

AN INVESTIGATION OF THE FACTORS INFLUENCING THE SUCCESS OF CONSTRUCTION PLANNING FOR THE 2012 OLYMPIC STADIUM: AN ETHNOGRAPHIC STUDY

Ashokkumar Subbiah¹

Birmingham School of the Built Environment, Birmingham City University, Birmingham B4 7XG, UK

Adherence to the planned duration is one of the main criteria when judging whether a construction project is a failure or not. In addition, construction planning is said to be successful if the project completes within the planned duration; or if it identifies an issue well in advance, thereby alerting the project management team to solve the issue before it causes any impact on the completion date. This research investigates the factors that influenced the success of construction planning of 2012 London Olympic Stadium. An approach of participant observation was adopted which is informed by the principles of ethnography: one that reports the participants' view of their world rather than imposing an artificial theoretical framework upon it. As a senior planning engineer working professionally on the Olympic Stadium from pre-construction until final completion, key human-relations factors were observed and identified that had an impact on the management and execution of the construction planning. The success factors were identified and relate to, for example: the effectiveness of preconstruction planning; the inclination of top organisation hierarchy towards construction planning; the inter relationship between the project participants; the influence of the client and contract; and the efficiency of planning team. It was found that a 'shadow culture' exists between the project participants which, it is argued, is only observable from the perspective of an embedded participant observer. This shadow culture acts to enable the management of the planning process and its efficacy relates to the 'quality' of human inter-relationships in the planning team and amongst immediate stakeholders. The research concludes by questioning the myth amongst project participants that construction planning is a mechanistic process that has to be conducted solely by the planning team.

Keywords: construction planning, inter relationship, participant observant, shadow process.

INTRODUCTION

Whilst there is an extensive literature that identifies construction planning as one of the major factors influencing the success of a construction project, there is scant examination of the factors that influence the success of construction project planning. This paper investigates the factors that influence the success of construction planning and the significance of the shadow culture among project participants to meet the planning requirements. A leading civil engineering contractor, Sir Robert McAlpine (SRM) was appointed as the design and build contractor for the construction of the 2012 Olympic Stadium under Engineering and Construction Contract (ECC), which is a part of the New Engineering Contract (NEC) family. This contract was signed

Subbiah A (2012) An investigation of the factors influencing the success of construction planning for the 2012 Olympic stadium: An ethnographic study *In*: Smith, S.D (Ed) *Procs 28th Annual ARCOM Conference*, 3-5 September 2012, Edinburgh, UK, Association of Researchers in Construction Management, 1035-1045.

between the Olympic Delivery Authority (ODA) and SRM in 2008. CLM (a joint venture of CH2M Hill, Laing O Rourke and Mace) the ODA delivery partner, was solely responsible for monitoring the works executed by SRM. NEC3 Engineering and Construction Contract, Option C: Target Contract with Activity Schedule was used for the appointment of the contractor for engineering and construction work, including any level of design responsibility. The top level hierarchy of SRM is occupied by the project director succeeded by the project manager. They are primarily responsible for the delivery of this project and they manage the various teams under them for the successful completion of the project. Bowles (1991) uses the conceptual framework of “shadow organisation” to investigate the underlying factors which act as a shadow for the effective functioning of the process. This paper researches the effectiveness of the planning process in terms of how it meets the requirements of the project participants and explores the significance of shadow organisation for the success of construction planning process. Although the research focuses on one landmark construction project, the 2012 UK Olympic Stadium, it can be related to the project management of a wide variety of other large projects.

