

**A GENERIC BUSINESS MODEL AND  
MANAGEMENT INFORMATION SYSTEM  
FOR QUICK ERP IMPLEMENTATION  
IN A PROJECT-DRIVEN SME**

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Pactera roburant, callus recti

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## **DECLARATION**

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

J van Eeden

## **EXECUTIVE SUMMARY**

A demand exists in SMEs to implement an ERP system to provide in-time transaction and management information to the employees and management respectively. The reason for this study developed from problems experienced in the past with ERP implementations.

As a first step, a generic business model for project management in an SME was developed. This business model is based mainly on the PMBOK. Experienced project management consultants provided inputs for the business model. CAE accepted the business model after a few reviews. The business model was implemented in CAE and the employees trained to perform their daily tasks on Qmuzik by using the processes suggested by the business model.

The five main processes in the project management business model are Initiating, Planning, Executing, Controlling and Closing. The model is complete with inputs to the processes and the resulting outputs from them. The business model was implemented on Qmuzik, and comments were included with every business process.

Reports for project management were developed to provide in the information requirements of the project managers. The reports developed and deployed aim at providing detail and summary information to assist project managers in performing project control. The reports were developed and implemented and are currently used by the CAE project managers.

The project management business model and reports fit into the bigger project for the complete enterprise with great success. The bigger project has completed the templates and is ready for the first fast implementation where the methodology will be tested.

## UITVOERENDE OPSOMMING

'n Behoeftes bestaan by kleinsakeondernemings om ERP-stelsels te implementeer om in hulle intydse inligtingsbehoefes vir transaksie-inligting aan werknemers en bestuursinligting aan bestuur te voorsien. Die rede vir hierdie studie het ontwikkel uit die probleme wat in die verlede met ERP-implementerings ondervind is.

As 'n eerste stap is 'n generiese besigheidsmodel vir projekbestuur in 'n kleinsakeonderneming ontwikkel. Die besigheidsmodel is hoofsaaklik op die PMBOK gebaseer. Ervare projekbestuur konsultante het insette gelewer vir die besigheidsmodel. CAE het die besigheidsmodel ná 'n paar hersienings aanvaar. Die besigheidsmodel is geïmplementeer, en die werknemers is opgelei om in hulle daaglikse werk Qmuzik vir die voorgestelde besigheidsmodelprosesse te gebruik.

Die vyf hoofprosesse in die projekbestuur-besigheidsmodel is Inisiasie, Beplanning, Uitvoer, Beheer en Afsluiting. Die model is afgehandel met insette vir die prosesse en die resulterende uitsette daarvan. Die besigheidsmodel is op Qmuzik geïmplementeer, en kommentaar is by elke proses ingesluit.

Verslae vir projekbestuur is ontwikkel om in die inligtingsbehoefes van die projekbestuurder te voorsien. Daar word beoog om met die verslae omvattende en samevattende inligting te voorsien aan projekbestuurders om projekbeheer te kan uitoefen. Die verslae is ontwikkel en geïmplementeer en word deur CAE-projekbestuurders gebruik.

Die projekbestuur-besigheidsmodel en verslae pas met sukses in by die groter projek vir die totale onderneming. Die groter projek is in die proses om die model te verpak vir die eerste loodsprojek.

## **ACKNOWLEDGEMENTS/DEDICATIONS**

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## **TERMS OF REFERENCE**

South Africa has project-driven enterprises that need a real-time information system to enable them to enhance their efficiency. Many South African SMEs require management information systems to assist operational and strategic management in running their business. These information systems are often very expensive, and even more expensive to implement. The smaller enterprise, i.e. the SME, cannot afford these systems.

There is a market potential for developing and marketing an affordable solution for these smaller companies. Part of this affordable solution is to develop a generic business model for the project-driven SME on an ERP system. This should be done in order to enable the same predefined, generic model to be implemented at any other business that is willing to accept this business model that was thus developed, in a fraction of the time it would normally take. This fast-track implementation will not be possible in an organisation where comprehensive business modelling needs to be done.

The aim of the project is to design, review and implement the generic model, to comment on the process followed in developing the model and to describe how to implement ERP systems for smaller organisations. The method used was to implement a chosen ERP system for an organisation fitting the target group. A literature study was completed, business models proposed to the target company, and rework done where required. A mixture between classical research techniques and an action research approach was used.

This thesis focusses on the establishment of the project management business model and project management reports for the project manager. The reports should specifically provide in the information requirements of middle management, i.e. the project managers.

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## **GLOSSARY**

### ***Acronyms***

APMBOK	APM's Body of Knowledge
APM	Association of Project Managers
ACWP	Actual Cost of Work Performed
BAC	Budget at Completion
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BPR	Business Process Re-engineering
CAE	Stellenbosch Automotive Engineering t/a CAE
CPI	Cost Performance Index
CV	Cost Variance
DSS	Decision Support Systems
EAC	Estimate at Completion
EIS	Executive Information Systems
ESi	Enterprise System Implementers
ERP	Enterprise Resource Planning
ETC	Estimate to Completion
EV	Earned Value
GAAP	General Accepted Accounting Principles
GCC	Global Competitiveness Centre
IS	Information System
MIS	Management Information System
MRS	Management Reporting Systems
OIS	Office Information Systems
PC	Percentage Complete
PM	Project Management
PMBOK	Project Management Body of Knowledge (by PMI)
PMI	Project Management Institute
RFP	Request for Proposal
SME	Small to Medium Enterprises
SMME	Small, Micro and Medium Enterprises

SOW	Statement of Work
SPI	Schedule Performance Index
SV	Schedule Variance
TPS	Transaction Processing Systems
US	University of Stellenbosch
WBS	Work Breakdown Structure

## **Definitions**

**Activity.** An element of work performed during the course of a project. An activity normally has an expected *duration*, an expected *cost*, and expected *resource requirements*. Activities are often subdivided into *tasks*.

