination is carried out by a questioning technique for which a critical examination sheet is very useful (Fig. C1). There should be liaison with the site management personnel who will carry out the work and they should be encouraged to put their ideas forward.

C.4.1 Site layout problems

When deciding on the relative positions of plant, working areas, storage areas etc. on site, reference has to be made to the various activities to be performed, i.e. the number and types of activity and the minimum transports and storages required. This basic information can be provided from materials flow process charts, which may be used in conjunction with a scale drawing of the site layout and paper templates. String diagrams can then be used either to evaluate or to visually represent the movement intensity for the alternative arrangements of the templates.

C.4.2 Steel cutting and bending area

Flow charts, flow diagrams and string diagrams can be used to assist in considering the layout of a steel bending area on site as described below.

The space required for storing steel in the form it is delivered

and after it has been prepared will be determined by the amount of steel involved and the timing of deliveries. A power bender will be required, but a hand cutter should be adequate for cutting purposes as large diameter bars for the floor slab ^{should be} ~~are being~~ purchased cut to length.

The site manager has suggested the layout shown in Fig. C2 and a material-type flow diagram has been superimposed on it; a flow process chart has also been drawn up for this arrangement (Fig. C3).

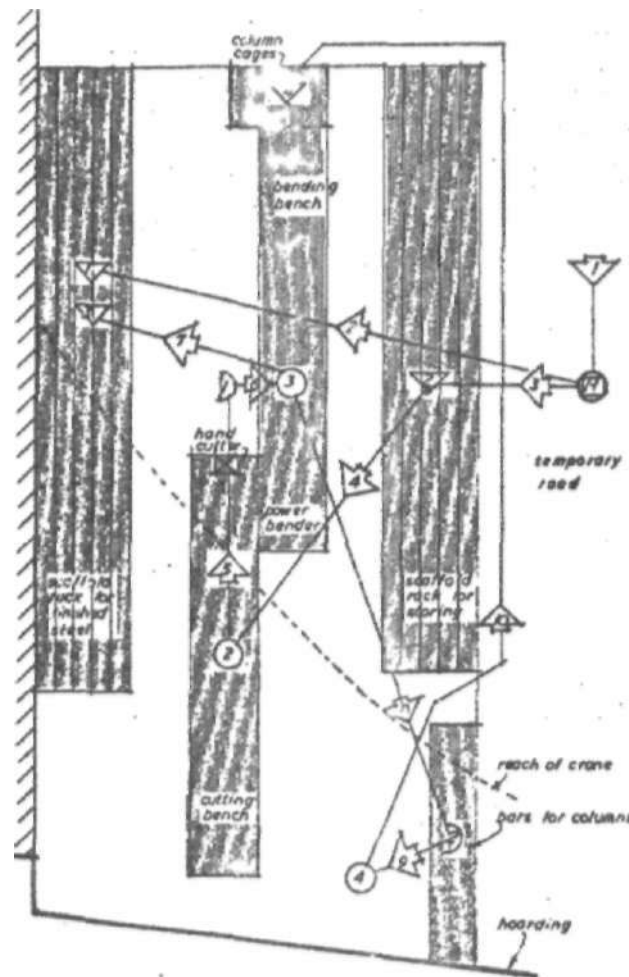
The chart and diagram are now critically examined to find improvements, and from the flow diagram (Fig. C2) it can be seen that a fair amount of movement is involved in transporting steel to and from the various positions where operations would take place. A string diagram is therefore produced to show the movement of materials for one day (Fig. C4) and it becomes evident that many long distances are travelled an excessive number of times. Alternative layouts are examined to eliminate long transports on frequently used routes, and Fig. C5 shows the string diagram for the selected layout, with shortening of the routes travelled most frequently; the flow diagram for this layout is shown in Fig. C6. If required, different coloured string can be used to show the movement of bars cut to length on delivery and those prepared on site etc.

