PROGRAMME MANAGEMENT: A CRITICAL ANALYSIS

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DECLARATION BY STUDENT

I, the undersigned, hereby confirm that the attached treatise is my own work and that any sources are adequately acknowledged in the text and listed in the bibliography.

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ABSTRACT

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Construction programmes serve a number of purposes. The objective of this treatise is do identify the functions to elaborate on them and to identify how such a programme should be formulated, developed and implemented successfully on site. The investigation into these functions has led to the conclusion that construction programmes are not merely time schedules for projects but serve as a management devise to run concurrent interrelated projects in such a manner to realize the maximum benefits for the construction contractor.

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Chapter 1- Introduction

1.1 Background

Building programmes are written for a number of reasons. Firstly it serves purely as a time schedule for works to be performed. This schedule places emphasis on works to be performed in a certain time period and should a certain activity be delayed, one can estimate the continuing effect this might have on the overall schedule. Secondly it shows the successive flow of work. The programme illustrates by way of "linking", which activities should follow successively. Thus it may be deduced that a building programme serves as a working manual for constructing a building, so demonstrating the importance that a building programme serves. Building programmes also serve a number of other purposes which will be discussed in this study. The main problem that will be investigated in this research report is as follows: How should a construction programme be formulated, developed and implemented successfully on a construction project? This study firstly explains the development of the building programme and the different professionals that should be considered in creating such a programme. Secondly it portrays the functions a building programme encompasses for use by both the professional team and the main contractor. The party that would create such a program is seldom the end user of it. Therefore there is potential for a number of problems to arise. Thus thirdly, the problems that can arise in the implementation of such a programme are investigated. Fourthly this study examines the methods that should be implemented in managing a construction project. Since the end user of a building program has different past experience and working methods than the creator, he/she will implement the programme quite differently than intended. In practice the end user would normally be a site agent, a foreman or a construction manager. These persons normally have had a number of years experience in the construction industry

and have their own working methods. Thus creating a programme for a party that the initiator might not even be familiar with at the time of creating, poses a number of challenges to be overcome.

1.2 The main problem investigated in this research report

How should a construction programme be formulated, developed and implemented successfully on a construction project?

1.2.1 Sub-problem One

How should a construction programme be developed? This problem incorporates the importance of CSFs (Critical Success Factors)

Hypothesis:

A number of CSFs are to be considered in creating a successful programme. Shehu & Akintoye (2009) propose a number of these:
Effective planning, establishing programmes priorities, effective communication, time management, performance management etc.

1.2.2 Sub-problem Two

What are the functions of a building programme and why are they not used to their full potential?

Hypothesis:

Building programmes are not used to their full potential for a number of reasons:

- It is tendency that these programmes are only created to satisfy the client in assuring him that the project will finish on time
- Both the programmer and the site manager do not know how to use it to its full potential

1.2.3 Sub-problem Three

Why is the implementation of a construction programme of critical importance and what are the challenges of programme management?

Hypothesis:

End users are site agents and foreman on site. It is tendency that these people do not use programmes. There are a number of reasons for this:

- People in these positions normally has a number of years experience and feel that they do not need be told what to do
- They do not understand all the functions of such a programme
- They are not trained in using such a programme

Not implementing the programme correctly, defies the whole purpose of creating such a programme. A programme is intended for assistance to the main contractor and should be used for that reason.

1.2.4 Sub-problem Four

How should a construction programme be managed during a construction project?

Hypothesis:

A suitable candidate should be in charge of such a construction programme. Suitable candidates include site managers, site agents and foremen. These are all people that are familiar with what is taking place on site.

1.3 Delimitation

The limitation of the study bound to the construction field of constructing buildings. Thus civil works are not in included in this study. Research is not in actual fact geographical bound but the focus is on South African methods and conventions of construction and the construction industry.

1.4 Definition

Critical Success Factors – Such factors as are critical to the success of an intended outcome. Rockart (1982) was the creator of Critical Success Factors (CSFs) and since then a number of further studies has been done in the field (Shehu & Akintoye, 2009).

1.5 Importance of the study

The academic reader will find the insight into the creation and the flow of documentation significant. Different role players in the industry work on and make use of such programmes for quite a number of reasons that are essential to the success of construction projects. The practical reader will gain a better understanding to the

functions of such programmes and the successful implementation thereof. In addition the importance of the management of such programmes are emphasized and explained. The reader will become familiar with contemporary management principles of construction programmes and the methods of implementing them.

1.6 Research Methodology

The following methods of research will be utilized during the study:

- Literature from academic and practical writers in the construction environment
- Interviews with knowledgeable professionals and contractors in the study field
- Research into the functions and methodology of the “Candy” construction programme, developed by CCS.

Chapter 2- Development of the Construction Programme

2.1. Introduction

Davies (2002) (cited in Shehu and Akintoye 2009) distinguishes between project success and project management success. Whereas the former is concerned with meeting the objectives of the project the latter is concerned with meeting time, cost and quality constraints. Another distinction is made between success criteria and success factors. Success criteria are those against which the failure or the success of the project can be measured. Success factors are rather those that lead to the success of the project.

Rockart (1979) as referenced by Leidecker and Bruno (1984) defines CSF's as factors that "are, for any business, the limited number of areas in which results, if they are satisfactory, will insure successful, competitive performance for the organization. They are the few key areas where things must go right for the business to flourish. If results in these areas are not adequate, the organization's efforts for the period will be less than defined." According to Hofer and Schendel (1978):

> "key success factors are those variables which management can influence through its decisions that can affect significantly the overall competitive positions of the various firms in the industry. These factors usually vary from industry to industry. Within any industry they are derived from the interaction of two sets of variables, namely the economic and technological characteristics of the industry involved … and the competitive weapons on which various firms in the industry have built their strategy…"

Leidecker and Bruno (1984) explain that Daniel Ronald was the initiator of Critical Success Factors back in 1960. The theory around CSF's received little attention for almost 10 years until "Anthony, Dearden and Vancil utilized the concept in the design of a management control system." These men found that certain key factors (or rather CSF's) impact the profitability in an organization. Leidecker and Bruno mentions that Rockart and Anthony (1972) believe that CSF's are valuable in certain management approaches, but that they also argue that CSF's are a "beneficial application in the strategic planning and business strategy development area."

In creating a construction programme one needs to strategically plan. CFS's are great tools to apply. Leidecker and Bruno say that by identifying CSF's, threats and opportunities can be assessed. A construction project poses many threats, but also a number of opportunities. In the development of a construction programme these need to be addressed and analyzed. One needs to take full advantage of the opportunities while minimizing any possible threats.

In the development of a construction programme certain key critical success factors must be identified, analyzed and incorporated. There are a number of role players in the development of such a programme which will be identified throughout this chapter. In this chapter the focus will be on the critical success factors that need to be considered in the development of a construction programme.

2.2 Identifying the critical success factors in the development of the construction programme

As referenced by Shehu and Akintoye (2009), the following authors, Abdul Kadir et al. (2005), Kommeta et al. (1995) and Bettaineh (2002) all used the importance index for their respective reasons in finding the relative importance items in their studies. Shehu

and Akintoye thus argue that this method is very accurate and states that it is widely used. Shehu and Akintoye formulated a Criticality Index in ranking CSF's. They explain that the criticality index for any item should not be more than 1, and that those with the highest value between $0 \geq 1$ are considered the most important. The functioning of the method used by them is not of great importance here and so will not be explained. What is of importance is the CSF's that show to be critical in developing a construction programme and how they will be analyzed. Therefore this chapter will focus on a few of the CSF's revealed in the criticality index as can be seen in table one below.

2.2.1 Effective Planning

Planning can be defined as the arrangement of a method or scheme beforehand (dictionary.com). Shehu and Akintoye (2009) state that planning is one of the most important critical success factors. As referenced by Shehu and Akintoye, Williams and Parr (2006) "describe programme planning as the creation of a series of documents that facilitate a shared understanding among programme stakeholders and guide the execution and control of the programme". Further more Young (1993) states that planning is creating "a predetermined course of action". Akintoye mentions that planning a programme is not the same as planning a project and that to make a success of a programme (Thomsen, 2008) depends on the success of carrying out individual project plans within a programme. This statement agrees with what Reiss (2003) – referenced by Akintoye - describes as programme planning. Reiss explains that programme planning encompasses "creation and editing" of different project plans. In a later article Reiss et al. (2006) advices that a programme must not be planned in too fine detail at the start of a project but rather further along as the project progresses.