**Actual Cost of Work Performed (ACWP).** Total costs incurred (directly and indirectly) in accomplishing work during a given time period. See also ***Earned Value (EV)***.

**Administrative Closure.** Generating, gathering, and disseminating information to formalise project completion.

**Baseline.** The original plan (for a project, a work package, or an activity), plus or minus approved changes. Usually used with a modifier (e.g. cost baseline, schedule baseline, performance measurement baseline).

**Budgeted Cost of Work Performed (BCWP).** The sum of the approved cost estimates (including any overhead allocation) for activities (or portions of activities) completed during a given period (usually project-to-date). See also ***Earned Value (EV)***.

**Budgeted Cost of Work Scheduled (BCWS).** The sum of the approved cost estimates (including any overhead allocation) for activities (or portions of activities) scheduled to be performed during a given period (usually project-to-date). See also ***Earned Value (EV)***.

**Contract.** A contract is a mutually binding agreement, which obligates the seller to provide the specified product, and obligates the buyer to pay for it.

**Contract Closure.** Completion and settlement of the contract, including resolution of all outstanding items.

**Control.** The process of comparing actual performance with planned performance, analysing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.

**Cost Budgeting.** Allocating the cost estimates to individual project components.

**Cost Estimating.** Estimating the cost of the resources needed to complete project activities.

**Cost Performance Index (CPI).** The ratio of budgeted costs to actual costs (BCWP/ACWP). CPI is used to predict the magnitude of a possible cost overrun using the following formula:  $\text{original cost estimate}/\text{CPI} = \text{projected cost at completion}$ . See also *Earned Value (EV)*.

**Cost Variance (CV).** (1) Any difference between the estimated cost of an activity and the actual cost of that activity. (2) In earned value, BCWP less ACWP

**Deliverable.** Any measurable, tangible, verifiable outcome, result, or item that must be produced to complete a project or part of a project. Often used more narrowly in reference to an external deliverable, which is a deliverable that is subject to approval by the project sponsor or customer.

**Earned Value (EV).** (1) A method for measuring project performance. It compares the amount of work that was planned with what was actually accomplished in order to determine if cost and schedule performance are as planned. See also **Actual cost of work performed, Budgeted cost of work scheduled, Budgeted**

**cost of work performed, Cost variance, Cost performance index, Schedule variance, and Schedule performance index.** (2) The budgeted cost of work performed for an activity or group of activities.

**Exception Report.** Document that includes only major deviations from plan (rather than all deviations).

**Functional Manager.** A manager responsible for activities in a specialised department or function (e.g. engineering, manufacturing, etc.).

**Functional Organisation.** An organisation structure in which staff are grouped hierarchically by speciality (e.g., production, marketing, engineering, and accounting at the top level, with engineering further divided into mechanical, electrical and others).

**GO-Live date.** The date the project team switches on the ERP system. From this day all transactions are performed on the ERP system.

**Initiation.** Committing the organisation to begin a project phase.

**Line Manager.** (1) The manager of any group that actually makes a product or performs a service. (2) A functional manager.

**Matrix Organisation.** Any organisational structure in which the project manager shares responsibility with the functional managers for assigning priorities and for directing the work of individuals assigned to the project.

**Milestone.** A significant event in the project that is marked by the completion of a major deliverable.



**Monitoring.** The capture, analysis and reporting of project performance, usually as compared to plan.

**Percentage Complete (PC).** An estimate, expressed as a percentage, of the amount of work which has been completed regarding an activity or group of activities.

**Performance Reporting.** Collecting and disseminating information about project performance to help ensure project progress.

**Programme.** A group of related projects managed in a coordinated way. Programmes usually include an element of ongoing activity.

**Project.** A temporary endeavour undertaken to create a unique product or service.

**Project Charter.** A document issued by senior management that provides the project manager with the authority to apply organisational resources to project activities.

**Project Life Cycle.** A collection of generally sequential project phases of which the name and number are determined by the control needs of the organisation or organisations involved in the project.

**Project Management (PM).** The application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder needs and expectations of a project.

**Project Management Body of Knowledge (PMBOK).** An inclusive term that describes the sum of knowledge within the profession of project management. As with other professions such as law, medicine and accounting, the body of knowledge rests with the practitioners and academics who apply and further it. The PMBOK

includes proven, traditional practices that are widely applied as well as innovative and advanced ones that have more limited use.

**Project Management Software.** A class of computer applications specifically designed to aid with planning and controlling project costs and schedules.

**Project Manager (PM).** The individual responsible for managing a project.

**Project Phase.** A collection of logically related project activities, usually culminating in the completion of a major deliverable.

**Project Plan.** A formal, approved document used to guide both project execution and project control. The primary uses of the project plan are documenting planning assumptions and decisions, to facilitate communication among stakeholders, and documenting approved scope, cost, and schedule baselines. A project plan may be summary or detailed.

**Project Schedule.** The planned dates for performing activities and the planned dates for meeting milestones.

**Resource Planning.** Determining what resources (people or equipment) are needed and in what quantities in order to perform project activities.

**Schedule Control.** Controlling changes to the project schedule.

**Schedule Performance Index (SPI).** The ratio of work performed to work scheduled (BCWP/BCWS). See **Earned Value (EV)**.

**Schedule Variance (SV).** Any difference between the scheduled completion of an activity and the actual completion of that activity.