CRITICAL EXAMINATION SHEET

DESCRIPTION OP OPERATION:
DESCRIPTION OF ELEMENT:

INVESTIG'N	PRIMARY QUESTION	SECONDARY QUESTION	POSSIBLE ALTERNATIVES	SELECT ALTERNATIVES
purpose	what is acheived	is it necessary	what else could be done	iwhat should be done
place	where is it done	why there	where else could it be done	;where should it be done
sequence	when is it done	why then	when else could it be done	when should it be done
person	who dees it	why him	who else could do it	who should do it
Eeans	how is it done	why that way	how else could it be done	jhow should it be idone

Fig. C1



1

Had the layout suggested by the site manager not been put forward, the first stage would have been to produce an outline process chart, followed by flow process charts, flow diagrams, and string diagrams.

C.5 Multiple activity charts

This technique is used to help solve problems when a number of subjects (operatives, machines or equipment) are dependent on each other. It shows the occupied time divided into elements of work if

necessary) and unoccupied time for the subjects in both present and proposed methods. The subjects are recorded on a common time scale and periods of unoccupied time can be readily seen; alternatives may then be considered, the aim being to balance the work content for the subjects. It is necessary to plot more than one cycle of work as the first taken may not be representative.

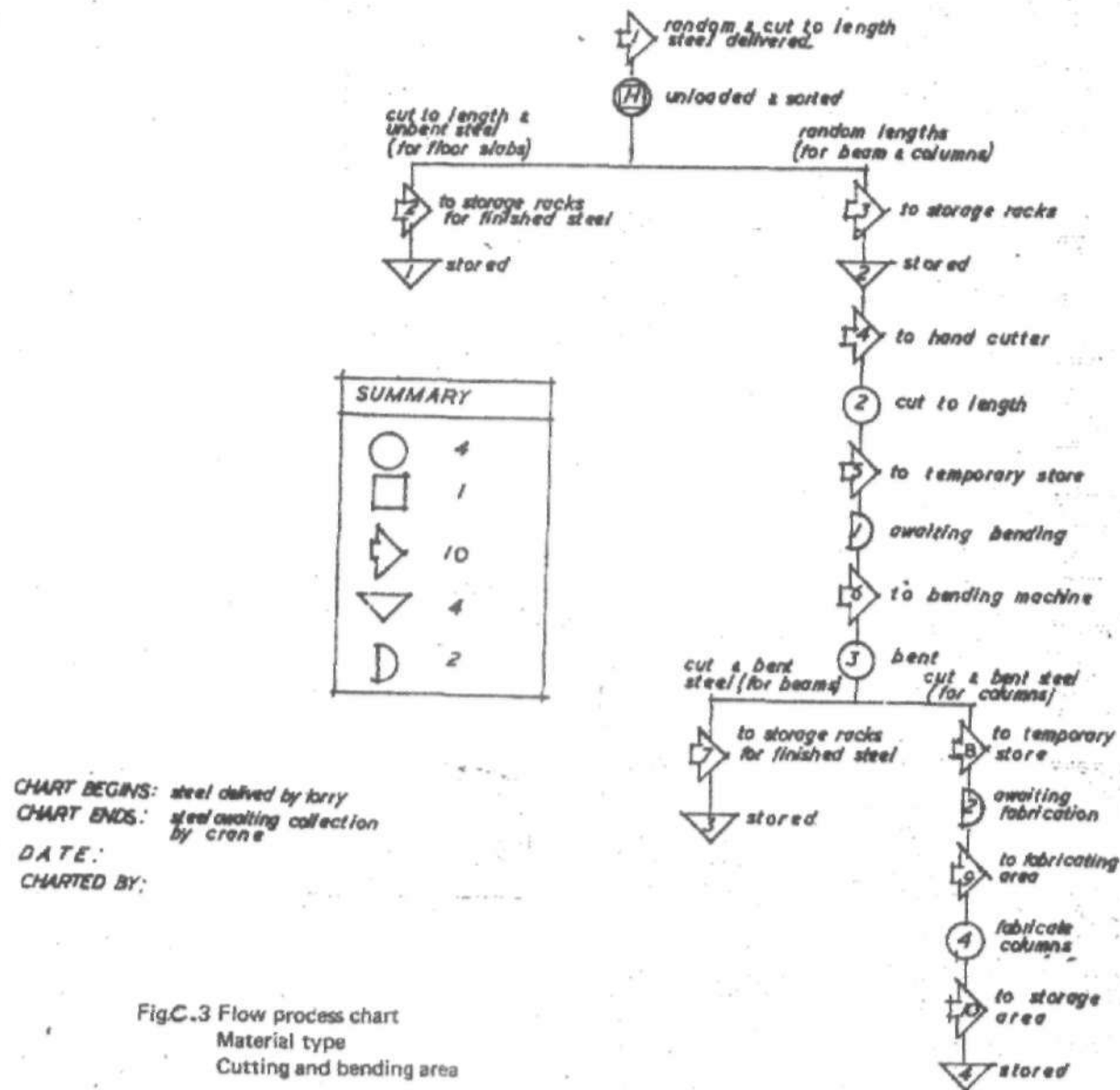


Fig.C.3 Flow process chart
 Material type
 Cutting and bending area

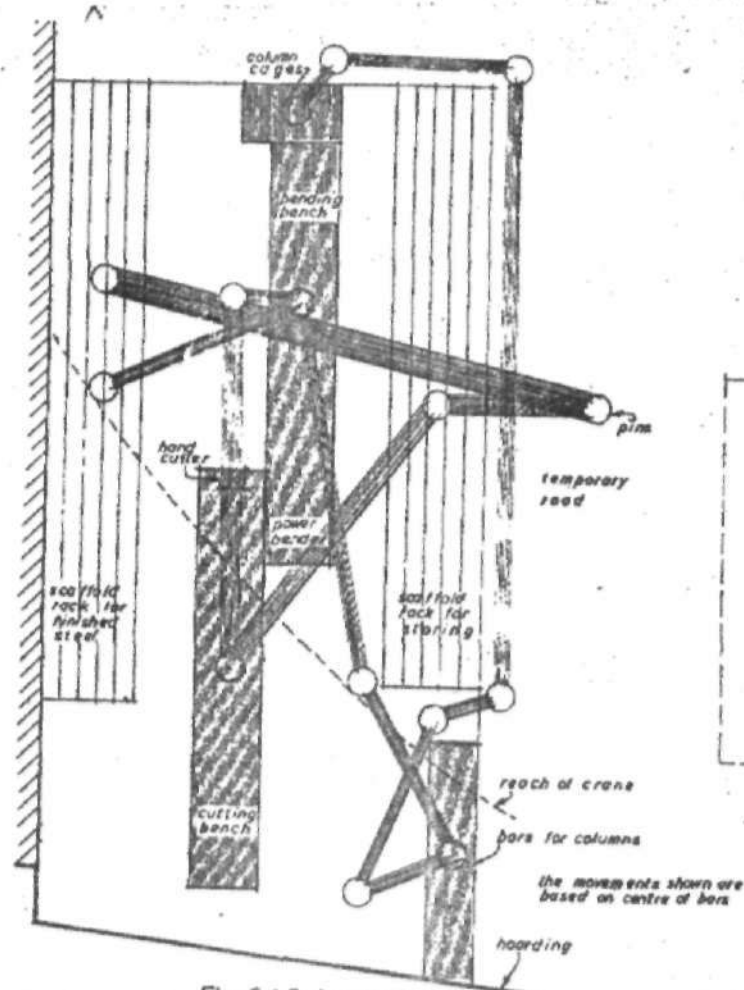


Fig. C.4 String diagram
Cutting and bending area

C.5.10 Laying concrete upper floor slabs

Multiple activity charts are to be used to help increase efficiency in laying upper concrete floor slabs. Taking a hypothetical example, let us assume that this operation is at present carried out by two men at the mixer (one driver and one loader), the tower crane transporting

the concrete to the required position, and one labourer discharging the concrete from the skip and spreading and levelling it. It is assumed that a time study has been carried out and gives the information shown below (the times stated are hypothetical).

