

Theoretical exploration of construction site management practices

Dube, N. N. F¹, Aigbavboa, C. O², Thwala, W. D³

^{1, 2, 3}Department of Construction Management & Quantity Surveying, University of Johannesburg, Johannesburg, South Africa

caigbavboa@uj.ac.za

Abstract. The construction industry is vital to the existence of other industrial sector and provides the environment under which other sectors operate. It is the largest industry and contributes about 10% of the gross national product (GNP) in industrialized countries. It also plays a major role in development and reaching the goals of society. The current study aims to establish the factors required in the management of good site management on construction sites in Swaziland. The study is conducted with reference to existing theoretical literature, published and unpublished research. The study is mainly a literature review/survey on site management practices on construction sites. Findings emanating from the study reveal that realistic studies have identified a number of problems on site management practices such as management and administration problems, technical problems and communication problems. It also indicates that site management involves a mixture of activities which turn basic sources to a finished product. The study presents a strong background on site management practices on construction sites in the Swaziland construction industry.

Keywords: Construction industry; site management; Swaziland

1 Introduction

Construction industries are currently faced with the problem of securing sufficient work to remain viable in an industry that contains many companies capable or at least willing to undertake almost any type of work for clients (Harris & McCaffer, 2001). Construction projects represent some of the largest and most complex undertakings known when completed. It could be viewed in two forms, the technical (in terms of concrete, steel, wood and pipes) and the complex set of roles and relationships (how the contract is planned, administered and managed) without which nothing could be achieved. These roles and relationships include

how the participants interact with each other so that the project is a success and how they resolve tricky issues encountered during the course of the project Gilbreath (cited by Obiegbu, 2002). According to Mohammed and Anumba (2006) there is an increasing number of construction organizations that are applying project improvement initiatives to improve their performance. The fundamental objectives are to deliver construction projects to the required quality more quickly and improve project performance. Unfortunately, practice is not that simple as construction work has become more complex technically and administratively, and there are several challenging engineering and management problems that occur on the site. This paper investigates site management practices in Swaziland. The paper starts with an overview of the concept of site management practices, followed by an explanation of the methodology design; presentation of the findings before conclusion are drawn.

2 Theoretical Literature on Site Management Practices

Site management practice is defined as a fundamental integrating process used to achieve organised and purposeful results in the area where building or construction work is being carried out, whether it is within, adjacent to, or separate from an existing occupied building. The main function of a site management team is to organise, inform, coordinate, order, instruct and motivate others to undertake site activities (Ashworth, 2001). Generally, the site management team has responsibility for:

- General control of all activities on the site (Newcombe, 1993).
- Production management in respect of the work undertaken by the main contractor and carried out directly on site (Santos, 2002).
- Control of sub-contractors and specialists on site (Holroyd, 1999).

According to Walker (2002) there are three most important factors considered by a site management team to be 'critical success factors' in measuring their performance. These include: completion on time; completion within budget; and attaining the specified quality level. When designing a formal system for site management, the ranking of the functions and the critical success factors should be addressed. This is necessary if high quality site management is to be attained. The site management team is also responsible for maintaining accurate records of the important happenings on site. The information should be properly recorded, so that whenever necessary it can be quickly retrieved for future use.

Site Management on construction sites involves a mixture of activities, which turn basic resources into a finished product (Mohammed and Anumba 2006). Bamisile (2004) drew attention to the fact that the effectiveness of managing production process cannot be economically attained by force, but requires the creation of conditions that will encourage self-motivation and bring about team spirit that

is important to an efficient project execution. Obiegbu (2012) indicated that construction can be seen as the conversion of raw resource inputs into defined functioning output, by means of a managed process. Construction activities can range from organization of the materials, labour, and other resources on the site activities which control the flows of information and finance (Mohammed & Anumba, 2006). The construction site is, therefore, seen as a key area where money is made or lost and where there is considerable scope for improving efficiency, productivity and quality. Obiegbu (2012) highlighted the following reasons why practicing of good site management is imperative:

- Ensuring the most efficient and effective use of resources;
- Maintaining high standard of quality and workmanship;
- Maintaining high standard of health and safety on building sites; and
- Building trust and good relations with suppliers, other professionals and support organisations which leads to fewer problems, delays and disruptions.