**Scope.** The sum of products and services provided as a project.

**Stakeholder.** Individuals and organisations who are involved in or may be affected by project activities.

**Work Breakdown Structure (WBS).** A deliverable-orientated grouping of project elements, which organises and defines the total scope of the project. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services.

[PMBOK, 1996, pp. 159-171]

# 1. INTRODUCTION

## 1.1. *Project Background*

### 1.1.1. **Project Management in SA Companies**

Different definitions of small to medium enterprises (SMEs) exist. The breakdown as given by the British Department of Trade and Industry (BDTI) is shown in Figure 1.1. In this literature study the author believes this definition to be the most applicable one for South African companies.

BDTI SME Definitions			
Criterion	Micro	Small	Medium
Max. Number of employees	9	49	249
Max. Annual turnover	-	7 million euros	40 million euros
Max. Annual balance sheet total	-	5 million euros	27 million euros
Max. % Owned by one, or jointly by several, enterprise(s) not satisfying the same criteria	-	25%	25%
Footnote: To qualify as an SME, both the employee and the independence criteria must be satisfied and either the turnover or the balance sheet total criteria must be satisfied			

Figure 1.1 – The British Department of Trade and Industry Definition [2001]

*Small businesses in South Africa absorb more than half the people formally employed in the private sector and contribute about 42% of the country's GDP. There are an estimated three million micro-enterprises in the country [Department of Trade and Industry, 2001].*

According to the South African government there are approximately 3 Million small, medium and micro enterprises in South Africa. These companies' role in the SA economy is considered as the factor to reduce unemployment and thereby increase economic growth. Although many other factors should be taken into consideration, the

SMEs importance to the South African economy is increasing. The South African government has realised this potential, and is actively promoting the SME sector as the cornerstone of economic growth and the future of the South African economy.

Most of these SMEs focus on either retail or providing services to the community. Many of them are using a **project-driven** focus. In doing so, they need business processes and systems to assist them with project planning, scheduling and execution. Arguably the most important aspect of project management though, is project control. With the limited resources available for the SME, any deviation from the schedule or a change in risk can or will have a direct impact on the company's cash flow, and ultimately profit could be in jeopardy. The skills required for project management are not as readily available in South Africa as many companies would have liked, with few SMEs having the luxury of employing qualified project managers.

Further increasing the skills shortage, is the fact that South Africa has many project-driven SMEs that need a **real-time information system**, i.e. an ERP system, to enable them to enhance their efficiency. However, very few can afford these systems. If a company cannot afford them, other options would either be to implement the system partially or to outsource it completely. Most South African users have not yet accepted the notion of outsourcing IT applications, so that option falls away. A partial implementation has the disadvantage of decreased functionality. An affordable, full ERP implementation would be a more acceptable option. Most, if not all, ERP vendors have developed implementation methodologies, but these had been focussed on big corporates. A methodology to make an ERP implementation affordable and complete, and aimed specifically at the SME market should be developed. Research is being done into the applicability of different approaches that ERP software suppliers and implementation partners are using to implement solutions for smaller users.

### 1.1.2. ERP Implementations

Too many inefficient and even unsuccessful ERP implementations have given ERP a bad name in the corporate IT World. Figure 1.2 tells the gruelling story of ERP implementations in the late nineties.

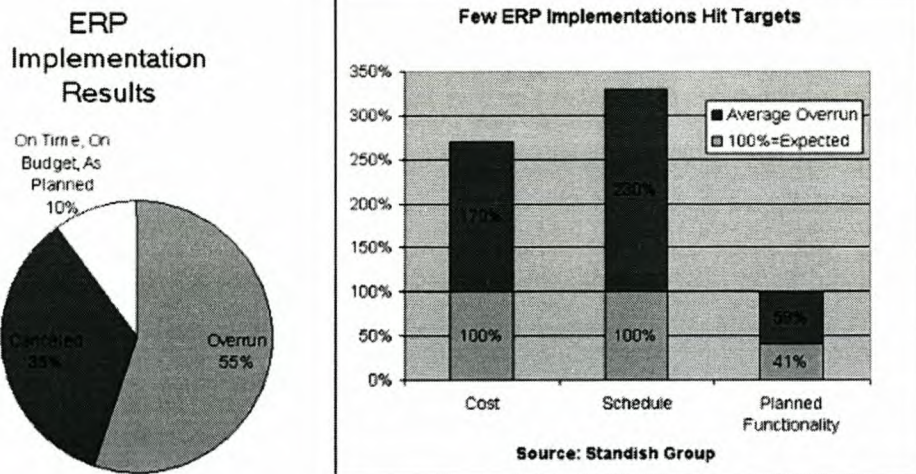


Figure 1.2 ERP Implementation Results [Gartner Group, 1997]

*The growing number of horror stories about the failed or out-of-control projects should certainly give managers pause.*

*[Davenport, 1998, p. 123]*

Overspent budgets, schedules not being met, functionality that does not meet the “promised” expectations of management and cancelled projects are some of the topics of unpleasant articles in ERP magazines. In South Africa the work force in general has less formal education, lower skill levels and less experience than is the case in most first world countries. For ERP implementations, this invariably leads to higher consulting hours required from consultants, as the dependency on them during and after implementation increases. This is true not only for the actual implementation, but also for the initial modelling of the required business processes. SMEs do not have the same availability of funds, as do large companies. Business

modelling is one deliverable where costs could be saved during ERP implementations, though in practice often to the detriment of both the implementation project and the company. The business model should be developed to ensure that the expected functionality is achieved within the shortest possible time.

A typical problem experienced in many enterprises is the fact that a part of the reports, the MIS reports, is not as crucial for the implementation as the day-to-day system reports. A lack of time and resources towards the end of the implementation causes these MIS reports to receive less attention than they should. The absence of these reports leaves top management blind to the situation of their company. This is then seen as lack of functionality, but it is actually finishing touches not completed due to a lack of time or funds.