Critical Success Factors	Criticality Index
Effective planning	0.870
Establishing programme priorities	0.839
Effective Communication	0.817
Proper co-ordination of projects	0.791
Effective risk management	0.791
Effective time management	0.770
Effective performance management	0.764
Cross-discipline coordination	0.739
Strategic focus on programme	0.735
Effective budgeting	0.730
Cross-projects coordination	0.728
Clarity and consistency of vision	0.726
Smooth handover to business operation on completion	0.715
Cross discipline problem solving	0.709
Clear benefits target	0.704
Effective change management	0.686
Effective management of transition	0.684
Effective quality management	0.670
Management infrastructure	0.660
Simplicity of programme	0.641
Easiness of techniques used	0.635
Understanding the stakeholders' attitude	0.627

Table 1 – Critical success factors in construction programmes

Source: Shehu and Akintoye (2009)

Akintoye (2009) says that the main focus of programme planning is the coordination of the various projects in a programme and eventually the objectives at an organizational level. Comparing the statement with a work breakdown structure the different projects in a programme can refer to stages in construction where as organizational objectives refer to work activities in different trades.

Programme planning goes hand in hand with programme time management. Milosevic et al – as reference by Akintoye (2009) – explains that there is "a high level of synergy" between the actual projects, or rather stages in construction. Thus good time management has an effect on all stages of construction in a programme. They further state that because consecutive stages are dependent on one another, should a programme in one stage arise this will affect all continuing stages.

Because of the high importance of planning, Zwikael and Globerson (2004) have developed a quality of planning (QP) index. This index "assesses the way in which project plans are being developed in organizations." The QP index – figure 1 below- comprises of two parts. Part one: Project know-how processes which is defined as "planning processes executed by the project manager (PM). Part two: Organizational support processes, which is defined as "the means that the organization places at the disposal of the project manager to enable proper project planning, execution and completion.

Figure 1 is a QP breakdown structure in which the project know how and organizational support processes are based. The working method of the QP index will not be explained further. The main focus is to demonstrate what resources are needed in doing programme planning. Bothe, a PM with a working knowledge of construction and organizational support is critical in creating a successful construction programme.

In programme planning a number of parties must be considered. Through the stages of a project many different role players will be part of a project. Parties that will take part in project planning must be considered in programme planning. These include the architect, the quantity surveyor, the client, the project manager and the contractor. The client must specify time constrains within the phases of the project. The quantity

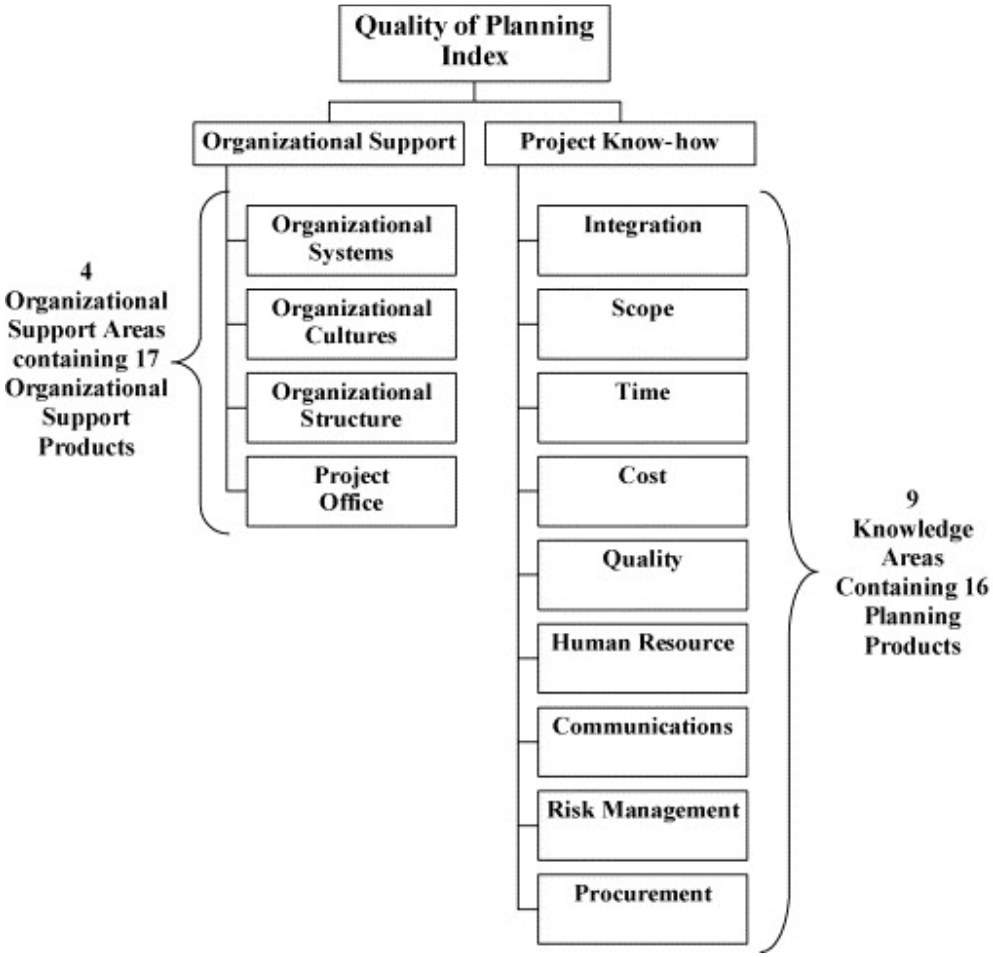

Figure 1 – The quality of planning index breakdown structure

Source: Zwikael and Globerson (2004)

surveyor will give a good estimation of work to be done in the bills of quantities. The project manager will state any rules or regulations the contractor must adhere to. The architect will be able to give proper specifications on specialized work to be done and may know lead times on these. Since the contractor carries out the actual work he is

normally responsible for creating a construction programme. The contractor is advised to make use of the project's professional team.

2.2.2 Establishing programme priorities

Due to the variance in projects, programme priorities will differ from one project to the other. In most projects some priorities will remain though. Reiss et al. (2006) advice that priorities must be established early, "quick wins" must be identified which will lead to "early benefits". Furthermore dependant factors between projects (construction stages) must be recognized. Lastly he states that one must ensure "that project deliverables are clearly mapped to the benefits expected".

All stakeholders need to be informed how the programme is planned, how it will affect them and what must be contributed by them (OGC, 2007b) – referenced by Akintoye. OGC (2007a) further emphasizes the importance of establishing programme priorities. Some mentioned include; resource requirements, procurement, supply chain management and early benefit realization.

2.2.3 Effective Communication

Much can be said on effective communication. Firstly the process of communication can be divided into three elements, namely the source (sender), the words or signs used in communicating and the receiver. Communication is a complex process and the sender must understand this. The sender must also be aware of the barriers to effective communication. A comfortable style of communication must be adapted in communicating to different role players. One can measure the effectiveness of the

communication between the ideas that are transmitted to the ideas that are perceived by the 'receiver'.

The sender's effectiveness of communication is related to three basic factors. Firstly the sender must use the right language for the receiver to interpret a meaningful message. Secondly, the sender reveals his attitude towards the idea being communicated and towards the receiver and thirdly, it is more probable that the sender will communicate effectively if the issue or the topic is accurate and up to date. The sender must realize that the effectiveness of communication also relies on the receiver's ability to understand and he must be confident in what he communicates. (Adapted from dynamicflight.com, Author – unknown. 2003)

William and Parr (2006) – referenced by Akintoye (2010) – states that the "exchange of meaningful information between groups of people in a programme to influence belief or actions" and constitutes effective communication. Additionally they explain that programme management only survives on the timely exchange of information between role players and the programme team. Programme development falls under the circumstances. Cross-functional communication that is clear and effectual must exist for the creation of a proper construction programme.

2.2.4 Effective risk analysis and management

For effective risk management, risk must be analysed first. In an article by Akintoye and MacLeod entitled "Risk analysis and management in construction" (1996), they explain that in many construction firms risk assessment plays an increasing important role. This is mainly because of cost overruns in construction projects. They further explain that the construction industry is generally prone to undesirable, unknown, unexpected and

unpredictable factors and although it is obvious that risk analysis and management is vital to the industry, techniques used in this regard are not commonly or widely known.

Akintoye and MacLeod (1996) carried out a survey obtaining feedback from general construction contractors and construction project managers on some of the following aspects in risk analysis and management:

- Risk perception
- Organizational risk management
- Risk premium in construction projects
- Management of risk

Feedback was obtained from 30 contractors and 13 project managers. Risk perceptions by contractors are generally linked with the objectives of the project. Risk is perceived as the probability of unforeseen circumstances which will affect the cost, time and quality on projects. Project managers' focus is on the consequences of risk and how it affects the client and his goals, and not so much the project manager himself.

Findings by Akintoye and MacLeod (1996) in the survey about risk premiums show that contractors and project managers place equal weight on elements of risk in the construction industry. Some with the highest rankings include:

- Financial
- Contractual arrangements
- Construction (productivity and safety)
- Project (design information)

It is thus widely known in the industry what are the causes of risk. The question is how should it be managed by accounting for it in a construction programme? Hillson (2002) believes one should go through the exercise of doing a risk breakdown structure (RBS).