Man/machine and element	Code	Description	Time in standard minutes
Loader Load hopper	L	Load mixer hopper with fine and coarse aggregate using hand scraper	2.00
Mixer driver Add cement	ct	Add cement to fine and coarse aggregate in hopper (from silo above mixer)	0.25
Mixer driver Raise hopper	R	Raise hopper up to opening in mixer drum	0.25
Mixer driver and mixer Mix concrete	M	(Tip contents into drum (Add water Mix concrete	0.20 0.05 1.75
Mixer driver Lower hopper	H	Lower hopper from opening in mixer drum down to ground level	0.25
Mixer driver Discharge concrete	D	Position crane skip and discharge contents of mixer drum into it	0.50
Crane and driver Delivdr concrete	DC	Lift concrete in skip, slew and deliver concrete to placing position	1.50

Spreader				
Discharge concrete	DL	Discharge concrete from crane skip		0.25
Spreader				
Spread concrete	SC	Spread and vibrate concrete between reinforcing steel and tamp		5.50
Crane and driver				
Return empty skip	RE	Return empty skip from placing position to concrete mixer		1.50

C.5.11 Method 1

The multiple activity chart (Fig. C7) shows the operation as carried out at present. One man loads the hopper on the mixer with sand and coarse aggregate. The mixer driver checks the weight on a dial and discharges the cement from the silo above the hopper; he next elevates the hopper and discharges the contents into the mixer drum, feeds water into the drum, and lowers the hopper. When the concrete is mixed, the mixer driver places the skip in position and then discharges the concrete from the mixer into it; the crane then lifts the concrete in the skip and transports it to the desired position. Finally a spreader discharges the skip and spreads the concrete, the crane returning with empty skip to the mixer.

The chart shows that the time cycle of 5.75 standard minutes is determined by the spreader, and this results in unoccupied time for other operatives and machines.

C.5.12 Method 2

The multiple activity chart (Fig. C8) shows an alternative

method. Two spreaders are used here to discharge and spread concrete from the crane skip, so that the crane now determines the time cycle of 3.75 standard minutes - a marked increase in efficiency.

C.5.13 Method 3

The multiple activity chart (Fig. C9) shows another alternative. This procedure is similar to method 2 but the mixer driver also does the loading. The cycle time remains the same, and this results in a further increase in efficiency.

C.5.14 Other methods

Additional alternatives could be tried and one possibility is to use two crane skips, which might cut down some of the time at present wasted whilst the crane waits for the skip to be filled at the mixer. There would of course be extra time involved in attaching and detaching the skip, etc.

