HARD OR SOFT:
PLANNING ON MEDIUM SIZE CONSTRUCTION PROJECTS.

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Summary

Some data suggest that the approach to planning in construction seeks to impose a managed future on construction work by providing plans which are strictly time scheduled and produced by initially identifying those activities which are critical to the plan and allowing other activities to "fit in" to this critical path. This is referred to in the paper as "hard" planning. The paper seeks to demonstrate that the reality for some managers and planners is that the planning process is "soft" and that in producing plans they seek initially to take account of the vast uncertainties of construction by removing criticality from all activities. The paper is based on data obtained from longitudinal case study research of four live, medium size, projects in the North East of England. The data analysis uses the Grounded Theory approach.

Keywords: Construction, Planning, Criticality, Uncertainty.

Introduction

The aim of the paper is to consider the process of planning on a small sample of medium size construction projects. It will consider the influences on the process and the way planners account for these influences. A literature review of previous research will provide a theoretical basis for what should occur within the process and this will be compared to the data from the study using Grounded Theory. In particular the concepts of a hard and soft approach to planning will be identified and considered.

Literature Review

Construction planning research has tended to break down into two areas: planning techniques and their improvement, and the planning process itself. There is no generally accepted definition of planning. Hayes-Roth and Hayes-Roth (1979) describe planning as some form of pre-determination of a course of action aimed at achieving a goal but consider that it is part of a two stage problem solving process which includes control. This is a view generally supported by others (Birrell 1980, Laufer and Tucker 1987) and which this paper has accepted.

The importance of planning in construction has been demonstrated in research. It is ranked very highly on a list of essential management skills (Duff and Makin 1990) and in another study (Mustapha and Langford 1990) 33% of construction managers time is identified as being spent on planning and co-ordination. Other publications support the theory that effective management of a construction project needs planning (Householder and Rutland 1990, Mansuy 1991, Stevens 1993, Trauner 1993). In part, this importance is

due to the complexity and high level of risk associated with managing a construction project which has been identified by Pohl and Chapman (1987).
Hoc (1988) makes a number of points about planning:

> Planning is about anticipation to guide decision making by taking possible or probable futures into account.
> Anticipation is also associated with schematization.
> Planning needs to be detailed enough for guidance but schematic enough to be probable.
> Planning has a problem solving aspect.

The components of a plan to allow effective management have generally been identified (Shugar 1985, Levitt *at al*, 1988) as the definition of project activities together with the establishment of their durations and their logical sequential relationships with each other to allow identification of critical activities. These are associated with the expression of this information, usually in a visual form, and the provision of the back up information used to produce the plan, such as the resource input. The need to express the plan in a visual form has resulted in much research into planning techniques, particularly networks and derivatives of these time scheduling techniques. However, there have been conflicting views about the suitability of the techniques in practice. Some say that network techniques have proved to be unsuccessful in construction (Birrell 1980, Allam 1988, Waugh and Froese 1990) while there is support for the view that the complexity of construction projects needs advanced planning methods such as networks (Morgan and Bakari 1986, Scott 1995).

Uncertainty has been identified as a major component of planning in construction, Laufer et al (1992) have made the point that uncertainty is an integral part of the nature of construction. Laufer at al (1994) point out that uncertainty is a permanent feature of construction work and that there is a causal relationship in that the more uncertainty the more difficult it is to plan and therefore the less effective is the planning. Cohenca *at al* (1989) find that the movement, in construction, from simple/certain situations to complex/uncertain situations has an influence on planning effort in construction in that more effort is needed as the situation becomes more uncertain and complex. Mace (1990) acknowledges this when he says that the odds are stacked against the original programme being right because of the nature of the construction industry. But according to Arditi (1981) [in Laufer and Tucker (1987)] uncertainty is often ignored by planners and they make little effort to seek more information to reduce uncertainty. Howell and Ballard (1995) in quoting data from Howell and Laufer (1993) show that "significant uncertainty" exists even as construction starts and they produce further data, collected from managers of similar construction projects, which shows that these managers underestimated the extent of uncertainty on 85% of the projects. The same research further states that the level of detail of planning in construction (which is an evolving process without high early definition) is too detailed too early. Nevertheless there is still much research which seeks to improve the accuracy of planning times and durations, for example Kumaraswamy and Chan 1994 and Walker 1995; albeit at a project level. Faniran *at al* (1994) were critical of the focus in construction on producing, before work commenced, a project schedule based on the "one feasible and acceptable way" and then using it for