"The RBS is a hierarchy of risks involved with the project." Hillson explains that it aids in "identifying, assessing, comparing, and reporting risk." A RBS is done alongside the work breakdown structure (WBS). It follows the same pattern and identifies each risk associated with items in the WBS. As with a WBS where work is simplified a more detailed with each descending level, in the RBS the risks are more defined and illustrated. Whereas the risk associated with bulk excavation may be not to have cost overruns, the risk associated with plaster work may be not to plaster walls before services first fixes are installed. Hillson (2002) states that after risk identification comes risk assessment. Here the severity of the risk is measured. The third step is to investigate ways to minimize or elude risks at all. RBS's can be compared from different project, by using a standard frame for a RBS. Thus the final step will be to report and review risks for future learning.

2.3 Conclusion

Only some of the CSFs were discussed here. These are not the only ones considered important but certainly are of the more significant factors. Akintoye (2009) states that, to know the prerequisites for programme management and development one has to understand the difference between programme and project management. The CSFs of these might be similar but the two are not the same. A good knowledge of project management must of course be acquired in order to develop a successful programme. Through experience, learning and education one would come to be familiar with the CSFs of construction programmes. Akintoye (2009) explains that programme management cannot be successful without a project management support. Project management can be improvised by effective programme management.

Developing a construction programme therefore needs many role players with working knowledge of project management principles and an understanding of the various critical success factors that will enhance its effectivity, ease of use and communication capabilities.

2.4 Testing of hypothesis

Sub problem one:

How should a construction programme be developed? This problem incorporates the importance of CSFs (Critical Success Factors)

Hypothesis:

A number of CSFs are to be considered in creating a successful programme. Shehu & Akintoye (2009) propose a number of these:
Effective planning, establishing programmes priorities, effective communication, time management, performance management etc.

Finding:

The hypothesis was to a great extent correct. What was discovered was the degrees of importance of certain CSFs are greater than other. More focus was placed on more significant CSFs and not all CSFs were discussed. An in depth study in this field would be possible and would be of immense length and research. Since this was only a sub problem of a superior one only an appreciable overview was provided.

Chapter 3- Functions of the Construction Programme

3.1 Introduction

There is a common misconception among persons in the built environment that construction programmes are only there for tracking time of the works in a project. The functions of the construction programme encompasses that of stipulating time periods for activities and deadlines to be met, but this is merely one of its functions. Currently, most construction programmes are done by using computer aided software in developing programmes. A number of these software programmes are available on the market. The software is developed to assist the user in finding an optimal programme of the works. However, this does not imply that any person can develop a programme with ease and more so a construction programme. A certain level of expertise and experience is essential to create a successful programme. Software programmes are written in aiding the construction programme developer.

A very prominent software programme in the construction industry is 'Candy'. Candy is created by Construction Computer Software or CCS. CCS has developed a programme that encompasses most of the functions needed in creating and maintaining a successful construction programme. Some of the functions in this programme will be discussed in this chapter. These functions are also certainly relevant to creating any construction programme with any computer aided software.

The functions that will be discussed include estimating and planning, valuations, cash flow and forecasting. CCS describes Candy as a 'single package, project control system designed by professionals specifically for the construction industry.' They further explain that all its functions are integrated to model a project's expected construction process and its financial performance. CCS (2010) believes that a unique aspect of its

programme is the dynamic link between money and time. This links the bills of quantities with the programme of the works.

Although such a readily adaptable computer system is available, it is rarely used to its full potential. There are a number of reasons for this and will be discussed in this chapter.

3.2 Functions of the construction programme

3.2.1 Estimating and Planning

Zakieh (cited in Laptali et al. 1997) states that 'the main aim in cost estimating and pre-tender planning should be to establish the optimum way of sequencing the job in order to arrive at a minimum price which requires a 'what if' analysis to be undertaken. Laptali (1997) explains that in an industry such as construction where quick decisions need to be taken, a system is needed where fast analysis of data can be done. Therefore a 'computer based time/cost model' is required to analyse different options swiftly. The principal contractor's major responsibility during the pre-tender stage is to estimate and plan. Harris and McCaffer (2006) explain estimating as the evaluation of resources in terms of cost, and planning the evaluation of resources in terms of time. By compounding these two would result in a cash flow. Furthermore, should the contract be allocated, the estimates and pre-tender programmes can be used for 'production planning, cost control and valuations' (Laptali et al: 1997).

The computer programme 'Candy' has many on board tools to assist the estimator and planner in their duties. A standardized estimating process is applied in the estimating module of Candy. It is also regularly updated to adapt to tendering conditions. Pricing libraries contain accurate, up to date rate build-ups. Another library also contains item descriptions for quick reference and use and bills can also easily be imported. Candy

provides for indirect costs to be priced in a separate bill. This bill incorporates all tools relevant to estimating and planning which will change with the indirect programme. Built-up rates can be calculated and shown on 'free-format worksheets'. An estimator using production and resource calculations can communicate his methods on these worksheets ensuring that all parties in the pre and post tender stage understand the calculations. Adding markups to items can be done in a number of ways. It can be done by 'item, trade or page range, or by resource type'. Candy provides a subcontract adjudicator for comparing subcontractors' quotes. The rates from the selected subcontractor are then transferred to the bill to continue pricing of original items.

Candy offers a number of standardized reports that can be used in presentations and reporting. "Among the many features in the program, the integration of the priced bill of quantities and the project schedule is an excellent tool for managing your tender and later your site" (Howard Watson, Grinaker-LTA Earthworks (South Africa) 2010). This is possibly one of the most excellent tools incorporated in the Candy programme. 'Items from the bill of quantities can be allocated to the programme activities. The result of the linking is an accurate forecast of the bill of quantities.' (CCS: 2010). This means that any change in either the estimate or the programme will revealed also in the forecasts. The program allows for final changes quickly and efficiently. Fast assessments can be done after changes because of rapid calculation performance.

Some tools and specifications in the estimating part of the program include:

- Resource-based analytical estimating
- Description and pricing libraries
- User-defined document layouts
- Free-format rate make-up sheets
- Resource and value analysis
- Wastage and productivity analysis

- Multiple-currency resources
  and bills
- Subcontract databases, enquiry
  and adjudication
- Report writer and data export
- Integration with Planning
  and Cash flow

(CCS: 2010)

Talarico et al (2010) states taking into account cost, time and performance in larger scale projects are becoming more important in our competitive business environment. Problems faced by project and construction managers are complex and intricate. Talarico believes that this is the reason for the increasing necessity of project management techniques which will assist a manager in 'planning, coordinating and controlling' a large number of activities. He further states that network models have proven itself successful in dealing with the aforementioned problem and accomplishing the functions. Talarico et al (2010) describes this model as project that 'is represented by the so called activity network, which is an acyclic, connected, directed graph with a unique source node (the start of the initial activity in the project) and only one destination node (the end of the final activity in the project).'

In planning a construction project one of the main aims is to deduce the critical path of the project. Candy uses the CPM (Critical Path Method) do work out the critical path. CPM can be defined as 'a mathematically based algorithm for scheduling a set of project activities.' (Wikipedia.org, 2010) A critical path can be defined as 'task graph with a set of nodes and edges, forming a path from an entry node to an exit node, of which the sum of computation costs and communication costs is the maximum' (Kwok

et al: 1996). To simplify this explanation a critical path can be defined as the path a project must follow in order to complete on time. Delays occurring on this path will lead to a delay in the whole project.

Planning functions in Candy include the utility to draw a bar chart and a precedence network, or a combination of the two. The work breakdown structure can be entered in a precedence manner or as a linked bar chart that will automatically create a precedence network. The program checks for duplicated activities and network loops that might cause errors. When creating a construction programme extra detail can be added. One can add notes to activities commenting on site conditions and include programme reports. Networks (work breakdown structures) can be sub-divided into sub-networks, which in turn can also be sub-divided. In the planning module a number of resourcing techniques can be used. Specific resources can be assigned to certain activities and general resources to a number of activities. After resources are assigned resource leveling can be done.
When a Bar Chart is set up, it is also possible to filter it. This means that one can sieve through activities according to codes, float or description. Any construction programme that is created and intended for use must be updated regularly. Progress should be recorded on a fixed basis for providing an 'as built record' of the project. The original programme is always kept as a base programme to measure actual progress.

Furthermore Candy provides long lead and information schedules (CCS: 2010). These are used in tracking and recording external processes such as long lead delivery items, client decisions and design work. These schedules serve as proof should design work be late on arrival, should long lead delivery items only be specified later on in the project and decisions made by the client effect performance. All of the above mentioned can cause a delay in executing and finishing work, and it is of essence that

the main contractor keep record of all such happenings.