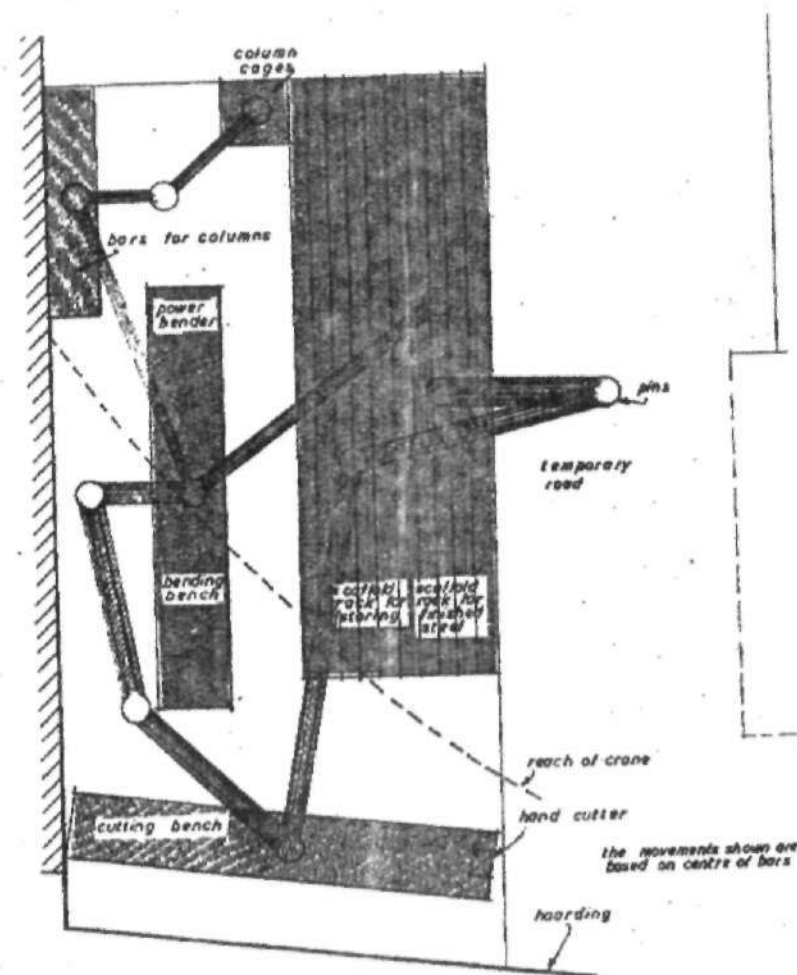


Fig. C.5 String diagram
Cutting and bending area

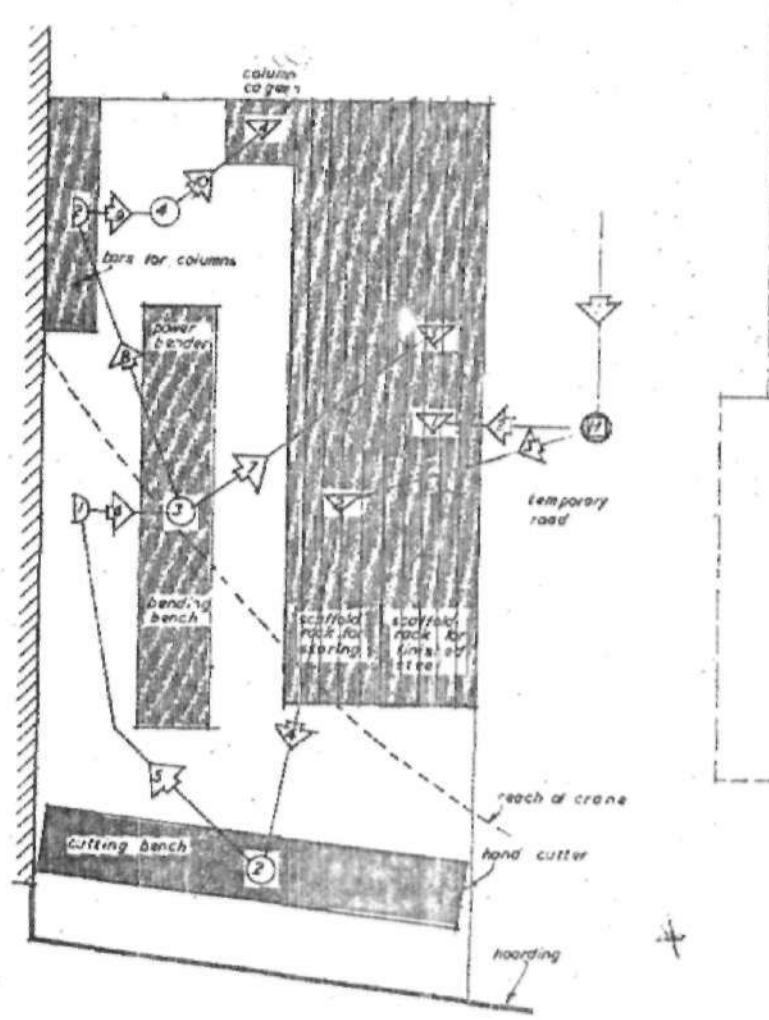


Fig. C6 Flow diagram
Cutting and bending area

MULTIPLE ACTIVITY CHART																											
OPERATION mixing delivering & spreading concrete													PLANT 300/20 mixer power scoop & cement silo 500 kg. lower crane					GANG mixer driver loader crane driver spreader				METHOD 1. 2 of mixer spreading					
time in standard minutes																											
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
MIXER				M	DR	M			DR	M			DR	M					DR	M					DR	M	
MIXER DRIVER			DR		DR				DR				DR					DR			DR					DR	
LOADER		L		L			L			L					L								L				
CRANE & DRIVER						DR	DC		RE	DR	DC				RE	DR	DC				RE	DR	DC			RE	DR
SPREADER																											
														</													