BACKGROUND

Construction planning is a key determinant of success for a project and the sequence of steps undertaken in planning can be identified (Syal *et al.* 1992; Hamilton and Gibson 1996). Mawdesley *et al.* (1997) argue that planning is a general term used to encompass programming, scheduling and organising. Programming is seen as a constituent part of planning (Mawdesley *et al.* 1997; Cooke and Williams, 2004; Griffith and Watson, 2004). According to Gidado (2004), construction planning is aimed at making effective use of space, people, materials, plant, information, access, energy, time and money in order to achieve the set project objectives. It is made up of four main parts, namely programming and scheduling, method statements, organisational systems and site set up. The project plan, often referred to as a programme, is prepared in close coordination with the project team. Programmes - good programmes - can be difficult and time-consuming to produce (Joselin 2004); however, they are also essential for the proper management of the contract. Dvir *et al.* (2003) identify pre-construction planning as a crucial factor in the successful delivery of the project. Winch (2002) proposed that overall project programme methodology is often effectively formed during the tender or pre-construction period and quickly becomes enshrined within the master construction programme; therefore subsequent programmes developed to actually manage the project are constrained by the decisions often made in haste during this stage. However, Miyagawa (1997) considers that it is essential to create pre-construction and project master plans that are feasible, as their overall reliability and achievability is deemed a prerequisite for later success during the construction phase.

Cooke and Williams (2004) state that the programme is an important document for administering the contract and its role is to monitor progress and to make sure that it is maintained as the most recent one. Bar charts have been used extensively for planning and monitoring construction projects (Lowsley and Linnett 2006). The construction plan is prepared by the planner and there are three types of planner, grouped by the role of their organisation, namely the client organisation, the architects or designers and the contractors (Harris and McCaffer, 2006). Laufer and Tucker (1988) state that specialist planners have the time to do the work and better strategic decision-making skills, but they may have incomplete practical knowledge, limited detailed information available and also lack final decision-making authority. Conversely, construction

managers may have improved practical knowledge and possess decision-making authority but lack the time to plan. Construction planning, be it master planning, stage planning or short-term planning, relates to site activities involving people who normally, with the exception of short-term planning, do not participate in this process (Cooke and Williams, 2004). Construction planning must be carried out by competent people who are experienced in field work (Clough *et al.* 2000). There are two types of construction planning; strategic planning and operational planning (Harris and McCaffer, 2006). Strategic planning results in a broad outline of an integrated programme, which consists of design, procurement and construction activities, and is logically linked to forecast the critical path. This program is submitted for acceptance to the client, and is later used for scheduling and tracking the project.

Adeli and Karim (2001) define scheduling as a process of creating and maintaining a plan of work that documents the sequence and timetable of execution; therefore considering only the time attribute of the project and not the cost. There is a substantial literature that examines the planning process. Over twenty years ago, Laufer and Tucker (1987) critically examined the US construction planning process and found an over-emphasis on critical path methods; a lack of construction experience amongst planners; poor information gathering; and an overemphasis on control at the expense of action-orientation. Subsequent work by Laufer *et al.* (1994) found that the planning process lacked a clear system, and is often conducted by a planning 'specialist' who often does not have the necessary practical experience. Furthermore, they argue that collaboration involving line managers, designers, and planners is essential for effective planning. Laufer (1992) claims that construction managers often consider the delegation of construction planning authority to planner as threat to their position and treat such plans as irrelevant forecasts.

Johansen (1996) agreed, finding that construction managers often ignore the formal project master programme and instead adopt their own flexible approach to planning. Ballard and Howell (1998) emphasize that construction planners should only be responsible for "quality assignments" where tasks are sufficiently well defined to be co-ordinated with other work, for example in an attempt to improve the quality of production. Winter and Johnson (2000) also shared the view that most contractors' programmes do not have the necessary links, are not resource-driven and, on the whole, are not prepared to reflect what will actually happen on site, but are designed to win the job for the contractor. Faniran *et al.* (1999) found that poor performance was the result of both too little and too much planning, where uncertainty and over-control were evident within the plan. Johansen and Porter (2003) highlighted the need for improved sub-contractor planning competence, their increased input and closer involvement in the planning process and the availability and distribution of accurate subcontract trade performance output and resource data.