According to Mohammed & Anumba (2006) site management practices is made up of the following six sub-processes:

- Management, supervision, and administration of sites: Including correspondence, minutes, labour allocations, payroll, progress reporting, notices/claims, instruction, drawing register, and technical information.
- Commercial management: This covers estimating, valuations, sub-contracting, payment, variations, day works, cost-value reconciliation, final accounts, and cash flow management.
- Legal, health and safety: Management of legal, health and safety requirements on sites. This considers safety policy, insurance and building regulations.
- Planning, monitoring and control: This covers all activities associated with project planning and scheduling, typically the production of Gantt charts, network analyses, method statements, resource levelling, progress reports and exception reports.
- Delivery and materials' handling: The activities associated with the management of deliveries and the subsequent handlings of materials on site are covered including requisitions, purchase orders, material call off, and plant returns.
- Production on-site and off-site: This considers activities supporting production such as testing, setting out, dimensional checks, and plant maintenance.

Bamisile (2004) opine that the effectiveness of managing the production process according cannot be economically achieved through the use of force but through creation of conditions that will encourage self-motivation and create team spirit which is efficient to project execution.

3 The role and responsibilities of construction site managers

The main responsibility of construction site managers is to put together an effective team, as well as dealing with outside influences such as the local labour market, competitors, local authorities and suppliers (Newcombe, 1993). Griffith and Watson (2004) see the main roles of construction site managers as: forecasting, planning, organising, controlling, motivating, coordinating and communicating. Furthermore, Styhre and Josephson (2006) take the view the site manager as a project leader who is responsible for a number of different activities and processes including production planning, procurement, administration, staff management activities, leadership works, and meeting with stakeholders such as clients, end users and customers. In terms of responsibility, Djerbarni (1996) found that construction site managers carry out one of the toughest and hardest jobs in the construction industry. Site management is characterised by a high work overload, long working hours, and many conflicting parties to deal with, including (amongst others) management, subcontractors, subordinates, and the client. Moreover, Mustapha and Naouni (1998) argue that the site manager stands at the heart of the success or failure of a project. In the project context, the site managers are assigned an intermediary role between the 'thinking' (top management) and the 'doing' (subordinate workers). Styhre and Josephson (2006) suggested that the experience of being stuck in between project objectives and day-to-day administrative routines has imposed an additional workload on site managers and caused some concerns. The site manager is responsible for directing and controlling all on-site activities within the limits of the organisational hierarchy. Therefore, how they spend their time is of critical importance. Griffith and Watson (2004) revealed that 25% of the site managers' time was being spent on administrative duties, instead of concentrating on managing the site more effectively. Construction site managers must have certain skills such as managerial skills and the competencies to overcome daily problems and constraints on the construction site. According to Newcombe, (1993), an effective site manager needs the certain skills which are essential ingredients for managing the construction site.

4 Components of site management procedures

Effective site management procedures provide the foundation for a successful construction project. The key components of site management procedures contributing to the success of a project are: the site organisation; site policies and procedures; planning; supervision; and meetings and reports (Newcombe, 1993).

4.1 Management, supervision and administration of sites

For any construction project it is a fundamental need to have appropriate management of the site. Basically, all the information collected on site needs to be referred back to the Head Office. It must be submitted on time so that the department receiving it can process the information. The site management team will have required timings and calculations for such items as the following: wages, plant, materials received on a weekly basis; valuations, sub-contract details on a monthly basis, and correspondence and general information as necessary. Although the site management team will receive information on costs on a monthly basis, wages arrive weekly, and general data also arrives weekly. For the purposes of communication it is customary for site managers to design suitable standard forms to be used in as many situations as necessary and which everyone finds easy to understand (Forster, 1989). Important information includes correspondence, minutes, RFIs, labour allocations, payroll, progress reporting, notices or claims, instruction, drawing register and technical information.