'Project estimating is a construction management function that is interrelated to other functions, most significantly construction planning, both of which have some effect on the other. Current practice usually performs these functions independently, ignoring the interrelationships between them.' Underwood et al (1997) further explain that on the one hand the estimator uses gross quantities from labour, resources, materials and temporary facilities to determine an estimate, while on the other hand, the construction planner determine construction sequences and time durations. 'Therefore, the project estimator, while assuming rates for construction plant, labour and temporary facilities, does not usually take into account the activity durations generated by the construction planner. This consequently has an effect on the project estimate costs. Also, when estimating the activity durations, the construction planner in many instances does not usually take into account, nor is even aware of, the construction plant, labour, temporary facilities rates used by the project estimator' (Underwood et al: 1997). Underwood et al (1997) explain that as a result of the assumptions made by either the planner or the estimator, inconsistencies may arise, resulting in either the estimate or the programme ineffective.

CCS (2010) remarks that the integration of the estimate and the programme is one of Candy's significant functions. Items from the bills of quantities can be assigned to activities in the programme. 'This allows resource or financial information from the estimate to be reflected against the time frame calculated' (CCS: 2010). Candy provides a histogram for the resources in the bills to be plotted on a histogram and should the programme or the estimate be changed, the histogram will show a reflection there off.

For linear activities, for instance pipelines, roads, railway lines or high rise building with repetitive work a time/location chart can be used to graphically represent a programme. Such a chart is simply a summary of a programme with the two axis, time and location.

The planning module in Candy provides the planner with all the tools necessary to plan a project effectively and efficiently. Some of the tools and facilities are summarised below:

- Contractor-orientated planning
- Screen bar chart
- User-defined activity list
- Multiple calendars
- Network libraries
- Resource libraries
- Resource leveling
- Progress monitoring
- As-built record
- Information schedules
- Long lead schedules
- Time/Location charts
- Integrate Estimate and Cash flow

(CCS: 2010)

3.2.2 Valuations

Underwood et al (1997) states that in an interim monthly valuation for payment certificates, the activities that has been completed on the project can be identified from the construction programme and so the percentage of completion can be determined. Furthermore, the design plans of the building provide information regarding the dimensional quantities of work completed while the bills of quantities provide the rates for work executed. Such information retracted is done by different professionals and are susceptible to errors, thus emphasizing the importance of the integration of the estimate with the construction programme once again. 'Numerous studies have been carried out with the aim of addressing, through IT solutions, the interdependency problems associated with project estimating mentioned above' (Underwood et al: 1997) .

Valuations are not only done on a monthly basis. There are a number of scenarios where there will be a need for a valuation. When variation orders are issued by a principle agent a valuation must be done to determine the cost of such a variation. In the situation where a contractor applies for an extension of time and is successful in doing so, a valuation must be performed to adjust the contract value. In house valuation must also be done by the contract on fortnightly basis usually. These include valuations of domestic subcontractor work, for example plaster or brickwork and valuations of selected and nominated subcontractor work should these not be done by themselves or for ensuring claimed valuations by such subcontractors are accurate.

In Candy the valuation module 'provides continuity between estimating and post tender commercial control' (CCS: 2010). All functions that Candy provides in this module can be carried out by site representatives. Job modeling allows the user to adapt and change the tender information to reflect situations that has an affect estimate or the programme. 'Buying savings and subcontract revisions can be

incorporated into the project' (CCS: 2010). Should the contractor receive bulk discounts on products, it should be recorded as such to reflect how it influences the profit on the end of the project. Subcontractor revisions, whether ordered so by the principal agent or by the main contractor must be adjusted accordingly for the contractor to keep track on expenditures and income. Monthly valuations done with Candy are 'produced by entering either a cumulative progress quantity or a percentage complete against changed bill items' (CCS: 2010). Measurement sheets provide for recording progressing build-up quantities which can be divided into claimed, paid and actual quantities.

In many occasions variations must be priced before it is ordered. Valuations of these can be done in three ways. Free-format analytical worksheets from the original estimate can be used. Secondly, the above can be used but modified accordingly. Thirdly, estimates can be built up once again using first principles. When the contractor prices these he can divide them into internal and external rates to keep track of his expenditure and profit.

Cost reconciliations are normally done on a monthly basis. 'The three industry standard approaches to controlling a construction project are catered for, being resource based, location and task orientated control' (CCS: 2010). produced in the cost reconciliation can be done in a format compatible with costing systems used on site or can be exported on spreadsheet for preparing monthly cost and control statements.

A unique tool in the Candy programme is the Engineering information facility. 'Full analytic detail of the budgeted use of resources for any part of the project or code structure can be produced' (CCS: 2010). This implies that activities can be closely

inspected for cost savings or changed before execution. The methodology of carrying out work can be discussed and fine tuned.

CCS (2010) believes that the site team interact more with estimating when dealing with the Valuation module in Candy. This way they can provide important feedback to the enterprise giving them a competitive advantage. More of the tools and facilities in this module are summarised below:

- Immediate use of tender information
- Analytical pricing of variations
- Detailed coding structures and analysis
- Subcontract liabilities
- Final and remaining values forecast
- Multiple quantity types
- User-defined document layouts
- Report Writer and data export
- Forecasts through integration with Planning
- Allowance reconciliation by user defined cost codes

(CCS: 2010)

3.2.3 Cash Flow

The cash flow in a company, especially a construction company is one of the most, if not the most important aspect of the business. A negative cash flow has caused many downfalls of construction companies. This aspect of the business needs to be closely monitored and recorded. The cash flow must meet the financial requirements for the business to function effectively.

'Candy Cash Flow models the financial requirements of a construction project so that the cash flow can be optimised' (CCS: 2010). Firstly, 'interest rates, retention rules and pre-payments can be specified.' Delays of payment to subcontractor and supplies can be stated and also the expected escalation in costs. Another function that the program provides is the calculation of the net present value from both the employer and the contractor's sides. This is generated from weekly or monthly cash flow calculations aided by the program.

The Cash Flow module 'accepts data directly from the Bill of Quantities or from the Bill of Quantities/Planning linked relationship, or else data can be entered from the keyboard – or any combination of the three. This forms a financial model describing what has to be done in terms of the cost of labour, plant, material, etc. and the time scale within which these must occur' (CCS: 2010).

More of the tools and facilities in this module are summarised below:

- Financial modeling
- Integrated Estimate and Program
- Payment lags
- Escalation
- Payment plans
- Advance payments and loans
- Client and subcontract retention
- Interest on savings and borrowing
- Nett Present Value calculation
- Multiple currency modeling
- Summary reports and data export

(CCS: 2010)

3.2.4 Forecasting

Because Candy provides the function of integrating the estimate or rather the bills of quantities with the construction programme, a number of forecasting functions are also available. 'All the information related the Bill of Quantities can be forecast over time' (CCS: 2010). This implies that items from the bills are allocated to activities on the construction programme and so linked to specific days, weeks and months. The estimate being done using the calculation of resources, gives the user the opportunity to allocate resources to time periods on the construction programme.

In creating an initial forecast for a project, it can be saved as a base forecast against which, actual expenditure and resource usage can be compared and monitored. The forecasting module is also used when generating monthly certificates. It is normal practice to enter progress quantities in the bills of quantities in preparation of the monthly certificate. The monthly allowable (monthly claim) can be transferred to the Forecast module to compare monthly costs. Furthermore, 'updating the programme will provide suggested progress quantities to the bill items each month' (CCS: 2010).

More of the tools and facilities in this module are summarised below:

- Linking the bill and program provides immediate forecasting
- Detailed analysis of forecast
- User defined cost codes describing with, what, where
- Summary analysis at cost code level
- Import of costs

- Monthly allowable cost reconciliation
- Remaining and final cost and value forecasts
- Financial and Engineering information

(CCS: 2010)

3.3 The lack of use of all functions by different role players

3.3.1 A lack of clear understanding

Akintoye et al (2009) referencing Pellegrinelli et al. observed that when different role players involved in programmes in the construction environment meet, they often try to figure out what the others' view of programme management is. GAPPS, also referenced by Akintoye et al. emphasize that there indeed little transparency of what programme management entails between construction related individuals. Akintoye further explains that even after a decade of 'academic and practitioner' interest, the uncertainties surrounding programme management still remains and that often people confuse construction programme management with schedule management which is the actual Gantt charts in a construction programme. Gantt charts are but one aspect of the construction programme, which was clearly shown in all the aforementioned functions of the construction programme.

According to research done by Akintoye et al (2009), he has come to the simple conclusion that programme management 'suffers from an identity crisis'. Ferns, (cited in Akintoye 2009), considers the term programme is commonly used but inconsistent in that, and the loose definitions of programme has contributed to the 'lack of understanding of the benefits achievable in its practice, but believes that if properly implemented, the construction industry will achieve efficient delivery of projects.' It

can therefore be deduced that the mere lack of understanding of the construction programme is a key reason for the lack of its usage in its entirety and thus leading do its effectiveness.