All these factors have a cultural context, but such studies are most often presented in a rationalistic framework of the work process. This research adopts a methodology that seeks to present the findings and analysis in manner that moves away from the rationalist approach towards a more 'fuzzy' interpretive approach; one that is better equipped to encompass the subtleties and even paradoxes observed in real practice. Jha and Iyer (2007) concluded that commitment, coordination and competence are the key factors for the success of a project and these need to be managed efficiently to achieve better overall performance. This research will apply some of the principles of shadow organisation to investigate the organisational structure and relationships in construction planning. The notion of the shadow organisation dates back to work by

Bowles (1993) which suggests that the overt work processes are often shadowed by unseen processes that make organisation function. These shadow processes are rarely evident by observers who are outside the organisation; yet such processes are often vital for the effective functioning of the organisation.

RESEARCH METHOD

Research on the factors that influence construction planning is still in its early stages. Eisenhardt (1989) suggests that prior to entering the field, researchers are well advised to begin by gaining some theoretical background on the phenomenon they wish to study: defining a set of research questions that they would like to address, and identifying constructs that they intend to investigate. According to the seminal work of Homans (1949), there are neither good nor bad methods, but only methods that are more or less effective under particular circumstances in reaching objectives on the way to a distant goal. These options range from qualitative investigations to quantitative analysis, from modelling to simulations designed to describe scenarios and test hypotheses. Qualitative research is appropriate for this type of research which examines the cultural dimension, with its informal and unstructured linkages and process of organisation (Lincoln and Guba, 1985). A qualitative, participant approach also recognises the call for a closer link between research and practice. Seymour and Rooke (1995), for example, argue that a researcher needs to access the 'situated knowledge' of people in practice in order to be able to identify the reasons underlying any problem or success. This method involves the researcher "getting to know" the people being studied by entering their world and participating - either openly or secretly - in that world.

Scott (1965) states that the researcher conducting an exploratory or a descriptive study is more likely to engage in sustained interactions with his subjects. In this research, the objective is to investigate the factors that influence the development and management of the construction planning. In order to answer these exploratory and descriptive questions, it was appropriate to perform qualitative field research. Some of the advantages of qualitative research are greater awareness of the perspectives of programme participants, understanding the significant developments in a programme (process) as it evolves, awareness of time and history, ability to "find out what's happening" more realistically, and alertness to unanticipated and unplanned events (Weiss 1998). Having chosen a qualitative approach, the next task was to choose a methodology from the several options available to qualitative researchers. Leonard-Barton (1990) suggests that the advantage of using one method outweighs the disadvantages of other methods. Being employed by Sir Robert McAlpine as a full-time planning engineer on site for the construction of 2012 Main Olympic Stadium, the researcher decided to choose participant observation as the research method as it would blend in with the role of a full-time employee. Participant observation is a deeply qualitative approach to management research and has much in common with approaches in sociology such as ethnography and action research (Carr and Kemmis 1986).

Dewalt and Dewalt (2002) add that participant observation improves the context-relatedness and overall quality of data collection and interpretation, and can lead to the development of new and insightful research questions. Yet some criticise the participant observer approach, suggesting that it produces erroneous material because of the inevitable bias of the researcher's personal interest in a particular setting or person's behaviour. To respond to this, this research will not seek to be neutral as in a

scientific experiment, but will involve the researcher's views and analysis in an open, balanced approach to neutrality. DeMunck and Sobo (1998) claim that there are problems when researchers select people or settings that are similar to themselves, and simply find what they had hoped to discover in the first place. As the researcher is also part of the setting being studied, it is a component of the methodology that prior thoughts and experiences are not excluded from the analysis, but used as a useful tool in the interpretation of what is going on. Barnard (2006), views as an advantage to have pre-understanding of the setting and not a disadvantage. Several theoretical and practical issues addressed by Van de Ven and Huber (1990) were considered while selecting a project to investigate the factors that influence the process of the project planning. These include the time commitment of the researcher, choices about data collection and the degree of involvement in the project. Having considered these objectives, the 2012 Olympic Stadium was chosen as a case study for this research. Major factors influencing selection of this project for this ethnographic case study included its status as a major landmark project in the global construction arena, involvement of large number of project personnel in organizational hierarchy, the type of contract, the reputation of the main contractor and client, and the facts that the project was then at its early stages and being embedded in this project would prove advantageous in collection and analysis of data.