### **1.1.3. Opportunity to be exploited**

There is a need in SME's for management information, providing the tools to enable better management of the company. The SME cannot afford the cost and risk involved in a full ERP implementation. The opportunity exists to make an affordable ERP solution available to these SMEs, at a reduced risk.

With such a solution, ERP solutions would become a viable option in the SME environment. This could be to the benefit of both the SME and the ERP vendors. A research project was thus engaged in to develop and test a methodology that would enable the participating companies to exploit this market opportunity.

## **1.2. *The Bigger Project***

### **1.2.1. Defining the Opportunity**

The aim is to develop an implementation methodology with the high-cost elements of the ERP implementation predefined where and if

possible. This enables the ERP vendor and implementation team to reduce the cost and duration of the implementation significantly, but sustain the quality of the implementation. The cost reduction should be from a standard R1.2M – R1.8M to a reduced R300k – R600k. The implementation time should reduce from 6 – 9 months to 6 – 9 weeks. This involves a significant saving to the SME.

The challenge is to decide on a business sector where 1) the need exist, 2) the employees are capable of the quick change in the company, and 3) the presence of technology is a given.

The high-cost elements that could be predefined are:

- Business models and processes
- Standard forms and reports
- Document templates to be used during the implementation
- Data migration templates to import existing company data
- Training material applicable to the business sector.

If these elements were predefined, the implementation time and cost could be significantly reduced, while the implementation quality could still be maintained.

### 1.2.2. The Potential Market

The project sponsors defined the target business sector as,

- **Project-driven SMEs,**
- Not afraid to embrace **technology,** and
- With a need for **management information.**

### 1.2.3. The Method Used in the Bigger Project

The first step was to implement the ERP system in a company similar to the target market defined above. This implementation was called the **primary implementation.** Secondly the methodology was



captured in a format (defined in Section 1.2.7) that would enable a project team to repeat the same implementation project at a second company in a fraction of the time used during the primary implementation. This second implementation will be called the **first secondary implementation**. This first secondary implementation will be a test project where the developed business model and the fast implementation methodology are tested. When proven, many similar secondary implementations can be done in companies willing to accept the business models that were developed during the primary implementation.

This study aims at providing a first building block for a successful and affordable custom ERP solution for the project-driven SME. This solution should provide a generic business model and a fast implementation methodology for an existing ERP system. Emphasis shall be placed on developing a business blueprint to limit the dependency on the skill of company employees, but at the same time to maximise the knowledge transfer to the employees involved. Training will be thoroughly scrutinised to ensure that the company is capable of operating the system after implementation. With the intended business model, the MIS reports will be standardised and completed before the first secondary implementation commences. The risk of a less than satisfactory implementation is thus reduced.

#### **1.2.4. Product Chosen**

Qmuzik is a midrange ERP system that was developed in South Africa, originally for the weapons industry. Implementations at JCI and ADS, both project-orientated enterprises, have distinguished Qmuzik as a strong role-player in the ERP projects industry. These two companies run projects with costs amounting to millions of dollars each year, and could be categorised as medium-sized enterprises according to the British Department of Trade and Industry definition in Figure 1.1. Although the focus of the project is on small companies,

the results from these enterprises have proven Qmuzik to be a serious role-player in the field of project management in ERP. Qmuzik was chosen as the ERP system to be used.

**1.2.5. Funding for the Project**

The Global Competitiveness Centre (GCC) at the Department of Industrial Engineering, University of Stellenbosch, in collaboration with the ERP developer, Qmuzik, introduced the South African government to this initiative. The government, through the Department of Trade and Industry, supports projects focussed on the competitiveness of South African enterprises. Funding for this project has therefore been obtained from the software suppliers, implementation partners and the South African government.

**1.2.6. ERP Implementation Method Used**

The implementation milestones used were adapted from ESi, a South African consulting company involved in enterprise system implementations. All the required steps for a proper ERP Implementation are present in the five-month project plan, including a two-month support period after the go-live date. Figure 1.3 illustrates the method used in project plan format.

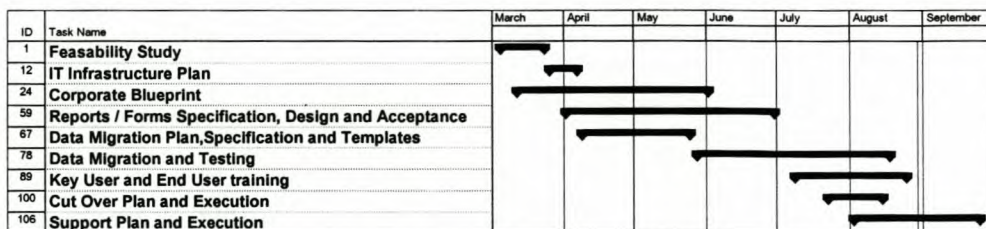


Figure 1.3 Overview of Project Plan Followed

More time than usually required was invested in developing the corporate blueprint. This was done to ensure that a generic business process model would be developed that could be rolled out in secondary implementations. A generic business model of a project-

driven SME was developed within a suitable ERP system for SMEs. The generic model has to portray all the processes and functions that should typically be fulfilled to operate any project-driven SME. The two main functional areas that, according to the project team, include more than 70% of the business model, are Finance and Project Management. The GAAP and PMBOK models were used respectively to ensure that these models are generic and according to acceptable standards. The academic partner, the Department of Industrial Engineering (University of Stellenbosch), provided inputs for the generic modelling process.