3.3.2 The lack of interest and training

According to Engelbrecht (personal communication: 2010), professional developed construction programmes rarely come to light. He explains that the JBCC (Joint Building Contract Committee) contract specifies that the contractor is obliged to provide the employer with a schedule or chart of the intended flow of work to be performed on the project. This is often the only reason a contractor provide a Gantt chart.

The programmer of such a programme – the head of the construction firm on many occasions – intends for the project to be carried out as showed on the Gantt chart. The site agent and the foremen on site usually do not. Engelbrecht believe the reasons for this can be manifold:

- The site representatives or team do not agree with the flow of work described on the programme
- The site representatives or team are not trained in following and managing the programme
- The site representatives or team feel it is not necessary to follow such a programme

3.3 Conclusion

In a survey done in the UK, Akintoye et al (2009) asked the question: 'Indicate if you practice programme management' and 'Indicate if you practice project management'.

The founding was that 58% construction firms do not practice programme management and 89% of respondents did practice project management.

Our construction industry is also in dire need of programme management training. The functions in a construction programme can benefit the contractor and the client in many ways. It can aid the contractor in everyday ambiguities and can show a clear path to follow. A majority of time can be saved in using computer aided software. Faster calculations, retrieval of information and programming can save the contractor a great deal of time.

3.4 Testing of Hypothesis

Sub-problem Two:
What are the functions of a building programme and why are they not used to their full potential?
Hypothesis:
Building programmes are not used to their full potential for a number of reasons:

- It is tendency that these programmes are only created to satisfy the client in assuring him that the project will finish on time
- Both the programmer and the site manager do not know how to use it to its full potential

Finding:

The hypothesis was to a large extent correct. In speaking to a professional in the build environment, the hypothesis that the construction programme is only created to satisfy the client was confirmed (Engelbrecht 2010, pers. comm., 15 July). The other

problem was not so much that a programmer does not know how to use the construction programme to its full potential. Larger companies that have dedicated programmers know of the different functions the programme can offer. The other problem is rather that it is not required from the programmers to use all the functions, since the other role players in a project are not equipped to use these functions and are not trained to use them.

Chapter 4 – The Critical Importance of Implementing the Construction Programme

4.1 Introduction

Akintoye et al (2009) performed a survey in the UK construction industry. An industrial questionnaire survey aimed at establishing 'the relationship, similarities and differences between programme and project management and subsequently draws comparisons of the practices relevant to programmes between programme and non-programme organisations.'

Two of the questions in the survey was: 'Do you consider the term Programme Management as aligning, planning coordination and execution of a group of related projects to realise benefits that is not possible if the projects are managed individually?' and 'Do you consider the term Project Management as the planning, coordination and execution of a single project from inception to completion?' Akintoye explains that the questions were designed to present a 'working definition' of the term because of the various definitions that encapsulate programme management. The working definition of programme management was accepted by 78.2% of the respondents and the definition of project management by 86.6%.

Pellegrinelli (2010) states that 'project management's practical success has transformed the way many private, public and non-for-profit organisations operate, with projects becoming the preferred way of working.' He further says that functional or line structures are falling away and are being replaced by the 'project-based organisation (PBO)'. The need to use resources effectively, to balance the priorities and interest and to develop capacity has come with the extensive use of projects. Pellegrinelli (2010) suggests Programmes and programme management has come to fulfill this need to a large extent.

In a different article Pellegrinelli et al (2007) says organisations that need to manage and deliver more 'complex change initiatives and project-based working', have adopted programme management do adapt to such changes and requirements. Furthermore, Pellegrinelli explains that managing programmes has been delegated to experienced project managers and that software companies have pursued the new trend and embraced the opportunity to assist companies in managing and employing programme management.

Programme management is not only the management of one construction programme on one project. It encompasses the coordination of resources between related projects, the planning and scheduling of activities over related projects and the execution of these projects in harmony.

4.2 The importance of programme management

4.2.1 The goal of the construction programme

Lycett et al (2004) believe the fundamental goals of the programme can be divided into two main items namely efficiency and effectiveness goals and business focus goals. Lycett et al describes the former type as aspects of management that an experienced project manager should address in related projects and that an improvement in efficiency and effectiveness can be attained by addressing these aspects of management. The latter is described as 'The external alignment of projects with the requirements, goals, drivers and culture of the wider organisation' (Lycett et al. 2004).

Table 2 below summarizes both types of goals with aspects of these goals and descriptions of these aspects.

Table 2 – Fundamental goals of the programme management

Source - Lycett et al: 2004

Goal	Description
Efficiency and effectiveness goals	
Improved co-ordination	Assist in identification and definition of project interdependencies and thereby reduce the incidence of work backlogs, rework and delays
Improved dependency management	Reduce the amount of reengineering required due to inadequate management of the interfaces between projects
More effective resource utilisation	Improve the effectiveness and efficiency of the allocation of shared resources. Assist in providing justification for specialist resources that deliver an overall improvement to programme delivery and/or business operations
More effective knowledge transfer	Provide a means to identify and improve upon transferable lessons. Facilitate organisational learning
Greater senior management visibility	Enable senior management to better monitor, direct and control the implementation process
Business focus goals	
More coherent communication	Improve communication of overall goals and direction both internally and externally to the programme. Target management attention clearly on the realisation of the benefits that are defined and understood at the outset and achieved through the lifetime of the programme and beyond. Assist in keeping personal agendas in check

Improved project definition	Ensure that project definition is more systematic and objective, thereby reducing the prevalence of projects with a high risk of failure or obsolescence. Enable either the unbundling of activities in a strategic project-set into specific projects. Enable the bundling of related projects together to create a greater leverage or achieve economies of scale
Better alignment with business drivers, goals and strategy	Improves the linkage between the strategic direction of organisations and the management activities required to achieve these strategic objectives. Provide an enabling framework for the realisation of strategic change and the ongoing alignment of strategy and projects in response to a changing business environment

4.2.2 Control of the programme

In a construction company, it is tendency that multiple projects will be controlled centrally. Akintoye et al (2009) believes that programmes that are controlled centrally are the most beneficial to the organisation, a clear visibility of the projects is acquired by management and providing a central control 'facilitates the harmony, uniformity and consistency of projects.' Centrality of control allows the project management of related concurrent projects to be run towards the goals of the organisation.

4.2.3 Resources

In the survey done by Akintoye et al (2009) a question posed was whether the projects that the construction firms execute share common resources. It was found that most organisations that perform programme management also share resources. Akintoye et

al (2009) believe that sharing resources is an important aspect of programme management. Resource sharing allows for resource leveling to be done effectively and knowledge sharing occurring. Olomalaiye as referenced by Akintoye et al (2009) state that sharing rotating resources through different projects enhances knowledge sharing and therefore save time and money, since new employees do not have to be employed and trained.

4.3 Challenges to the implementation of the construction programme

Abraham as referenced by Akintoye et al (2010) believes achieving success in the construction industry, projects must be planned and executed within the expected time. Furthermore he explains that companies that complete projects within time, budget, and quality standards are regarded as successful construction companies. 'Therefore, if a programme delivers the functional projects late, this can result in a challenge to the practice of programme management' (Young cited in Akintoye et al. 2010).

'The alignment, planning coordination and execution of projects' are usually carried out strictly with accuracy. This can cause a problem from one project to be distributed to other, which ultimately can affect an entire program. Thus, 'cross-functional working and coordination' in any one of the projects in a programme will turn out to be a major challenge of successful implementation (Akintoye et al. 2010).

Akintoye et al (2010) describes 'lack of knowledge of portfolio management techniques, risk management and financial skills' as the next major challenge of implementing construction programmes. Choi (cited in Akintoye et al. 2010) states that knowledge has the ability to enhance a firm's value to assist individuals to quickly

adapt to new and atypical situations, but the lack thereof can cause a firm to lose their competitive advantage.

Effective communication is necessary in any team that has a central goal to be achieved. Akintoye et al (2010) describes effective communication as the exchange of useful and meaningful information between individuals in a group or team with the aim of influencing their notions and actions. Communication is imperative to changes in the work environment. Akintoye et al (2010) referencing OGC state, 'the greater the change, the greater the need for clear communication about the reasons and rationale behind it, the benefits expected, the plans implemented and its proposed effects'. Akintoye et al explains that programme management is no different, in the sense that it aims at the exchange of functional information between team stakeholders on a timely basis. He therefore deduces that another challenge to the successful implementation of programme management is the lack of cross-functional communication.

Reis (cited in Akintoye et al. 2010) emphasize that implementing and practicing programme management is an expensive endeavor. Akintoye et al (2009) referencing Williams and Parr put forward that financial constraints may be encountered in implementing programme management and that it can definitely pose a major challenge to the implementation of the construction programme.