It has to be agreed with the view of Hammersley and Atkinson (1995) that the problem of obtaining access to the necessary data looms large in ethnography and is often at its most acute in initial negotiations to enter a setting and during the 'first days in the field'; though the problem persists, to one degree or another, throughout the data collection process. It should be noted that access to information and official permission for choosing such a landmark project for research would be virtually impossible if the researcher had not been a full-time employee of this project. As Hammersley and Atkinson (1995) point out, in using this participant observant approach the researcher is himself the research tool *par excellence*. Several key writers have emphasised the need to build relationships during the initial stages of field research (Gardner and Whyte, 1946). In the initial days of this project, the focus of the research was to build relationships with project personnel rather than moving directly to interviews. This research was conducted in an ethical manner by consulting with the project personnel regarding the purpose of observing and the documentation of their activities. Interviewees invited to participate in this research were informed about the purposes of the research and given the opportunity to decline to take part. Another ethical responsibility was to preserve the anonymity of the participants in field notes and in the final write-up. Identities have been described such that stadium team members will not be able to identify the individual participants.

RESULTS

Being embedded as a participant observant for more than 4 years, it was helpful to identify the factors that influenced the success of planning process of the 2012 Olympic Stadium project. A further investigation of the identified factors and semi structured interviews with the project participants was efficient to categorise the key factors. They are pre-construction planning; SRM management team and organisational structure; system of planning; coordination and communication among project team; contract and procurement type; and contribution of client. These factors are discussed below.

Pre-construction planning:

The pre-construction planning commenced almost a year ahead of actual construction. Productivity during the pre-construction stage was exemplary due to the fact that the project participants (which include the client, main contractor SRM, Designers) were all based at one location. The main intention of placing the entire team in the same location is to initiate and drive the design and procurement process. The procurement of the major packages such as piling, substructure and superstructure concrete and structural steel, precast terrace units etc was completed during this pre-construction phase. A senior Quantity Surveyor commented that 'It is very rare to find a whole team organised so early during the preconstruction stage to strategically work out the design, procurement and logistics processes. This pre-construction period also helped to develop the organisation structure of the project team. The pre-construction period was very helpful for the main contractor, SRM to educate their project personnel about the requirements of the contract and the client well ahead before commencement of the actual construction. Due to the effective pre construction planning, the commencement of the actual construction was one month in ahead of what had been planned during by SRM.

SRM Management Team and Organisation Structure:

The involvement and dedication of the SRM management team played a major role for the successful development and management of the construction project plan. The regional management team emphasises effective planning on all construction projects undertaken by SRM irrespective of the requirement of the client and type of contract. A high level summary programme was prepared by the planning team for the project director every month to be presented at the regional board meeting. The regional director made weekly visits to the construction site office and reviewed the detailed project plan with the planning manager and project manager. The organisational structure developed for this landmark project was well resourced with respect to adequate project personnel who had good experience in their allocated designation. SRM had their best and sufficient project personnel allocated for every role of the project. An Engineer commented that 'the responsibilities I have on this project is very less compared to my previous projects with SRM and it is mainly because of the sufficient resources allocated to this project'. The regional management team's direct involvement in the project plan and organisational structure development motivated and demanded that the project planning team achieve the objectives set by the client and the contract.