control. They felt that this focus needed to be changed to systematic evaluation of alternatives to determine appropriate methods. This research indicates that current planning is retrospective and directed towards correcting the deficiencies of past decisions rather than trying to create a desired future.

Literature Review - Conclusions

The following concepts have been identified in the literature:

- That planning is considered important and that plans are produced in construction.
- That plans seek to manage the future in a process which is uncertain throughout project life and which contains much complexity.
- That plans are mainly produced as time schedules which are produced hierarchically in developing detail.
- That these time schedules derive from a process of breaking the project into activities, producing durations and logic and sequence relationships between activities to allow critical activities to be identified and monitored.

Within these concepts lie two opposing approaches to planning which centre around the hard or soft approach to uncertainty in the process. The first, which can be seen in the school of thought which supports the use of networks as planning tools, believes that the production of rigid plans which highlight and allow monitoring of the critical activities to be the correct method. The second believes that rigid methods cannot be successful in dealing with an uncertain and complex future. The two approaches are not in absolute opposition, indeed in Scott (1995) Driscoll (1979) is quoted as believing that as much as 40-50% of network logic could be preferential rather than absolute. The first approach is supported in the teaching of planning in the UK as evinced by the techniques contained in the major textbooks on the subject available in a relatively well stocked construction section of a University Library such as the researchers own institution or by the syllabus of the main Institute for building professionals the Chartered Institute of Building. The second approach, while the subject of considerable discussion in research papers, finds little expression in the developed techniques which are being passed on in the training of construction managers. The only technique mentioned in text books which seeks to identify and control uncertainty is PERT which is a network technique using complex probability calculations. There is little evidence that it is used regularly in construction.

Research methods

The four projects studied were selected to produce a representative sample of companies working within the regional construction workplace. The projects were all building orientated and were representative of the normal market and range of work of the companies taking part in the research. Lead planning was carried out by two site managers, one contract manager and one planner. The data collection was based on semi-structured interviews with those involved in the planning and managing of the projects and observation of the process. Data analysis was by qualitative methods being

particularly based upon the "Grounded Theory" approach in which the theory develops from
the researchers interaction with the data rather than from outside imposition. In particular, by questioning existing theory, patterns emerge from the data and can be related back to the existing theory. The methods involve qualitative analysis of the data and involve the researcher staying close to the data and refining the questions whilst requiring methods to ensure that theoretical sensitivity is achieved. This method of data collection and analysis was identified as being useful in studies, such as this one, which had the following factors present:

- The researcher is an experienced practitioner in the area being researched.
- The research is based on longitudinal Case Study [i.e. it occurs over a period of time and the data extraction is progressively developed by interaction with the data].
- Large amounts of raw data are produced in the form of field notes or taped interview data.
- The research seeks to develop concepts to explain the reality of what is happening.

Theoretical sensitivity is considered a key element of grounded theory. This is the ability to recognise what is important in data and give it meaning. It helps to formulate theory which is faithful to the reality of the phenomenon under study and has two sources:

1. By being well grounded in the technical literature and professional and personal experience.
2. By continual interaction with the data.

Analytical techniques are used to develop Theoretical Sensitivity but a balance between the real and what is created by the researcher is needed.
This is done by :

1. Asking what is really going on here
2. Maintaining an attitude of scepticism to early categories and hypotheses and validating them repeatedly with the data
3. Following specific data collection and analysis techniques which are recommended in the literature.