4.2 Commercial Management

It is important for construction site managers to fully appreciate that commercial management is essentially a management technique, not a quantity surveying technique. A cost control system should be designed so that it enables the site management team to satisfactorily collect and produce information from which the monitoring of actual costs can be compared to estimated costs. This covers estimating, valuations, interim payment, variations, day works, cost-value reconciliation, final accounts and cash flow. To get maximum benefits from the system that the site management team employs, crucial actions are required (Griffith & Sidwell, 1995).

4.3 Health and safety management

Effective health and safety (H&S) management is founded on the provision of a safe and healthy working environment with safe systems of work at its core. The key to success is to ensure that H&S aspects are carefully considered and the risk of danger and hazard to persons, as a result of site activities, is systematically safeguarded. According to Mohamed (2002), the major causes of accidents on site have been identified and can be directly attributed to unsafe design and site. H&S management on the construction site should include the following: safety policy; COSHH and CDM regulations, insurance, building regulations, British Standards and Codes of Practice. The achievement of the H&S management implemented is evidenced in the effectiveness of information gathering through monitoring and the methods by which it is recorded. Different organisations will have their own procedures for documenting H&S activities on site. Typical approaches include the use of a set of forms which are completed by supervisors and operatives as elements of the H&S plan are implemented (Griffith & Watson, 2004).

4.4 Planning, monitoring and control

Planning is the process of determining, analysing, devising and organising all resources necessary to undertake the project. The core element of planning is the establishment of a programme which reflects the planning process in relation to real time (Griffith & Watson, 2004). In practical terms, construction planning is the total process of determining the method, sequence, labour, plant, and equipment required to undertake a building project. It is also to obtain the necessary volume and speed of output, and ensure quality. Harris and McCaffer (2001) argued that construction planning involved two main elements: method study and work measurement. The method study is to record work procedures, provide systems of analysis and develop improvement. It gives improved planning and control and better use of material, plant and manpower. The work measurement is the measurement of the time required to perform a task so that an output standard of production for a worker and machine may be established. The main aim is to assess human effectiveness to production planning, estimating and incentive scheme on site. This covers all activities associated with project planning and scheduling, typically the production of a Gantt-chart, network analyses, method statements, resource levelling, progress reports and exception reports.

4.5 Delivery and Materials Handling

This process is to bring to the project the appropriate materials at the right time, quantity and price to enable the construction work to proceed according to programme and to the necessary quality standards (Newcombe, 1993). There are four types of information considered useful for the delivery and materials' handling process: the specification, the contract drawings, the bill of quantities and architect's instruction issued during the construction. The activities associated with the management of deliveries and the subsequent handlings of materials on site are covered including requisitions, purchase orders, material call off, and plant returns. Clearly a site manager or his/her sub-ordinate has to carry out a crucial task to monitor the performance of materials on-site including quality and quantity checks on arrival. The quality checks include: visual checks on all materials; examination of ready-mixed concrete by hand for texture and check using slump tests; and carry out visual and handling checks on bricks and the like for broken edges. The quantity checks can be by: a site or public weighbridge, counting and volume checks. According to Holroyd (1999) site control measures should be kept by the site manager.

4.6 Production on and off site

Applying quality procedures to production on-site and off-site will enhance quality levels by reducing defects. Examples of activities supporting production include Quality Assurances (QA) plans and report, contract terms, drawings, specifications, setting-out and measurements. The QA plan is important for the site management team to have as a benchmark against which to control quality on site. QA focuses upon consumer protection and offers clients an assurance that the building has been built properly under satisfactory conditions of quality controls and that the building has been judged suitable for its intended use.

4.7 Problems on the construction site

There are several challenging engineering and management problems that occur on construction sites. These problems affect the time, budget and plans, and specifications (Trauner, 1993) and often cause defects, disputes and delays (Clarke, 1988). According to Holroyd (1999) many construction site procedures and methods have not changed over the years and the same mistakes are being repeated. The main reasons are because the site management is characterised by high work overload, long working hours and many conflicting parties to deal with,

including the management of the sub-contractors and liaison with the clients (Griffith and Watson, 2004). For instance, the problems identified within site management practices can be categorised into three: management and administration problems; technical and engineering problems; and site communication problems.