System of Managing Construction Planning by the Planning Team

Programmes are the best way to develop and manage the construction planning of any major project. The major strategy implemented in 2012 Olympic Stadium project, to make the construction planning successful was to produce the Programme for Acceptance (PFA) and Progress Reports (PR) on a monthly basis. According to the contractual requirements, the main contractor Sir Robert McAlpine Ltd (SRM) submits a programme for acceptance (PFA) in the first week of every month. The Client (CLM) reviews the programme and communicates to SRM within the next 14 days about the outcome of the programme through project manager's instruction (PMI). If the programme had been accepted, SRM record the actual progress in that programme and measures it against the planned progress in PFA. This is then submitted to the client as progress report (PR) towards the last week of every month.

If the programme had been rejected then SRM record the actual progress in the previous accepted programme and submits it to CLM. SRM submitted the first PFA in April 2008 and was accepted by CLM. The last PFA was submitted in March 2011. There had been several programmes which had been rejected by CLM and SRM had to make the required modifications to get it accepted. There had been several programmes rejected by CLM along with an explanation for the rejection during the initial months when programmes were submitted by SRM for acceptance. An informal communication between the Planning Managers of SRM and CLM with an objective to get the programme accepted before formal submission was a key shadow process identified in this research. This shadow process helped to get the programmes submitted by SRM to be accepted by the CLM. The Planning Manager stated 'objective of a PFA is to demonstrate to CLM that the programme is practicable and therefore, that we are spending the Clients money properly. Process/obligations not fully understood or adhered to initially by either SRM or CLM, but for most of the time they were followed as closely as reasonably practicable'. All the Planners involved in the project agreed with the Planning Manager view that PFA cannot be prepared just by the planning team. It must have significant input from construction, design and commercial management staff.

Coordination and Communication among Project Team:

It is a well known fact among construction industry professionals, that the coordination between the project manager, planning manager and site team should be excellent for the successful development and management of the project plan. This research identified the shadow process that made the communication and coordination among the project personnel effective and thereby played a key factor for the successful development and monitoring of the construction planning. The coordination between the planning manager and project manager, planner and subcontractor had shadow process embedded in it to develop and manage the construction project plan. The shadow process was identified from the pre-construction stage up to the final completion. The ability of the planning team to develop, coordinate, communicate and monitor the construction project plan to satisfy their own requirement along with the needs of the SRM management, client and sub contractors was one the major driving factor for the success of the planning process.

Contract and Procurement Type

The NEC contract and the procurement type were major factors that influenced the success of the construction planning. The level of information required to be presented on a construction planning is very high and this requirement pushed the planning team to develop a detailed integrated program to accommodate the NEC contract requirements. NEC form does not make provision for a traditional baseline other than the current Accepted Programme. It's emphasis was to looking forwards at what needs to be done to achieve the objectives, (with the effects of all the updates) rather than assessing what we have done compared with what we should have done against a programme developed a relatively long time ago. Also to satisfy the requirements of the NEC contract on programming, a significant amount of effort from designers, commercial team, construction team and sub contractors were required. The procurement type for this project was Design and Build, and this allowed the main contractor SRM to drive the design process to the required standards during the preconstruction phase. SRM dictated the designers the sequence of the design deliverables to accommodate the construction program. For example, the designers

were prepared to develop and deliver the drawings of the south stand of stadium ahead of the west stand as per the contract programme. During the pre-construction period, the main contractor realised that the design information of the west stand was of higher priority and instructed the designers to release the details of west stand ahead of the south stand. It was design and build procurement type which allowed the main contractor, SRM to communicate and coordinate effectively with the design team.

Contribution of Client

The involvement of the client on the planning process was a major factor for the success of planning process. The contract placed a set of requirements on the main contractor's planning team and the client played a significant role by making sure that the objectives set by the contract was achieved. The correspondence between the client and main contractor were formally communicated as 'project manager's instruction' and was recorded. The program for acceptance and progress reports submitted by the main contractor planning team was reviewed and the outcome of the decision was formally communicated within the specified time limit. Though some of the reports which were produced to the client on a monthly basis were time- and effort-consuming, and proved to be of lesser significance from the main contractor's perspective, it has to be acknowledged that the client's requirements pushed the main contractor to develop a fully integrated programme as per the contractual requirements.