FIG. C7

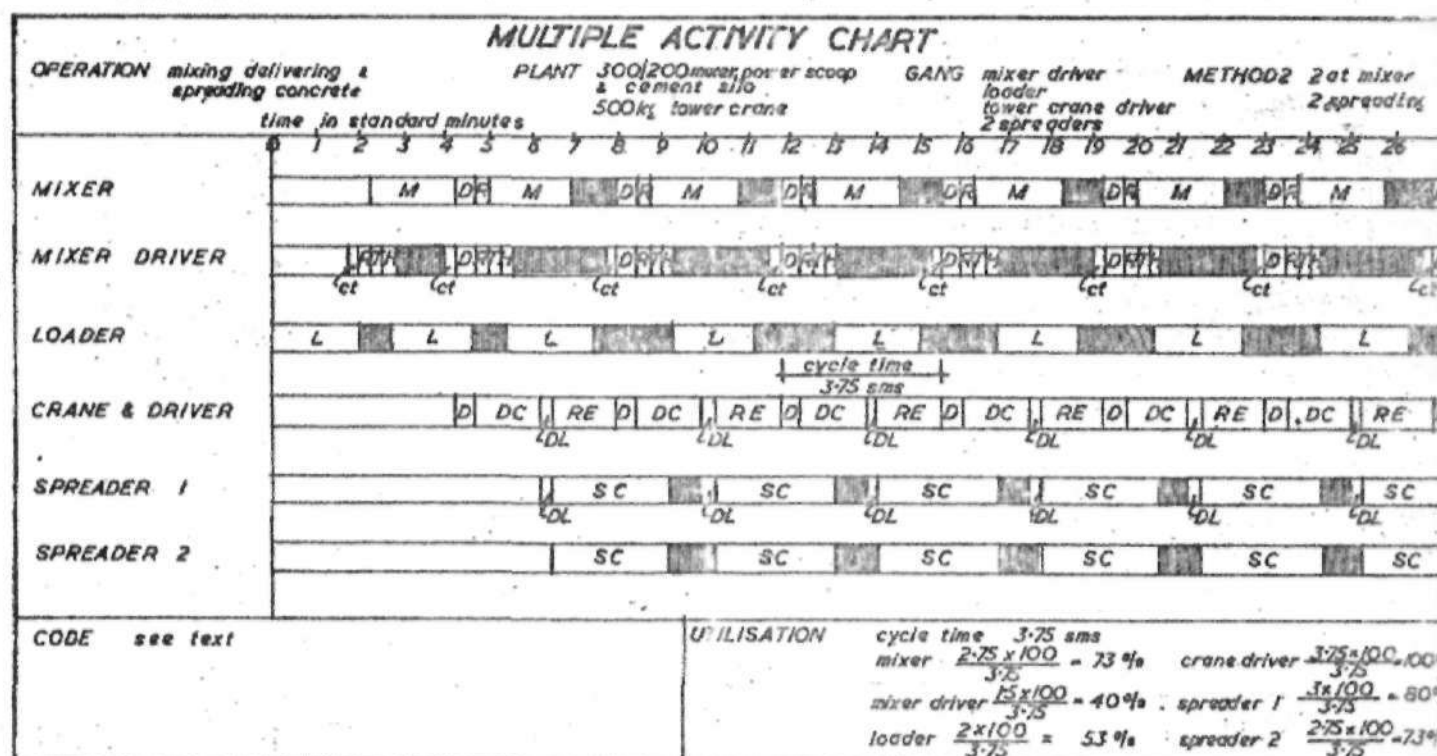


Fig. 6.8

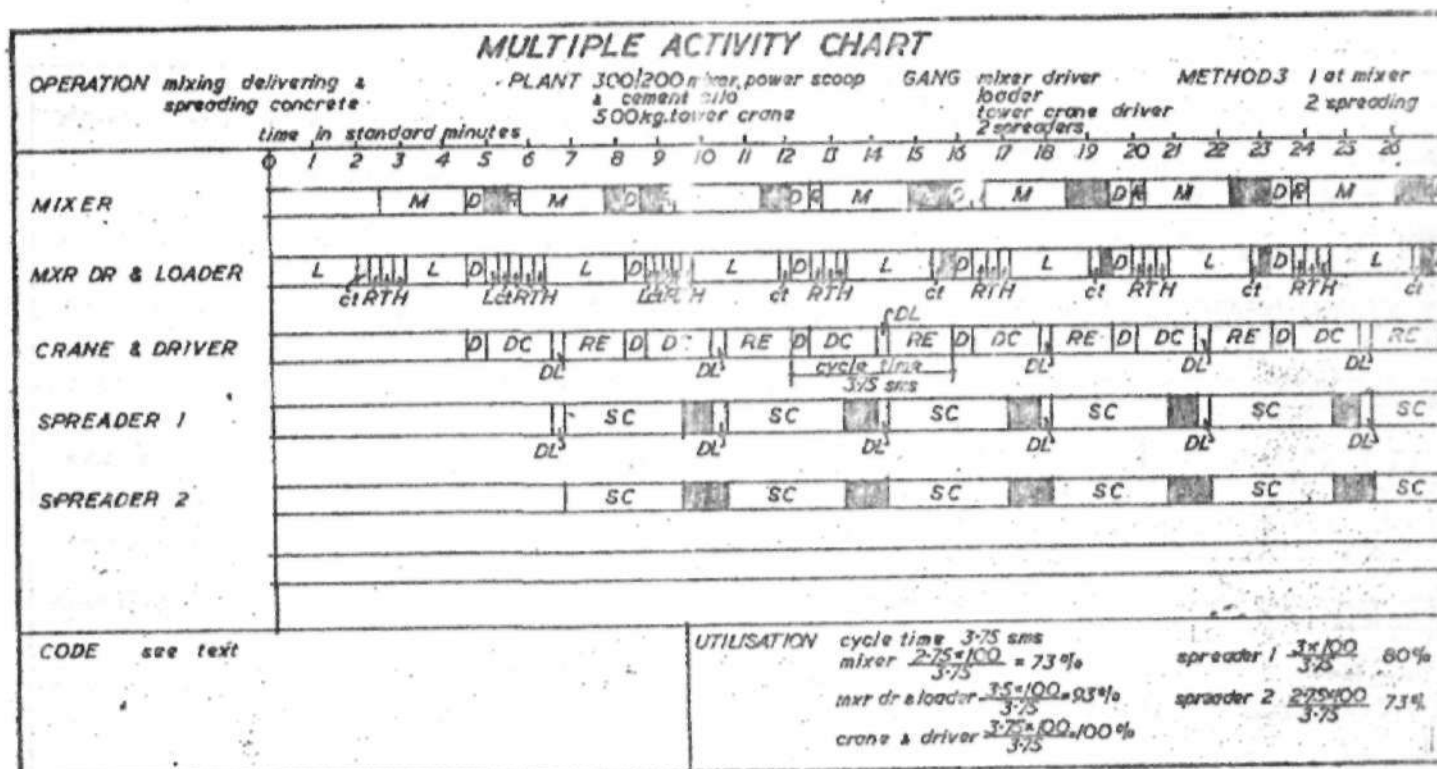


Fig. 6.9

APPENDIX D:

APPRAISALS AND ECONOMIC INCENTIVES FOR IMPROVING PRODUCTIVITY OF
LABOUR - SKILLED AND UNSKILLED.

D.1 PERIODIC APPRAISAL AND GRADING OF SKILLED LABOUR

From the observations recorded during the course of the foregoing study, one of the major problems affecting the level of productivity is the application of the fixed daily wage rate which is often un-related to the actual daily performance of the worker. Generally, the wage rate is fixed at, presently, five Naira a day for skilled worker and six Naira for the head-man. This generalised pay scale, though not considering differential performance levels of the workers, is normally based upon the standard output expected of a worker per day. Thus, for example, a mason can claim to have put in a full day's work when he lays 50 blocks and expects some overtime for any number he lays beyond this figure even though he may have completed this number when it's only just mid-day. It would not be easy to persuade him to go on working for the rest of the day without paying the overtime rate which, because of its higher cost, is understandably prohibitive.

The disadvantages of this system are obvious particularly when one considers the fact that different levels are set for different trades under conditions which, to say the least, vary considerably

from one place to the other. More frustrating is the fact that it does not take cognisance of the quality of work done. ^{question} The ~~now~~ is what to pay the tradesman who, though recognised as skilled, is not seen to put in "a fair day's work for a fair day's pay?"

More frustrating even, is the fact that the current method of remuneration does nothing to encourage workers to continually seek to improve their skills since no formal recognition would be accorded ~~their~~ improved performance.

A possible solution to the problems posed above could be the adoption of a system of grading skilled workers according to their degree of skill. This can be done by adopting a grading system on the basis of which performance appraisals or tests could be conducted every few months (six months could be ideal) to assess the quality and quantity of the workers' individual outputs.