### **1.2.7. CAE, The Pilot Company**

The Centre for Automotive Engineering (CAE) in Stellenbosch was approached as a test company for this project. CAE is a fast growing consulting company in the motor industry, with about 50 employees and an annual turnover approaching R10 million. This classifies CAE as a micro to small company according to the British Department of Trade and Industry rules as defined in Figure 1.1. Before the start of the project CAE had a financial bookkeeping system that provided month-end results only by the middle of the following month. Their project planning and scheduling were done on MS Project 98.

The aim was to develop the generic blueprint for ERP implementation, and at the same time implement the Qmuzik ERP system at CAE. The implementation was done in cooperation with ESi, an ERP implementer with experience of Qmuzik and other ERP systems. A normal implementation project was used at CAE, but after the AS-IS model was finalised, a generic TO-BE model for any project-driven company was developed. The generic blueprint could then be used to roll out the ERP system to other interested SMEs.

### 1.2.8. The Implementation Methodology

A fast implementation methodology was developed, is presented in Figure 1.4 and the step definitions are explained in Table 1.1.

These step definitions should be followed during the implementation and the methodology provides data as inputs to the implementation process. Templates and example documents provide the project team with sample information to enable them to complete the fast implementation within the reduced time period and within the expected functionality.

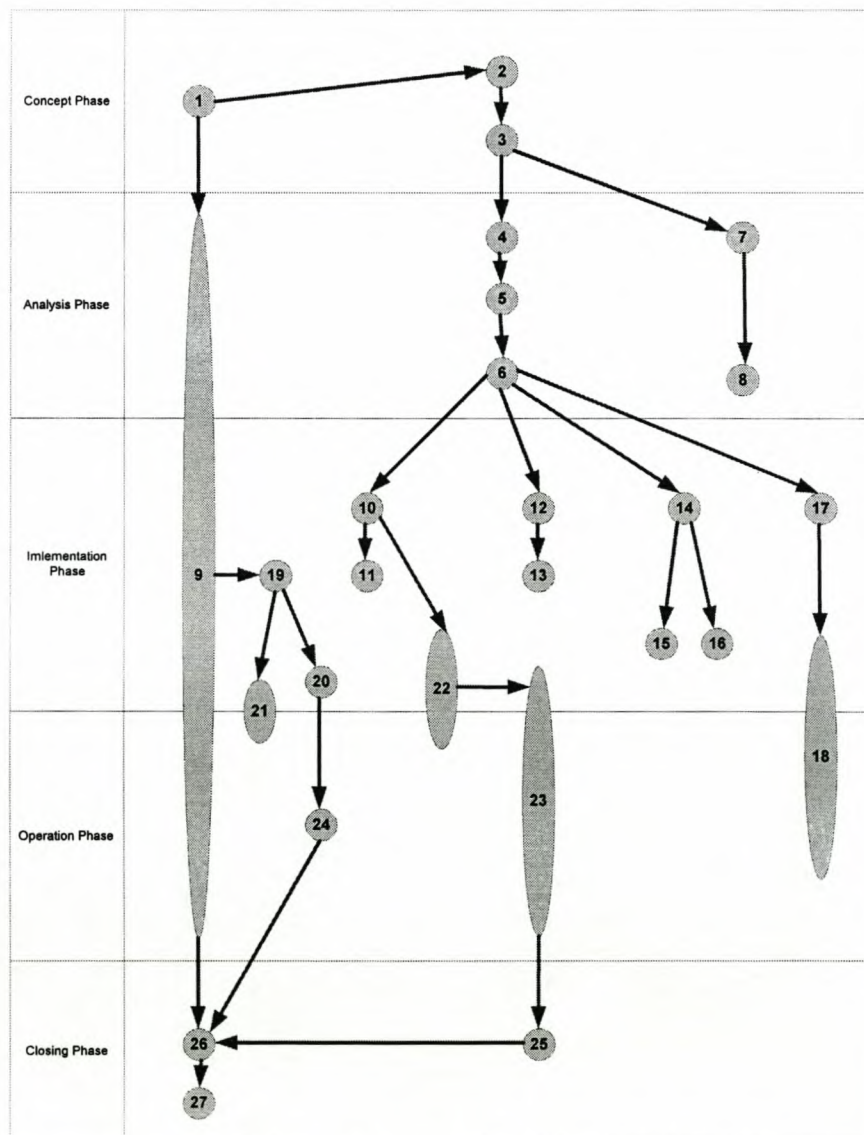


Figure 1.4 Implementation Methodology Diagram

Nr.	Step Name	Description
1	Project Initiation	Initiating the project from an idea to reality.
2	Feasibility Study	Looking at available information and deciding on the feasibility of the project.
3	Project Charter	Creating a project charter that defines the project requirements and all the methods and management techniques of achieving them.
4	AS-IS Analysis	Analysing current systems and processes in place at the organisation.
5	TO-BE Analysis	Establish the post-implementation requirements for the business process model and company structure diagram.
6	Business Process Simulation	Knowledge transfer of proposed business processes to key users of the company in a simulation workshop environment.
7	Information Technology Infrastructure Plan	A description of the IT infrastructure presently available and planning of deployment of the requirements for future development.
8	Infrastructure Deployment	Deploying the developments proposed in the IT infrastructure plan.
9	Project Management	<p>Project management is the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed the stakeholder needs and expectations from a project. Meeting or exceeding stakeholder needs and expectations invariably involve balancing competing demands among which:</p> <ul style="list-style-type: none"> <li>◆ Scope, time, cost, and quality;</li> <li>◆ Stakeholders with differing needs and expectations;</li> <li>◆ Identified requirements (needs) and unidentified requirements (expectations).</li> </ul> <p>[PMBOK, 1996, p6]</p>
10	Standard Reports Specification	Specify which of the available standard reports provide in the information requirements of the company.
11	Standard Reports Acceptance	Acceptance of the standard reports providing the company information requirements.