CONCLUSION

The aim of this research was to investigate the factors that influence the success of construction planning of 2012 London Olympic Stadium. The participant observation method was adopted from pre-construction until final completion, to understand the process of construction planning and the challenges associated with it. The preconstruction planning proved to be very helpful to progress well in advance with the design and procurement phase before the commencement of the actual construction. The key factor which helped SRM during the preconstruction planning was the formation of a project team during the preconstruction stage and the same team was maintained till the completion of the project. The top management of the main contractor were very committed and focussed in planning process. Training was given to project personnel to extend their full cooperation towards planning process. Engineers were trained to become managers and educated them that planning is a process which will be successful only when it is supported by the whole project team.

The planning requirements of the client helped the main contractor to successfully manage the planning process. Though some of the planning reports which the main contractor produced for the client were of lesser importance from the perspective of the main contractor, it drives the main contractor to develop and manage a strong planning process in order to deliver the reports to client. The procurement type and the contract played a significant role for the performance of the planning process. The preconstruction planning of the stadium was very effective with respect to design delivery since SRM was the design and build contractor and instructed the design team to produce information based on their requirements. This research revealed that planning is a systematic process and requires key human-relations factors to have an impact on the management and execution of the construction planning. The research revealed that shadow culture acts to enable the management of the planning process and its efficacy relates to the 'quality' of human inter-relationships in the planning team and amongst immediate stakeholders. The research concludes by questioning the

myth amongst project participants that construction planning is a mechanistic process that has to be conducted solely by the planning team. It is evident from this research that there is not going to be a single programme which could foresee and address the entire list of challenges to be encountered before the construction phase. The initial programme which is being developed with the best available information should be continuously monitored and developed further to reflect any additional information from design team or any change in the planned sequence due to the challenges faced by the construction team. The process of planning was made successful by SRM in the 2012 Olympic Stadium due to the contributions of the factors discussed in this paper and could be related to major construction projects across the globe. The outcome of the research will benefit the planning professionals, the client and the contractors.

REFERENCES

- Adeli, H. and Karim, A. (2001). "Construction Scheduling, Cost Optimization, and Management: a new model based on neurocomputing and object technologies", London, Spon Press.
- Ballard, G. and Howell, G. (1998). Shielding production: essential step in production control. "Journal of Construction Engineering and Management", 11-17.
- Bernard, H. R. (2006). "Research Methods in Anthropology: qualitative and quantitative approaches", 4th edn, Oxford, AltaMira Press.
- Bowles, M. L. (1991) 'The Organization Shadow', *Organization Studies* **12**(3): 387-404.
- Carr, W. and Kemmis, S. (1986). "Becoming Critical: education, knowledge and action research", London, Deakin University Press.
- Clough, H. R., Sears, A. G. and Sears, S. K. (2000). "Construction Project Management", 4th edn, Colorado, John Wiley and Sons.
- Cooke, B. and William, P. (2004) "Construction Planning, Programming and Control", 2nd edn, Oxford, Blackwell Publishing Ltd.
- DeMunck, C. V. and Sobo, J. E. (1998). "Using Methods in the Field: a practical introduction and casebook", Walnut Creek, AltaMira Press
- DeWalt, K. M. and DeWalt, B. R. (2002). "Participant Observation", Walnut Creek, AltaMira Press.
- Dvir, D., Raz, T. and Shenhar, A. J. (2003). An empirical analysis of the relationship between project planning and project success. *International Journal of Project Management*, **21**, 89-95.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, **14**, 532-50.
- Faniran, O. O., Love, E. D. P., Li, H. (1999). Optimal allocation of construction planning resources. *Journal of Construction Engineering and Management*, 651–666.
- Gardner, B. B. and Whyte W. F. (1946). Methods for the study of Human Relations in Industry. *American Sociological Review*, **11**, 506-12.
- Gidado, K. (2004). Enhancing the prime contractor's preconstruction planning. *Journal of Construction Research*, **5**, 87-107.
- Griffith, A. and Watson, P. (2004). *Construction Management: principles and practice*, Basingstoke, Palgrave Macmillan.
- Hamilton, M. R., and Gibson, G. E. (1996). Benchmarking pre project planning efforts. *Journal of Construction Engineering and Management*, **12**(2), 25–33.