Milosevic et al, as referenced by Akintoye et al (2010), state that 'programmes are quite complex structures with high level of coordination and synergy among the cross-functional projects with many stakeholders of conflicting interest'. They further say that programme management will only be implemented successfully if its user is competent and own the relevant skills needed to employ the role of its handler.

Therefore, training also is essential for role players, part of programme management. Training therefore also poses as a major challenge to the implementation of programme management.

A survey was done by Akintoye et al (2010) in the UK construction industry. The survey was intended for the purpose of unearthing the major challenges in programme management in the construction industry. A total of 119 responses were received. Data obtained from the major challenges were analysed using a criticality index (CI). The closer the CI is to one, the more critical the challenge pose (Akintoye et al: 2010). The table below lists all the challenges ranked by the respondents.

Table 3 – Major Challenges to successful programme practice in the UK construction industry

Source - Akintoye et al (2010)

Lack of commitment from business leaders	0.789
Late delivery of projects	0.772
Lack of knowledge to evaluate risks	0.759
Lack of understanding of the role of programme	0.726
management in the organisation	0.722
Defining clear mission for the programme	0.722
Frequent projects scope changes	0.711
Conflicting project objectives	0.69
Lack of cross-functional communication	0.684
Lack of programme delivery infrastructure	0.681
Lack of clear company strategy	0.678
Financial constraints	0.67
Lack of coordination between projects	0.668
Lack of relevant training	0.664
People constraints	0.66
Lack of alignment of projects to strategy	0.646
Lack of cross-functional working	0.641

Initial funding and ongoing operational costs to the organisation	0.638
Lack of appropriate way to measure projects benefits	0.623
A perception among the project community that the programme	0.622
will serve as an obstacle to the timely accomplishment of project management	0.622
Lack of financial skills of project/other staff	0.611
Lack of understanding of the value proposition that programme management provides	0.604
Lack of awareness and associated benefits	0.593
Lack of resources (human/financial) to analyse project data	0.583
Resistance to organisational change	0.578
Lack of knowledge of portfolio management techniques	0.567
Disappointment with final project benefits	0.554
Too many unrelated projects	0.544
Presenting a detailed description of the intended roles of a PMO in the organisation	0.544

4.4 Hypothesis, finding and conclusion

Sub-problem Three

Why is the implementation of a construction programme of critical importance and what are the challenges of programme management?

4.4.1 Hypothesis:

End users are site agents and foreman on site. It is tendency that these people do not use programmes. There are a number of reasons for this:

- People in these positions normally has a number of years experience and feel that they do not need be told what to do
- They do not understand all the functions of such a programme
- They are not trained in using such a programme

Not implementing the programme correctly, defies the whole purpose of creating such a programme. A programme is intended for assistance to the main contractor and should be used for that reason.

4.4.2 Finding and Conclusion

Programme management poses many challenges to be overcome. The hypotheses above focus on the on-site team rather than initiation of the construction programme. Although practical end user application of the programme also poses a number of challenges, the major challenges are to be overcome at the commencement of the construction programme.

Pellegrinelli et al (2007) finds that programme management work 'is as much about coping as it is about planning and rational decision making, as much about re-shaping the organisational landscape as it is about delivering new capabilities.' It is therefore essential that not only programmes are designed with the end in mind but that the programme is implemented according to the intention of its design. Pellegrinelli et al explain that projects and related activities are shaped and coordinated by programmes in order to achieve 'organisational goals and benefits in the context of a dynamic organisational environment.' This statement alone emphasizes the importance of programme management implementation.

Chapter 5- Management of the Construction Programme

5.1 Introduction

The management of the construction programme tends to be individualistic. This means that every project in execution within a company is managed independently with its own construction programme. Lycett et al (2004) explain that developments regarding the theory and practice of project management have been considered individually on single projects. He further explains that Programme Management, in essence, entails the management of interrelated projects to achieve maximum benefits. Pellegrinelli et al (2002) describes the programme approach as 'a way of managing the interdependence between projects and the requirements to learn and respond to changing circumstances associated with strategy implementation.' Interrelated projects can also be seen as different activities on a single project. All activities in a project can be divided into sub-projects and handled as such. The management of the construction programme should therefore encompass the management of not only one, but a number of related projects, should they be executed concurrently.

As indicated in Chapter 5, the programme has a number of fundamental goals. These goals can be broadly and uninformative stated as:

- Efficiency and effectiveness goals
- Business focus goals

These goals are obviously more elaborated on when a study is done to identify the goals of the organization. Pellegrinelli et al (1997) point out three important features of the programme:

- A programme ‘creates benefits through better organization of projects and their activities’
- A programme ‘evolve in response to business need in an uncertain competitive, political and technological environment’
- A programme ‘takes a wider view to ensure that the overall business benefits from projects’ activities, not just the project client or sponsor’

The management of the construction programme should be aligned so to achieve these goals. The management of the construction programme is therefore of critical importance in what can be said as the last step in its lifecycle.

5.2 An approach to programme management

Lycett et al (2004) explains the contemporary approach to programme management. He describes that this approach is analogous to the standard approach to project management’s structure and control. ‘In broad terms, the common themes in these approaches are: (a) a hierarchy of roles, (b) a linear lifecycle and (c) a set of defined activities’ (Lycett et al. 2004).

5.2.1 Programme roles and responsibilities

Lycett et al (2004) firstly recognizes the importance to define the programme organization. How different role players interact in the programme enhance the success of successful programme management. Lycett suggest the Managing Successful Programmes (MSP) approach. The MSP approach identifies three main roles within the management function: the programme director who has the eventual responsibility for the programme, the programme manager who sets up and runs the

programme and the business change manager, who is responsible for benefits realisation and management.

Pellegrinelli et al (1997) has a different perception over the roles applicable to programme management. He firstly states than one is inclined to focus on the similarities between programme and project management role, but understandably so since they correspond in a number of ways. He suggests a 'programme client', who acts as an agent for the enterprise, determines the requirements of the overall programme and assumes the responsibility for achieving the attainable benefits resulting from the programme. The programme manager's responsibility is that of 'realising the anticipated benefits from the programme.' Furthermore an operations manager or team supply the expertise needed in the programme management key areas of .definition, planning, monitoring and control, risk identification, evaluation and appraisal. Lastly a project manager is responsible for the implementation of the work packages within the programme linked to the project.

Lycett et al (2004) concludes that the common feature in different approaches to the roles and responsibilities to programme management is that the programme manager role 'sits in linear hierarchy at a level above the project manager, implying a direct reporting relationship.' This point is illustrated in figure 5.1 below.

5.2.2 Programme management lifecycle

The second theme in the approach to project management is the linear lifecycle of the programme which is directly parallel to the lifecycle of the project(s) within the programme (Lycett et al. 2004). The lifecycle is illustrated in figure 2 below.

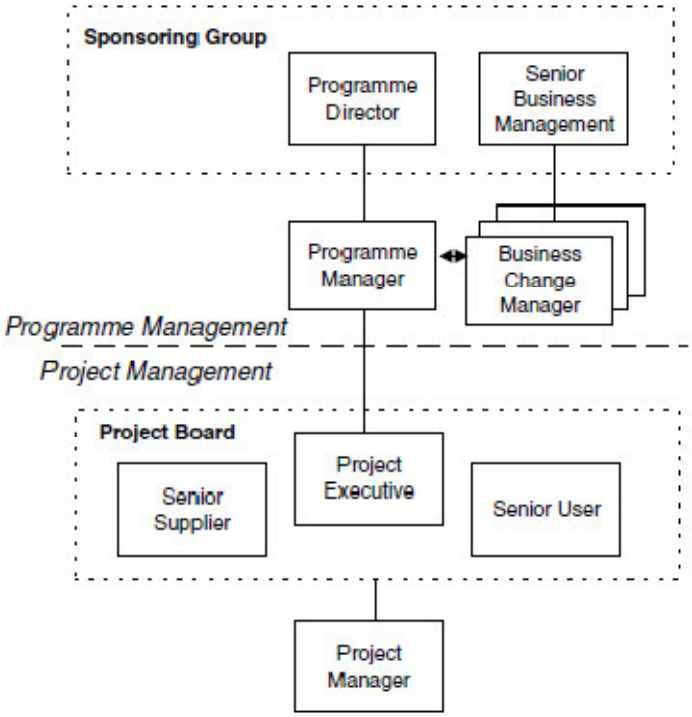

Figure 2 – 'Programme and project roles as per managing successful programme approach

Source: (Lycett et al. 2004)

The four stages namely, identification, definition or planning, execution and closure can be observed on the figure above. Programme identification defines 'the overall objective for the programme and positions the programme within the organisation's corporate mission, goals, strategies and other initiatives' (Platje cited in Lycett et al. 2004). Haughey, (cited in Lycett et al. 2004) emphasizes the importance of boundaries to the programme in terms of what it should deliver. The identification which also forms part of the development of the programme was discussed in full in chapter 2. Programme definition and planning was described in full in chapter 2.