The Study Findings

The study found that all the companies involved used bar charts as the vehicle for planning. Networks were noted as being used within one company but only rarely and the company representative said that the planner tended to ".....doctor the network to suit the desired bar chart"
The people involved in producing plans had all been trained in planning either within the local construction education system or internally within the company by formal or informal methods. They all professed knowledge of networks and bar charts and believed that they knew how to produce them. They preferred bar charts because they were easier to produce, easier to communicate with and allowed looser interpretation. Their methods of production of plans followed the outlines mentioned on page three i.e. breaking down into activities, producing durations and working out logic and sequence relationships to allow the critical activities to be identified. In reality, however, there were a number of

discrepancies between the "textbook" approach which they professed to follow and the reality.

These were seen in:

- The information gathering
- The use of performance data
- The method planning
- The identification of critical activities
- The calculation of critical activities.

These can be loosely gathered together under two headings. The first three as PLAN CALCULATION and the last two as CRITICALITY ASSESSMENT.

Plan calculation

The way programmes were produced was similar on all projects. Key dates from the Master programme were identified and focused upon. The next level of programme was then produced around these key dates. While the intention was to reduce uncertainty it was accepted that sometimes the level of detail of the information needed was not available. The strategy for dealing with this was to make decisions about individual activities in softer and more flexible ways by including an element of float which is assessed based on the experience of the person producing the plan. The more detailed levels of programme then included their own key dates which were often extracted and issued as individual items which a third line manager or site operative could focus on as a key task. The gathering of information to allow short term and detail plans to be produced took place to varying degrees. Much of it was informal with the person concerned referring to drawings, bills of quantities and specifications and meeting subcontractors while keeping hand-written notes of the information discovered. Some of the information gathering from subcontractors was more formal with initial meetings being called where the sequence and logic of the work was discussed in detail. Alternatively formal plans were sometimes requested from subcontractors which were then considered by the main contractor before meetings took place to negotiate a final plan proposal. When input into the plan was allowed from lower level managers there was a concern that they also built-in their own float by asking for more time than they needed. It was considered that "*most programmes are hurried these days*". The process was affected by this lack of time and conspicuously the first casualty within the process was a reduction in information gathering which it was believed allowed more informed planning decisions to be made - "*source information is needed and you need time to get it".* The strategies used to produce plans in these time pressurised situations involved reductions in the perceived accuracy of the plan. There was a stated intention in one case to produce a *"perfect detailed programme*" but work pressure resulted in "*leaving it for now*" then *"returning when I can to find it is now out of date*" and so having to begin the cycle again with the resulting further pressures on time. *"You end up producing programmes and saying; this will do*". It is clear that for most companies the work on site must come first and planning that work has lower priority. "*Time determines planning effort which affects planning quality*". One strategy was particularly put forward by a planner. This was to

overcome the uncertainty produced by the various pressures on the available time for him to produce quality plans. The strategy was to soften the plan by "*exaggerating periods and fudging start and end dates*" he felt that this was acceptable *"as long as you remember what was fudged*". This person was also strongly biased towards the production of very accurate plans. This dichotomy may be partly explained by the comment that the *"intention is to plan in detail but this is rarely the reality".* Another planning strategy noted was that the managers appeared to make a subjective judgement, based on experience, of the likelihood of subcontractors performing to their promises and if they felt unsure they would try and build in some float into the period shown on the programme without telling the subcontractor that it had been done.
The sources of performance data were generally stated to be:

- Company records of performance.
- The experience of managers and planners.
- Meetings, discussion and negotiation with subcontractors.
- Combinations of all three of these.