<b>Nr.</b>	<b>Step Name</b>	<b>Description</b>
12	Forms Specification	Specification of the business forms as required by the TO-BE business processes.
13	Forms Design and Acceptance	Designing, developing and testing the specified business forms and acceptance by the receiving company.
14	Data Migration Plan	Develop the plan to migrate both business and master data from any legacy systems, electronic and/or manual data to the new system.
15	Data Migration	Migration of both business and master data from any legacy systems, electronic and/or manual data, to the new system.
16	Data Validation	Verifying the correctness of migrated data in the new ERP system.
17	Key User Training	Develop training material and execute training for key users from functional areas to operate the new ERP system.
18	End User Training	Develop and execute training of end users to perform their daily tasks on the new ERP system.
19	Cut Over Plan	Developing a plan for changeover from legacy systems to a new ERP system.
20	Support Plan	Developing a plan for providing sufficient support to the key and end users after the cutover execution.
21	Cut Over Execution	Performing the cutover to the new ERP system, as specified in the cutover plan.
22	Custom Reports Specification	Specification of reports to supply in information requirements of the company excluded by the standard reports.
23	Custom Report Development	Designing, developing and testing the reports specified in the customer reports specification.
24	Support	Providing support to users as specified in the support plan.
25	Custom Report Acceptance	Acceptance of the custom reports developed specifically for the company.
26	Process Review	Review the processes followed in the project and incorporate improvement for future projects.
27	Project Closure	Formal closure of the project.

Table 1.1 Implementation Methodology Definitions

This methodology will be used in future implementation projects at other SMEs interested in implementing the Qmuzik ERP system and willing to accept the standard generic business models. More detail on the process involved in every step is outside the scope of this thesis.

### 1.2.9. The Criteria for Quick Implementation

Criteria were defined to test whether a company is suitable for the quick implementation methodology. This criterion will enable the project team to quickly assess a company for their ability to accept the ERP system and take ownership during the implementation process. This criterion is listed and explained in Table 1.2.

Nr.	Criteria	Explanation
1	10 - 250 employees	The definition of an SME (Fig 1.1) is from 10 - 250 employees. Companies closer to 10 employees may struggle with the workload involved, whereas companies of 250 might be able to pay for a full implementation.
2	Annual Turnover >= R10m (< R400m)	Companies with a turnover of less will be struggling to pay the implementation cost. Companies with an annual turnover of more than R400M can afford and will most likely choose the full implementation.
3	Project driven	The business models were developed for a project driven company. Since the business models have to be accepted, the company must be project driven. Projects typically range from 3 - 30 months.
4	Technology friendly	Although this is a difficult criteria to measure, the feasibility study and IT infrastructure study will provide the answer to the company's ability to adapt to the new technology.
5	Stand alone enterprise	The company cannot be a division, cost centre or business unit of a company. Conflicts of interest between the business models and reports of this unit and the parent company will be detrimental to the success of the implementation.

Nr.	Criteria	Explanation
6	Accept Business Models	The company must accept the business models as is. If required, company employees could make adjustments after the implementation. These are however excluded from the project cost.
7	Accept Reports	Adequate standard reports were developed, and will ship with the implementation methodology. Additional company specific reports will cost extra.
8	IT Infrastructure	The company should have sufficient IT infrastructure in place or make provision for additional costs.
9	R300 - 600 k	The project cost will be dependent on the company size defined in criteria 1 and 2. The company size together with the required functionality will define the final quotation value for the implementation. Additional costs for any project scope changes required will be for the company's own account.
10	Own employee availability	One of the most important aspects of ERP implementation is the company employees' own involvement. The company should take ownership of the ERP system during the 6 - 9 weeks of the implementation. The requirement would be between 10 - 20 % of full equivalent employees involved in the process for the 6 - 9 weeks. Again this will differ according to company size.

Table 1.2 Implementation Methodology Criteria

These criteria summarise the expectations of the project team to enable a successful secondary implementation. A full feasibility study still needs to be done though to ensure that the implementation with the developed methodology will be to the company's benefit, and most important, that the risk to the company is limited to within acceptable standards.



### 1.3. **Problem Statement**

The bigger project has now been defined and includes the work done in this thesis. The limited scope of a thesis does not allow for all the work done in the bigger project, and the focus must be narrowed to an achievable target.

The following tasks were the sole responsibility of the writer as part of the project team during the bigger project and are thus included in this thesis:

- Develop a detail generic **project management business model** complete with inputs, processes and outputs. The business model must be developed for quick ERP implementation, focussing on the needs and requirements of the smaller business, the SME. Implement the project management business model that was developed on the Qmuzik database for CAE. (Fig 1.4 – Step 5)
- Develop **project management reports** for project managers at middle management level. The reports must provide management information to assist the project manager in performing project control as intended by the PMBOK. Write reports specifications, supervise the development and implement the reports at CAE. (Fig 1.4 – Step 10)

A few items included in the bigger project, but not in this thesis, must be mentioned. The following is specifically excluded from this study:

- MS project integration to be developed. This will enable the project manager to perform project planning on MS Project, and data will be shared between MS Project Central and Qmuzik. Although this will influence the execution of some of the project management processes, the business model remains unchanged.

- The business models of functional areas other than project management. These business models interact with the project management business model. The links to other functional areas are shown in the project management business model.
- Reports outside the project management area are not discussed.
- Other steps in the fast implementation methodology, Figure 1.4.