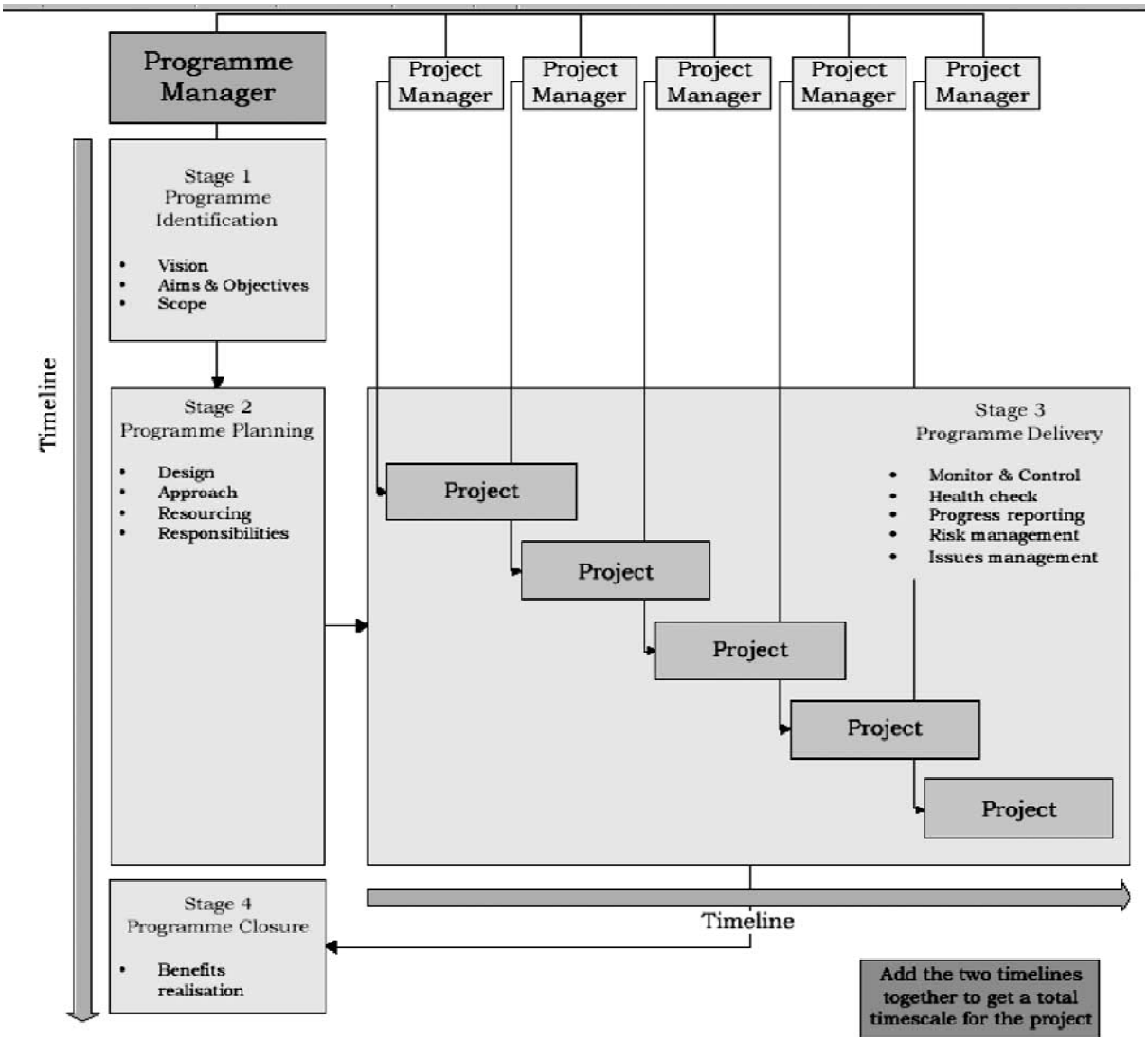

Figure 3 – Typical programme management lifecycle

Source: (Lycett et al. 2004)

The third stage in the programme lifecycle is the programme execution phase. This phase can be considered the most important phase. Lycett et al (2004) describes that the project managers carry out the work packages appointed to them while programme managers are responsible for the monitoring and control of the programme. The programme manager must further assess the risk and continuously

report on the progress of the project(s) within the programme. Lycett et al (2004) specifies two distinctive activities prone to this stage in the programme lifecycle. Firstly, it must be ensured that the 'target business environment is adequately positioned to receive the changes.' His suggests that the parties involved in the management of the programme, including the project manager must be familiar with the programme and be confident in using the programme. Secondly, it must be ensured that risks are handled benefits managed properly throughout the lifecycle. Risks are identified in the development of the programme. All persons interrelated to the programme should be aware of these risks and how to deal with them.

The last phase in the programme management lifecycle is the programme closure stage. Lycett et al (2004) state that this stage is mainly 'concerned with benefits realisation.' Lycett et al (2004) emphasize that it has to be ensured that all benefits are realised and that the programme delivers these. Furthermore, this stage provides the confirmation whether all projects within the programme are completed and can be closed.

5.2.3 Programme management activities

The programme lifecycle explains the processes that take during the time period of the projects within the programme. In the management of the programme a number of activities should take place in its execution. Lycett et al (2004) recommend a number of activities, which are focused around the programme roles and linear lifecycle of the programme as discussed above:

- Planning an resource management
- Monitoring and control
- Configuration management and change control

- Risk and issue management
- Benefits management
- Stakeholder management

Programme planning and resource management was discussed fully in chapter 2. Programme monitoring and control can be identified as one of the most important activities to be performed in programme management. This activity includes tracking progress of the project(s) against the programme and taking steps if required (Lycett et al. 2004). Tracking also alerts the programme manager 'to any project interdependencies that are becoming critical in terms of delivery date, resource-utilisation, costs or benefits'. Pellegrinelli (1997) explains that monitoring financial expenditure and resource usage is reasonably simple and that it is only a matter of convenience of how it is collected. However the continuity of a programme over a project provides a method of analysing benefit inflows to the enterprise and information on how other projects within the programme should be planned.

Configuration management and change control entails the creation of a 'programme blueprint' (Lycett et al. 2004). Lycett et al (2004) state that this activity is incorporated in most standard approaches to programme management. The 'programme blueprint' serves as a baseline for managing the overall configuration. He explains that any programme has a baseline from which costs and benefits is measured. This baseline further defines the scope of the projects 'in order to facilitate change control' (Lycett et al. 2004).

Pellegrinelli (1997) describes risk analysis at the project level as the assessment of the possibility that a project might not meet its time, cost and quality constrains. Furthermore, risk management is described as the identification of problems that has

occurred, implementing contingency plans, and taking preventative action where required. Risk analysis and management at the programme level, is aimed at addressing wider issues. This activity would rather focus on how effectively the programme is enhancing the organisations competitive advantage (Pellegrinelli 1997). Some other points of focus will entail the 'achievement of the programme's benefits' and the effects changes has on the programme in the projects (Lycett et al. 2004).

Programme benefits management is not different from the project level concept of benefits management (Lycett et al. 2004). Lycett et al (2004) further explain that in the way a project manager has the responsibility to complete and sign-off a project; the programme manager also has a responsibility to benefits realisation. As for stakeholder management, Lycett et al (2004) believes there is still a more flexible method of handling stakeholders that come and go over the lifecycle of the project needed. The standard approaches to programme management do not propose more flexible methods.

5.3 Conclusion

Lycett et al (2004) argues clearly that programme management is much more than managing a number of larger projects. He further explains that a unique approach must be adapted to deal with different programmes over different cultures and work ethics. Two erroneous assumptions that must be discarded in programme management is that: 'project management and programme management are essentially equivalent' and that 'a single standard approach to programme management is applicable in all circumstances' (Lycett et al: 2004).

Through the standard approach discussed in this chapter, it is possible to approach any project in its own right. A standard approach can only serve as a backbone to management of programmes and each and every project commands its own aspects and methods within the outlined lifecycle processes and activities.

5.4 Testing of Hypothesis

Sub-problem Four

How should a construction programme be managed during a construction project?

Hypothesis:
A suitable candidate should be in charge of such a construction programme. Suitable candidates include site managers, site agents and foremen. These are all people that are familiar with what is taking place on site.

Finding:

The hypothesis was found to be quite incorrect and lacked depth. A suitable candidate should be chosen to head the construction programme, but it was found in this chapter that the approach, rather than the candidate is of more importance and that such a programme manager is higher in a linear hierarchy. The programme manager is also not only the manager of a single project but of a number of interrelated projects. Site managers, site agents and foremen are rather stakeholders in such a programme responsible for certain activities within the management of the programme.