However one manager did note that within his company "*there is little company performance data available*". It was also stated that performance data within one company tended not to include subcontractors. On detailed examination it was apparent that most of the companies relied much more on experience and what were called *"guestimates"* or *"gut feelings*" than on calculated durations based on quality performance data. There were discrepancies in behaviour. In one case the same manager said *"You can never have too much information"* and later *"I do not look for more information than I have".* Another manager was clear in his beliefs about the quality of durations when he said *"Sometimes experiential assessment is more accurate than data based assessment. I rely on experience more than formal data".*
From what was observed it seems that some managers are making an assumption that the level of accuracy of plans is always suspect because of the uncertainty which is endemic in construction and that they may be taking a *"Soft Planning*" approach i.e. planning within their perceived limits of inaccuracy. This may be because they expect continually to update the plan. One manager made the following statement which supports this:
"We plan on what we know and review as more information becomes available".

Criticality Assessment

Uncertainty exists in construction planning and is influenced by the relationship with the client, the level of trust and confidence in the subcontractors and the managers belief in the quality of existing plans. The influences affect the strategies used by managers in producing and communicating plans and in reporting progress. In producing plans the strategy is often to build in as much flexibility as possible. The person producing the plan becomes a "soft analyst" (Mintzberg 1995) looking for the widest possibilities available for activity durations and sequence logic. Because the only formal planning techniques used were Bar Charts the issues of uncertainty and criticality are important for progress reporting. There was evidence of selective reporting to suit the contractor and of contractors plans having inbuilt "*safety zones*" in critical activity durations which distort the accuracy of the report. Even dates *"written in stone*" had an inbuilt, undeclared

flexibility. Staff believe that uncertainty had a major influence on planning in construction and that the concept of some activities being critical to progress and some having free time or *"float*" was an accepted norm.

So how was criticality decided upon and how was it expressed?

Most of the managers agreed that the industry norm was to "*find*" the critical path. All of the projects studied used bar charts and a pilot study also indicated that these were by far the commonest method of planning in use. Yet one of the managers observed *"Deciding on critical activities and those with float is difficult without a network and probably not demonstrable on a bar chart*" and that float and criticality are not expressed formally but *".....kept in the head".* Decisions on what was critical were made from experiential judgement and from looking for information. This latter applied particularly for subcontractor work although subcontractors plans were not accepted without appraisal. The interfaces with other trades were considered in detail before subcontractors plans were agreed. Plan producers judged the quality of the planning information available and made decisions about the level of uncertainty based upon this.

They make judgements about which activities are critical and which have float while they are producing the plan - *"You decide as you produce the programme".* However, one manager admitted that float "*arises in planning discussions as an afterthought".*

In observing the actual production of one plan it was noticeable that the process involved continuous re-assessment of earlier decisions on sequence based on subsequent activities being assessed. This indicated that one of the key decisions affecting criticality which is about the logic/sequence issue appeared to be reasonably carefully considered but the other key issue which is the accuracy of the duration was not observed to be given the same level of attention. What was clear was that decisions on float and criticality were usually based *on "gut feeling*" or experiential factors.

Here are some quotations which illustrate this reliance on experience:

> *"You decide [on criticality] based on experience".*
> *"You decide as you produce the programme."*
> *"It comes from personal knowledge of the job, gut feeling and experience".*
> *"I know what the critical path is based on experiential judgement on a small job. On a larger job you may have to do a network".*

One manager said that he was continually re-assessing what was critical. This implies a planning process which is in continuous flux and is rarely firm. Managers strategies for dealing with uncertainty seemed to be to try and manage criticality rather than to indicate a firm critical path early in the process.