4.8 Management and Administration Problems

Most site organisations have policies which lay down procedures for the site managers to observe regarding management and administration problems. These problems have to be addressed in order to ensure that project objectives are achieved. Additionally, there is a wide range of constraints which could occur on-site and the site managers should be prepared to deal with each of them in a systematic and efficient way. This can be achieved through training or education on how to deal with the unexpected (Forster, 1989).

4.9 Technical Problems

Plant problems: Maintenance of construction plant and plant management (Ogunlana and Olomolaiye, 1989). Many construction organisations tried to avoid these costs by providing the minimum of maintenance, which has often resulted in unexpected breakdowns, lost production and inefficient machinery (Harris and McCaffer, 2001). Piling construction: Methods used for recording the pile information may duplicate effort and potentially places the integrity of the pile at risk. Data transfer errors made from the schedule and miscalculation during pile construction can result in nonconforming piles being constructed, leading to additional costs, delays, and client dissatisfaction (Ward et al., 2003). Existing services: The utility services such as existing sewers, water distribution pipes, electricity cables, gas mains and telecommunications cables can disrupt construction works (Illingworth, 2000).

4.10 Communication Problems

The nature of the relationships was the main factor behind the poor communication; as a result of the historical development and fragmentation of trades, professions and responsibilities. In fact, top management often do not know what was happening on site (Tah and Carr, 2001 & Barber, 1999). Communication difficulties often occur during the construction stage because it is here that the level of information available to all parties reaches its peaks. However, Emmitt and Gorse

(2003) suggested that as information is received from structural engineers, architect, mechanical engineers, and other consultants, discrepancies, drawings should be expected, and checks should be made to find where instructions are incompatible. Any problems must be reported to the contract administrator and meetings should be held with the aim of quickly resolving any differences. In addition, developments in information technology and communication have changed organisational communication. Information is now available to site managers and other employees faster, more reliably and in larger quantities than before. Information now has to be systematically managed and information networks carefully designed and monitored (Fryer, 2004).

4.11 Management Approaches to Improve Construction Site Management

According Griffith and Watson (2004) successful organisations are those that have drastically changed or re-engineered their business processes. Consequently, other industrial sectors such as manufacturing and petrochemical industries are commonly able to benefit from better prospects in attracting skilled workers, either by providing superior working conditions or in being able to pay higher levels of remuneration. Improvement of the construction site management processes has focused on attempts to change practices to be more responsive to customers and to improve performance in quality, time, speed and reliability, while reducing production costs. There are several management approaches implemented to improve construction site management. These approaches include total quality management, just-in-time, business process re-engineering, concurrent engineering and knowledge management.

Findings and lesson learnt

Findings from the review of literature reveal that the effectiveness of managing construction site production process can economically be achieved through creation of conditions that will encourage self-motivation and the creation of team spirit which is efficient to project execution but not through force. Also, the site manager was found to be responsible for directing and controlling all on-site activities within the limits of the organisational hierarchy and must have certain skills such as managerial skills and the competencies to overcome daily problems and constraints on the construction site. As an essential ingredients for managing the construction site, an effective site manager needs some skills to provide the foundation for a successful construction project. It is also customary for construction site managers to design suitable standard forms to be used in as many situations as

possible which every employee will find easy to understand for the purposes of communication. They also need to some crucial actions in order to get maximum benefits from commercial management. Unsafe design has been identified to be the major causes of accidents on site. There is the need for planning, control and measurement on site to to assess human effectiveness, as well as performance monitoring of materials on-site. Defects will aslo be reduced and quality levels enhanced when on and off-sites production is applied. Management and administration, technical and communication were identified as the major challenging engineering and management problems that occur on construction sites. Total quality management, just-in-time, business process re- engineering, concurrent engineering and knowledge management are the required approaches by management to improve construction site management.

8 Conclusion

It can be concluded from the the findings that effective management of the production process cannot be economically achieved through force. The construction site manager is responsible for directing and controlling all on-site activities within the limits of the organisational hierarchy and must have skills to provide the foundation for a successful construction project. Total quality management, just-in-time, business process re- engineering, concurrent engineering and knowledge management can be uaed to solve the major challenging engineering and management problems on construction sites.