- Hammersley, M and Atkinson, P. (1995). *Ethnography: principles in practice*, 2nd edn, New York, Routledge
- Harris, F and McCaffer, R. (2006). *Modern Construction Management*, 6th edn, Malden, Blackwell Publishing.
- Homans, G. C. (1949). The Strategy of Industrial Sociology. *American Journal of Sociology*, **54**, 330-337
- Jha, K.N. and Iyer, K.C. (2007). Commitment, coordination, competence and the iron triangle. *International Journal of Project Management*, **25**, 527–40.
- Johansen, D.E. (1996). Planning on medium sized construction projects. Unpublished MPhil thesis, University of Northumbria
- Johansen, E. and Porter, G. (2003) An experience of introducing last planner into a UK construction project, in 11th Annual Conference of the International Group for Lean Construction, Virginia, 22-24 July, International Group for Lean Construction, Blacksburg
- Joselin, C. (2004). Programming issues under the NEC-a response. *New Engineering Contracts (NEC)*, Issue No 29, <http://www.newengineeringcontract.com>
- Laufer, A. (1992). A micro view of the project planning process. *Construction Management and Economics*, **10**, 31-43.
- Laufer, A. and Tucker, R.L. (1988). Competence and timing dilemma in construction planning. *Construction Management and Economics*, **6**, 339-55
- Laufer, A and R.L. Tucker. (1987). Is construction planning really done its job? A critical examination of focus, role and processes. . *Construction Management and Economics*, **5**, 243-266.
- Laufer, A., Tucker, R. L., Shapira, A. and Shenhar, A. J. (1994). The multiplicity concept in construction project planning, *Construction Management and Economics*, **12**, 53–65.
- Leonard-Barton, D. A. (1990). A dual methodology for case studies: synergistic use of longitudinal single site with replicated multiple sites. *Organisation Science* **1**(3): 248-66.
- Lincoln, Y. S. and Guba, E. G. (1985). *Naturalistic Inquiry*, Beverly Hills, Sage.
- Lowsley, S. and Linnett, C. (2006) *About Time- Delay Analysis in Construction*, RICS.
- Mawdesley, M., Askew, W. and O'Reilly, M. P. (1997). *Planning and Controlling Construction Projects*, Harlow, Longman.
- Miyagawa, T. (1997). Construction manageability planning- a system for manageability analysis in construction planning. *Automation in Construction*, **6**, 175-91.
- Scott, W. R. (1965). *Field Methods in the study of Organisations*, Chicago, Rand McNally.
- Seymour, D. and Rooke, J. (1995). The culture of the industry and the culture of the research. "Construction Management and Economics", **13**, 511 – 523.
- Syal, M. G., Grobler, F., Willenbrock, J. H., and Parfitti, M. K. (1992). Construction project planning process model for small-medium builders. "Journal of Construction Engineering and Management", **118**(4), 651–666.
- Van de Ven, A. H. and Huber, G. P. (1990). "Longitudinal field research methods for studying processes of organisational change". *Organisation Science* **1**(3), 213-19
- Weiss, C. H. (1998). "Evaluation Methods for Studying Programs and Policies". 2nd edn. Upper Saddle River: Prentice Hall.

- Winch, G.M. (2002). "Managing Construction Projects: an information processing approach". Oxford, Blackwell Science.
- Winter, J. and Johnson, P. (2000). Resolving Complex Delay Claims. A report on a meeting of the UK Society of Construction Law, at the National Liberal Club, Whitehall Place, London.