Chapter 6 – Summary and Conclusion

6.1 Background

As stated in Chapter 1, construction programmes serve a number of purposes. Other than being a time schedule for work to be performed, illustrating the successive flow of work and a number of other functions discussed throughout the research report it was found that a construction programme serves another important function. Construction programmes harmonize resources, cashflow, plant, equipment and the labour force of a company. A construction programme not only focuses on one project but rather on two or more concurrent similar projects. The above mentioned factors are balanced, distributed and circulated between projects to achieve the main goals of each project and the goals of the enterprise as a whole. The main problem investigated in this research report was: How should a construction programme be formulated, developed and implemented successfully on a construction project? This problem was sub divided into four sub-problems that were addressed in the research report.

6.2 Summary

The first sub-problem was as follows: How should a construction programme be developed? This problem incorporates the importance of CSFs (Critical Success Factors). In this chapter a number of CSFs were focused on that are key factors in the development of the construction programme. These key factors were found to be present in the field of project management, serving similar but not identical purposes in both programme and project management. As mentioned in chapter 2, programme management cannot be successful without a project management support and

likewise, project management can be improvised by effective programme management.

The four CSFs that were focused on were:

- Effective planning
- Establishing programme priorities
- Effective communication
- Effective risk analysis and management

These CSFs were discussed because of their high criticality as shown in table one in chapter two. In studying these CSFs, it was found that they are all interrelated and that each factor incorporates some aspects of the other. The chapter has been limited to due to the vast nature of this field of study. In depth research on these CSFs and how they affect the successfulness of the programme can certainly be of interest.
The second sub-problem discussed, concerned the functions of a building programme and why they are not used to their full potential. Five main functions were identified:

- Planning
- Estimating
- Valuations
- Cash flow
- Forecasting

The computer aided software programme 'Candy' was examined and how these functions can be performed using this software. These five functions were found to be used in the construction environment, but only by certain role players and not to their full potential. Three reasons were identified for the lack of usage of the functions of the construction programme:

- A lack of clear understanding

- A lack of interest
- A lack of training

Furthermore the benefits in using computer aided software for programme management were discussed. Doing faster calculations, retrieving information quicker, and rapid programming are but a few of these advantages. That programmes are often only done because the client requires one, was confirmed by a professional in the build environment. The main problem identified is that different role players and stakeholders of the construction programme are not equipped and trained to utilize all functions to their full capabilities.

Sub-problem three asked the question: Why is the implementation of a construction programme of critical importance and what are the challenges of programme management? As cited in chapter, project management is transforming the way many organisations operate. Functional and line structure are disintegrating making way for the new 'project based organisation'. With employing projects in order to operate within an organisation, comes the need to use resources effectively, too balance the priorities and interest and to develop capacity. Pellegrinelli (2010) suggests that programmes and programme management has come to fulfill these needs to a large extent.

In assessing the importance of programme management one needs to determine the goals to be achieved in utilizing such a programme, the manner such a programme needs to be controlled and the resources benefits achievable in employing a programme management approach. These aspects are all dealt with in chapter four.

In adopting a programme management approach a number of challenges arise:

- Lack of commitment from business leaders
- Late delivery of projects
- Lack of knowledge
- Lack of understanding

- Lack of clear definitions of missions

These are a few of the challenges in implementing programme management. Some of these aspects are dealt with in chapter four. Challenges to be overcome were found to be more at the commencement of such a programme than in practical end user application. Furthermore it is just as important to design the programme with the end functions of it in mind.

Sub-problem four focuses then on the end user application and asks the question: How should a construction programme be managed during a construction project? The suggestion, at first, towards managing a construction programme was individualistic, meaning that construction programmes were assigned to individual projects managed on their own. Through research it was found that the management of a programme rather encompasses the management of multiple, interrelated concurrent projects. Furthermore the management of the construction programme should be aligned so as to achieve both efficiency and effectiveness goals and business focus goals.

Three aspects were focused on in chapter five. Firstly, programme roles and responsibilities, explaining how different role players interact. Secondly the programme management lifecycle were depicted focusing on four main stages of the programme:

- Programme identification
- Programme planning
- Programme delivery
- Programme closure

Thirdly, the programme activities were described. Some of these included:

- Planning an resource management
- Monitoring and control
- Configuration management and change control

- Risk and issue management
- Benefits management
- Stakeholder management

The management of a construction programme is thus not merely managing projects to meet the criteria of time, cost and quality. It includes handling different types of projects, meeting the needs of the projects in terms of resources and cash flow and ensuring the realization of project and organizational goals.

6.3 Conclusion

The main problem enquires: How should a construction programme be formulated, developed and implemented successfully on a construction project?
Chapter two, entitled: 'Development of the construction programme' deals intensively with both the formulation and development of the construction programme. As described above all the critical factors in developing the construction programme are described. Chapters three and four focus on the functions in implementing the construction programme and the importance of implementing the programme. Chapter four further provides the challenges encountered in implementing the construction programme. Finally, chapter five entitled: 'Management of the construction programme' illustrates once again the formulation of the construction programme by describing different roles and responsibilities and the programme lifecycle. Chapter five also expresses many activities within the programme during its implementation.

6.4 Suggestions for further research

The development of the programme is the most crucial part of programme management. Only an appreciable overview was given in chapter two. The development of the construction programme can definitely be a study of its own.

In chapter three the computer programme 'Candy' was investigated in aiding the programmer and end user in the functions of the construction programme. Further research can be done on different programmes available and to which extent computer aided software can assist the user in its application.

BIBLIOGRAPHY

Akintoye, A & MacLeod, M 1996. 'Risk analysis and management in construction.' *International Journal of Project Management*, Volume 15, Issue 1, February 1997, Pages 31-38, Published by Elsevier Science Ltd.

Akintoye, A & Shehu, Z 2009. 'Construction programme management theory and practice: Contextual and pragmatic approach', *International Journal of Project Management,* Volume 27, Issue 7, Pages 703-716

Guerriero, F & Talarico, L. 'A solution approach to find the critical path in a time-constrained activity', *Computers & Operations Research*, Volume 37, Issue 9, Pages 1557-1569

Harris, F & McCaffer, R 2006. 'Modern Construction Management' Page 65, Published by Blackwell Publishing.

Kwok, Y & Ahmad, I. 1996 'Dynamic Critical-Path Scheduling: An Effective Technique for Allocating Task Graphs to Multiprocessors', viewed 7 July 2010,
< http://0-citeseerx.ist.psu.edu.innopac.up.ac.za>

Laptali, E & Bouchlaghem, N 1997. 'Planning and estimating in practice and the use of integrated computer models', *Automation in Construction,* Volume 7, Issue 1, Pages 71-76

Leidecker, J.K & Bruno A.V 1984. 'Identifying and using critical success factors', University of Santa Clara, Santa Clara, CA 95053, USA, Published by Elsevier Science Ltd.

Lycett, M & Andreas, R & Danson J 2004. 'What's in a name: Project or programme?' *International Journal of Project Management*, Volume 22, Issue 4, Pages 289-299 Viewed 4 July 2010, <www.sciencedirect.com>

Pellegrinelli, S et al 1997. 'Programme management: organising project-based change'. *International Journal of Project Management*, Volume 15, Issue 3, Pages 141-149. <www.sciencedirect.com>

Pellegrinelli, S et al 2002. 'Shaping context: the role and challenge for programmes', *International Journal of Project Management*, Volume 20, Issue 3, Pages 229-233. <www.sciencedirect.com>

Pellegrinelli,S et al 2007. 'The importance of context in programme management: An empirical review of programme practices'*, International Journal of Project Management* Volume 25, Issue 1, Pages 41-55

Pellegrinelli, S 2010. 'What's in a name: Project or programme?' *International Journal of Project Management*, Viewed 1 July 2010, <www.sciencedirect.com>

Shehu, Z & Akintoye, A 2009. 'The critical success factors for effective programme management: a pragmatic approach', viewed 8 April, 2010, <http://www.tbher.org/index.php/bher/article/viewArticle/22>

Shehu, Z & Akintoye, A 2010. 'Major challenges to the successful implementation and practice of programme management in the construction industry', *International Journal of Project Management,* Volume 28, Issue 1, Pages 26-39, viewed 4 March, <http://zshehu.com/Papers/Major_Challenges.doc>

Underwood, J & Alshawi, M 1997. 'Data and Process Models for the Integration of Estimating and Valuation', *Microcomputers in Civil Engineering,* Volume 12, Pages 369–381. Viewed 10 July, <http://0-www3.interscience.wiley.com>

Zwikael, O & Sadeh, A 2004. 'Planning effort as an effective risk management tool.' Journal of Operations Management, Volume 25, Issue 4, June 2007, Pages 755-767, viewed 10 April 2010, <http://www.sciencedirect.com/science>

INTERNET:

Dictionary.com, viewed 18 April 2010, <http://dictionary.reference.com/browse/plan>

Author unknown Page Last Updated on 11 November 2003, viewed 20 April, <http://www.dynamicflight.com/avcfibook/communication/>