It can be concluded from the the findings that effective management of the production process cannot be economically achieved through force. The construction site manager is responsible for directing and controlling all on-site activities within the limits of the organisational hierarchy and must have skills to provide the foundation for a successful construction project. Total quality management, just-in-time, business process re- engineering, concurrent engineering and knowledge management can be uaed to solve the major challenging engineering and management problems on construction sites.

References

- Ashworth, A. (2001). Contractual Procedures in the Construction Industry: 4th Edition. Longman, Harlow.
- Bamisile, A. (2004). Building Production Management: The Professionals Instruction Manual. Foresight Press Limited, Lagos – Nigeria.
- Clarke, R. H. (1988). Site Supervision. Thomas Telford, London.
- Construction I.T. (1996). Benchmarking Best Practices Construction Site Processes. Construct I.T. Centre of Excellence, University of Salford, Salford.

- Djrbani, R. (1996). The Impact of Stress in Site Management Effectiveness. *Construction Management and Economics*, Volume 14, pp. 281 – 293.
- Emmit, S. and Gorse, C. (2003). *Construction Communication*. Blackwell Publishing, Oxford.
- Forster, G. (1989). *Construction Site Studies, Production, Administration and Personnel: 2nd Edition*. Longman Scientific and Technical, Essex.
- Fryer, B. (2004). *The Practice of Construction Site Management: 4th Edition*. Blackwell Publishing, Oxford.
- Griffith, A. and Sidwell, T. (1995). *Constructability in Building and Engineering Projects*. Mac-Millan, Basingstoke.
- Griffith, A. and Watson, P. (2004). *Construction Management: Principles and Practices*. Palgrave MacMillan, New York.
- Harris, F. and Mc Caffer, R. (2001). *Modern Construction Management, 5th Edition*. Blackwell Science, Oxford.
- Holroyd, T. M. (1999). *Site Management for Engineers*. Thomas – Telford, London.
- Illingworth, J.R. (2000). *Construction Methods and Planning, 2nd Edition*. E&F Spon, London.
- Mohamed, S. (2002). Safety Climate in Construction Site Environments. *Journal of Construction Engineering and Management*, Volume 128, Issue. 5, pp. 375 – 384.
- Mohammed, S.F. and Anumba, C.J. (2006). Potential for Improving Site Management Practices through Knowledge Management, *Construction Innovation: Information, Process, Management*, Volume 6, Issue 4, pp. 232-249.
- Mustapha, F. H. and Naoum, S. (1998). Factors Influencing the Effectiveness of Construction Site Managers. *International Journal of Project Management*, Volume 16, No.1, pp. 1 - 8.
- Newcombe, R., Longford, D. and Fellows, R. (1993). *Construction Management: Organisation Systems*. B T Batsford, London.
- Obiegbo, M.E. (2002). An overview of the Unique Role of the Builders.
- Santos, A. D., Powell, J. A. and Sarshar, M. (2002). Evolution of Management Theory: The Case of Production Management in Construction. *Management Decision*, Volume 40, No.8, pp. 788 – 796.
- Styhre, A. and Josephson, P. E. (2006). Revisiting Site Manager Work: Stuck In the Middle? *Construction Management and Economics*, Volume 24, No.5, pp. 521 – 528.
- Tah, J. H. M. and Carr, V. (2001). Towards a Framework for Project Risk Knowledge Management in the Construction Supply Chain. *Journal of Advancing in Engineering Software*, Volume 32, pp.835 – 846.
- Trauner, T.J. (1993). *Managing the Construction Project: A Practical Guide for the Project Manager*. John Wiley and Sons, New York.
- Walker, D.H.T. (1997). Choosing an Appropriate Research Methodology. *Construction Management and Economics*, Volume 15, pp. 149 – 159.
- Ward, M.J., Thorpe, A., Price, A.D.F. and Wren, C. (2003). SHERPA: Mobile Wireless Data Capture for Piling Works. *Computer – Aided Civil Engineering and Infrastructure Engineering*, Volume 18, No.4, pp. 299 – 312.