The test arrangement may be simple, as described below, and can be conducted under normal working conditions in the normal course of the work. Performance standards are set and different grades awarded based on the output and quality of work performed (just as typists are graded on the basis of the number of words per minute they can record without incurring more than a set number of errors).

Thus, for example plasterers can be graded on the basis of an average output of $15m^2$ of plaster (cement/sand, 12mm. th.) per day using three categories graded as follows:

CATEGORY	GRADE	OUTPUT	WAGE RATE TO BE PAID/DAY	
Plasterer	AI	17-20m ²	$\frac{18}{15} \times \text{R5}$	= R6
"	AII	14-16m ²	$\frac{15}{15} \times \text{R5}$	= R5
Trainee Plasterer	BI	11-13m ²	$\frac{12}{15} \times \text{R5}$	= R4
"	BII	9-11m ²	$\frac{10}{15} \times \text{R5}$	= R3.33
Apprentice		9m ²	$\frac{7.5}{15} \times \text{R5}$	= R2.50

If a worker's record exceeds this scale, it may be worthwhile to accord him the status of instructor on a special scale. This may be equivalent to or even higher than the supervisor scale - the temptation of according him the position of supervisor should be resisted as he would then not be involved in actual production work. He should be retained on the job while being further entailed with the responsibility of imparting his skills to those less experienced than himself.

The reasons for addressing the B grades as trainees should be obvious - unions would not accept payment of wages below the approved rate to recognised skilled craftsmen. There is no rule, however, to stop us from classifying or reclassifying our workers on the basis of the accepted standards.

To be effective, it is important that the exercise be seen as a continuous process. Random checks should be carried out between

test dates to ensure that workers are not producing below the level for which they have been recognised. This will obviate the likelihood of a worker excelling himself on a test date only to fall back after he has been awarded a high scale. HE SETS THE STANDARD FOR HIMSELF AND SHOULD ALWAYS BE SEEN TO ACHIEVE IT. If he does not perform up to expectation, he must be advised immediately and any failure to comply should earn him a down-ward revision in line with his regular output.

To further enhance the usefulness of this exercise, and so that workers are further encouraged to take it seriously, whenever a worker is to be made redundant he should be given a testimonial indicating the last grade he attained and the wage rate attached to this including all relevant details. Employers will be well advised, however, to always conduct their own tests to confirm these.

ADVANTAGES TO BE GAINED BY THE FIRM

One major advantage that will be gained is that workers will become more dedicated and continue to strive to improve themselves and their output. The frustrations inherent in the former system of remuneration would be avoided and the benefits of improved productivity will begin to show up in the firm. The firm will be sure to retain most of their work-force (thus cutting down the problems associated with high turnover of labour) because of the fact that the best

workers will welcome the chance to control their own progress towards their fortunes.

Savings in time related overheads (because of the speed at which the work will progress) accrue and can be boosted by savings in material costs by using material economy achieved by the tradesman as one of the performance criteria to be used in the grading system.

D.2 ENSURING MAXIMUM PARTICIPATION OF UNSKILLED LABOUR GANGS IN THE PRODUCTIVITY IMPROVEMENT PROCESS.

Unskilled labour is utilised on many different tasks on the construction site and it can be envisaged that their use will further increase with the increased simplification of the work process advocated in section 5.6.0. This would make the regulation of their output even more important to the productivity improvement process.

This is because not all labour work can be controlled directly, nor is it as simple as one may think. While a labourer serving a mason, say, is constantly within sighting distance of the mason and can easily be pushed to work at the mason's pace, the problem of controlling labour where only their own work is involved in the job, is more difficult to achieve. Furthermore, there is, in such conditions, no need to retain the labourer on a semi-permanent basis for operations such as excavation, transportation and placing of concrete, aggregate filling, etc. Such work, it is recommended, should be given purely

on a task basis, the fixed sum payable being calculated according to the quantity of work and based on prevailing wage and standard performance rates. The gang work can be organised in a way similar to the mode of operation of stevedores.

In addition, an agreement should be reached specifying the expected finish date including a penalty clause to reduce the amount payable according to the number of days by which this date is exceeded without justification.

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