Another series of quotations gives substance to this concept:

> *" You mark the early starts as accurate as possible and guestimate the rest."*
> *" We provide a safety zone in case things do not work out, I know that information is likely to be delayed."*
> *" Once we have the subs programme we try and negotiate a reduction in the period to produce float."*

One observation is critical here. In programme discussions the scaffold for a particular piece of work was indicated as being critical. On the next visit it was observed that the dismantling of this scaffold was the critical element. On the next visit it was observed that it looked unlikely to be dismantled on programme. However, the managers said *"It is*

okay, I knew when I identified it as critical that I could build in a bit of float because I can get on with the next operation if I only strip a part of it.". The manager had built in flexibility into what was announced as a critical activity. It seems that the decisions on what was critical were very heavily based on the experience of the person producing the plan with little factual back up. The evidence indicates that the managers do not formally express criticality one says *"it is kept in the head".* There is a difference in approach between some of staff in how they produced their plans in relation to float and criticality. The project planner strongly believed in making the plan as accurate as possible within the restraints of *"guestimating*" criticality. He said *"I always go for 100% accuracy. Trying to build in flexibility is defeatist*". On one of the other projects the manager said that he produced his *programmes "subject to confirmation"* so that he always accepted that they may be wrong. Yet another manager reflected that, even with critical items; *"We provide a safety zone in case things do not work out".* Staff said that criticality was monitored but the project planner put this in context for his project by saying that he only monitors the critical items as they were originally identified, he does not consider non critical items [which may become critical] *".....until it is too late, I am afraid to say".*

If managers are deciding on criticality in this way what happens if their assessment is wrong? The problems with obtaining information on durations and methods from subcontractors is noted earlier but what are the affects of this on criticality considerations? In this context one manager noted that decisions about float and criticality came after discussions with subcontractors, although he did not accept subcontractor information without appraisal and negotiation. In particular if the work was likely to be critical he would try and negotiate a reduced period to produce some float. He also confirmed that he was continually assessing what was critical. A specific subcontractor problem identified was that the definition of activities and interpretation of programmes might differ between the main and subcontractor which would affect assessment of criticality. The suggested solution was to improve communication and have detailed discussions. This was also identified as important to alleviate a general assumption by most managers that the quality of subcontractor durations was not good and that they tended to be inaccurate. Of course there is also evidence in this study that main contractors durations may be relatively inaccurate and the subcontractors may simply follow the same trend.

Criticality is closely associated with planning accuracy. There were different opinions given by the people surveyed in the data collection. The following quotations illustrate the differences:

> *" The plan is basically a guide for the Contracts manager and Site manager."*
> *" An accurate plan is a great help on site."*
> *" You need flexibility but an inflexible critical path."*
> *" I prefer a flexible plan but the reality is that you need rigidity to control, particularly subs, if you increase the float you may give them more scope not to perform."*
> *" I expect planners to produce a 100% achievable plan."*

On investigating further it appears that some managers expected a fairly rigid plan with clear indications of what was critical while others looked at the plan as a guide which they would adjust as they go. However, it should be noted that the people who looked for 100% achievable plans and were most concerned with rigidity were the Contracts

Manager and the Planner. It is possible to argue that they are not as directly involved as other managers in producing the outcomes which are being planned.

Conclusions

The textbook model of construction planning suggests that work is broken down into activities and information is gathered in as accurate a form as possible and taken with accurate performance data is used to calculate the durations of these activities.
The logical and sequential relationships between these activities can then be established using network based techniques. This produces plans which are as accurate as possible within the constraints of project at the time of plan production. A HARD plan.
The reality for the medium size building projects in this study is that the textbook approach does not happen. Many of the decisions made in planning begin from an acceptance that the plan will never be accurate because of uncertainty in information, time pressures on plan production, reliance on the bar chart, lack of performance data and the need for flexible interpretation. It is clear that float and criticality are not produced in a formal measured manner although most people said that they did consider them. This consideration was based on experience rather than measurement and taken with the inherent uncertainty of the planning situation on the projects produced strategies which involved over assessment of durations and alterations in logic to build in float into items which were noted as being critical. So managers producing plans seek to communicate the plans as being accurate and HARD while actively seeking to produce the plans with as much hidden flexibility as possible. A SOFT plan.
The sample size is small but it is felt that the rich qualitative data obtained from close observation of the planning process in action suggest that new techniques need to be developed to assist managers in planning their work in a SOFT rather than HARD manner.

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