#### **1.4. *About this Document***

Chapter 1 provides the background of the bigger project of which this document forms part. An introduction into the ERP market situation and the market opportunity in the SME market for ERP vendors was done.

Chapter 2 provides a theoretical basis of project management, MIS and ERP. This basis needs to be established for the work that follows in Chapters 3 and 4.

In Chapter 3 the generic project management business model that was developed during the project is introduced and discussed.

Chapter 4 is devoted to the project management reports that were specifically developed for supporting middle management, i.e. project managers, in their task of performing project control.

Chapter 5 concludes with the achievements and recommendations made to both CAE and for rollout of the fast implementation methodology to other SMEs.

## 2. LITERATURE STUDY

### 2.1. *Introduction*

Before a subject can be discussed, a sound knowledge of the related areas is required. This chapter aims at setting the background for the chapters to follow. Fundamental theory is explained with cross-references between three knowledge areas, i.e. project management, management information systems and enterprise resource planning. A foundation is established for Chapters 3 and 4.

**Project management** is the main issue for discussion.

*The primary purpose of this document is to identify and describe that subset of the PMBOK that is generally accepted. Generally accepted means that the knowledge and practices described are applicable to most projects most of the time, and that there is widespread consensus about their value and usefulness [PMBOK, 1996, p. 3].*

Even though it seem as if the PMBOK is proclaiming itself, it is the basis for the extensive use of its material. The PMBOK is worldwide accepted as one of the leading knowledgeable project management sources. The second section of this chapter gives a broad overview of the project company, the PM field, and also focusses on project reporting and controlling. The complete picture of all related processes regarding project management is sketched before focussing on the one aspect where the main reporting requirements are, i.e. controlling. PM Software and its capabilities for effective project management will also be highlighted.

**Management information systems** are the science of presenting information within and from a defined system in a format that provides meaningful management information to company management. This science should be incorporated with discussions on project

management and ERP. Background is provided for Chapter 4: performance reporting in a project-driven SME.

The implementation of an **ERP system** initiated this study. ERP acts as the backbone for the project management and MIS models to be developed. ERP theory provides background for the complete thesis on the issues that should be considered while developing the reporting and operational business models to visualise data to management. The information provided in the ERP section will be mainly from experience gained during involvement in the ERP industry for a period of four years.

The last section before the chapter conclusion is on **business process modelling**. The process and method used are defined briefly.

## **2.2. Project Management**

### **2.2.1. Introduction**

*A **project** is a temporary endeavour undertaken to create a unique product or service. Temporary means that every project has a definite beginning and a definite end. Unique means that the product or service is different in some distinguishing way from all similar products or services [PMBOK, 1996, p. 4].*

*A Project can be considered to be any series of activities and tasks that:*

- *Have a specific objective to be completed within certain specifications.*
- *Have defined start and end dates.*
- *Have funding limits (if applicable).*
- *Consume resources (i.e. money, people, equipment)*

*[Kerzner, 1995, p. 2].*

*Other primary project features include:*

- *A distinct start and finish (the limits of the project duration).*
- *A life cycle (beginning, ending and other phases in between).*
- *A budget (with a cash flow prediction).*
- *Unique and non-repetitive activities that divide the complete scope of the project into manageable parts.*
- *Use of resources with various skills, and from various departments within the project management company.*
- *A single point of responsibility for final delivery of the complete project (i.e. the project manager).*
- *Team roles and relationships that are subject to change and need to be developed, defined and established*

*[Adapted from Burke, 1999, pp. 2-3].*

The major characteristics, according to the above references, that distinguish a project, are the uniqueness of its product or service, and the necessity to be of defined duration. Even though the product or service might last for some time after the project was completed, a project will eventually stop; it cannot be an ongoing effort. The objectives of a project will somehow be reached, or not, and the project terminated.

*The **project manager** must be able to develop a fully integrated information and control system to plan, instruct, monitor and control large amounts of data quickly and accurately to facilitate the problem-solving and decision-making process [Burke, 1999, p. 1].*

*Experience has shown that the selection of the project manager is a key appointment, which can influence the success or failure of the project. The following list some desirable project manager attributes:*

- *Leadership ability.*
- *Ability to anticipate problems.*

- *Ability to integrate the project stakeholders.*
  - *Operational flexibility.*
  - *Ability to get things done.*
  - *Ability to negotiate and persuade.*
  - *Understand the environment within which the project is being managed.*
  - *Ability to review, monitor and control.*
  - *Ability to manage within an environment of constant change.*
  - *Ability to keep the customer happy*
- [Burke, 1999, pp. 9-10].

According to Burke, the project manager needs a “bag of tools” that he/she can use to present project data in a format that can be interpreted and reacted to by both him/herself and senior management. The project manager sets up a project structure within the company to assist the project team. The structure must enable the team to fulfil their part of the deliverables within time, cost and specification. The project manager must make decisions and must solve problems to fulfil the specified project scope. The customer and other stakeholders have needs and expectations that must be managed by the project manager.

***Project management is the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed the stakeholder needs and expectations from a project. Meeting or exceeding stakeholder needs and expectations invariably involves balancing competing demands among:***

- *Scope, time, cost, and quality.*
- *Stakeholders with differing needs and expectations.*
- *Identified requirements (needs) and unidentified requirements (expectations)*

[PMBOK, 1996, p. 6].

*Project management on the other hand involves project planning and project monitoring and includes such items as:*

- *Project planning:*
  - *Definition of work requirements*
  - *Definition of quantity and quality of work*
  - *Definition of resources needed*
- *Project monitoring:*
  - *Tracking progress*
  - *Comparing actual outcome to predicted outcome*
  - *Analysing impact*
  - *Making adjustments*

*[Kerzner, 1995, pp. 3-4].*

Although Kerzner and the PMBOK state some issues differently, they do agree that projects and project management exist within the broader environment of an organisation or organisations, and should be understood in this context. Kerzner also provides the goal for every project manager, namely the definition of successful project management.

*Successful project management can then be defined as having achieved the project objectives:*

- *Within time*
- *Within cost*
- *At the desired performance/technology level*
- *While utilising the assigned resources effectively and efficiently*

*[Kerzner, 1995, pp. 3-4].*

The project, the project manager and project management have now been defined. The next step is to look at the environment in which a project is done.

### 2.2.2. The Project in Context

*Projects and project management operate in an environment broader than that of the project itself. The project management team must understand this broader context [PMBOK, 1996, p. 11].*

Any project operates in a broader environment. The challenge for the project manager is to understand, manage and use these external factors so as to get the best results for the project. Some factors that can have an influence here are:

- A project is divided into phases. Phases combine to form a **project life cycle**. The project is a dynamic object that can change its format and scope throughout the project life cycle.
- The interests of **stakeholders** might differ to such a great extent that conflicts could arise. Stakeholder expectations must be managed to prevent conflicts of interest that could jeopardise the defined results of the project. In general differences should be resolved to the benefit of the customer. The issues as stated by other stakeholders should however be carefully considered before action is taken. Resolving such conflicting interests can be one of the major challenges in project management.
- Organisation structure can be orientated towards project management, towards functional management, or a mixture of both. The organisation structure can provide support to the project manager, and the lack of it can be to the detriment of the project. Project managers must understand the business structure, business processes and business culture to make effective use of the resources inside the company, without creating conflict on limited critical resources.



- General management skills can and should be applied to project management. When assigning a project manager to a project, skills and abilities should be matched to the skill and ability demands of the specific project.
- Socio-economic influences, like standards and regulations, internationalisation and cultural influences can have disastrous effects on a project.

The external factors mentioned here have a large influence on the project and the project manager. These external factors must also be managed by the project manager to ensure that the project will deliver the desired results at the desired time, quality and cost.

### **2.2.3. Project Management in the Small Business Organisation**

*The acceptance of project management in large companies has been relatively easy because of the abundance of literature identifying its potential pitfalls and problems [Kerzner, 1995, p. 455].*

Up to now the small company has been left in the dark in terms of the pitfalls and problems they face with regard to project management. Kerzner provides valuable answers for project management in the SME:

- Smaller companies cannot afford fulltime project managers. The project manager and functional manager are often the same person. The functional manager's priority will be with his/her business unit, and not with the project. Usually the project will reflect this lack of dedication and interest. Where two persons fill these roles with different dedications and aims, they will reach a goal that will be to the mutual benefit of the company. One person is sidetracked some or other goal and the company can forfeit the benefits.

- In smaller companies one project manager handles multiple projects. The amount of time spent on each project is just enough to catch up with what is going on, and not enough to make a difference to the effort by the project teams. Furthermore, with different priorities the projects with lower priorities are never implemented or executed.
- In the smaller company the resources are limited. A project manager in a large organisation can negotiate for better or other resources from the functional managers. In the small organisation the project manager may have only the resources in the company available, and cannot do anything about it.
- In the smaller company better general management and interpersonal skills are required from the project manager. The motivation of team members in an environment with little resources available is very important.
- The project manager has a limited number of levels of management to report to. In most instances it means one level, which is a top-level executive. This can be seen as both positive and negative. If the project manager has good relations with the managing director, it can be beneficial to the project. If the opposite is true, the project might suffer.
- Small companies do not have a project office. The project manager has to act as the project office, and his/her attention is divided between issues relating to the project only and other company issues. Project administration can burden the project manager to an extent where it is impossible to perform the project.

- The risk of a project failing in a small company is very high. In fact, one project failing can be detrimental to the total business. Careful decision-making regarding the projects that are undertaken by the company is vital. The monetary value of a single project should not constitute too high a percentage of the total company revenue. If such a project fails, or is stopped by the customer, the company could be in serious financial trouble. If the company takes on a project that requires many additional resources or which forces them to give up some other accounts, the company could be in an undesirable delicate position.
- In a small company tighter cash-flow controls are required, but not always available. The smaller companies cannot afford expensive information systems that could assist them to control their cash-flow. Manual techniques might be good, but not always effective and fast enough to control project expenditure.
- In a small company there is a considerable amount of interference from top management with the project managers. This is understandable if one takes into account the risk involved in one failed project. However, if executives do not delegate responsibilities to project managers, they may just as well perform the project management function themselves.
- The evaluation procedures for individuals are much easier in smaller organisations, because of the higher interpersonal relations required from **and** by the little resources available.
- As the margin of error in smaller companies is smaller, budgeting and estimating are more detailed in these. Planning is manual as a result of a lack of computer software. Because of the culture in a smaller organisation where everybody knows everybody else, functional managers feel more obligated to keep their promises

*[Adapted from Kerzner, 1995, p. 455].*

The above-mentioned comments are not intended to discourage smaller companies, but rather to highlight problems that could cause their project management to endanger the company. It is important to develop a structured business model and to define business processes to assist the SME to eliminate these problems. Implementation of a feasible ERP system for the smaller company could contribute to this resolution. SMEs need the structured approach of the business models provided, and the information provided by the reports on data stored in the ERP system database.

#### **2.2.4. Project Management Processes**

*Project management processes are concerned with describing and organizing the work of the project [PMBOK, 1996, p. 27].*

The five process groups described in this section are the processes involved in managing projects, and not the processes as regards performing the actual work necessary to establish the deliverable or product, namely the product-orientated processes. These process groups and their interrelationships are shown in Figure 2.1.

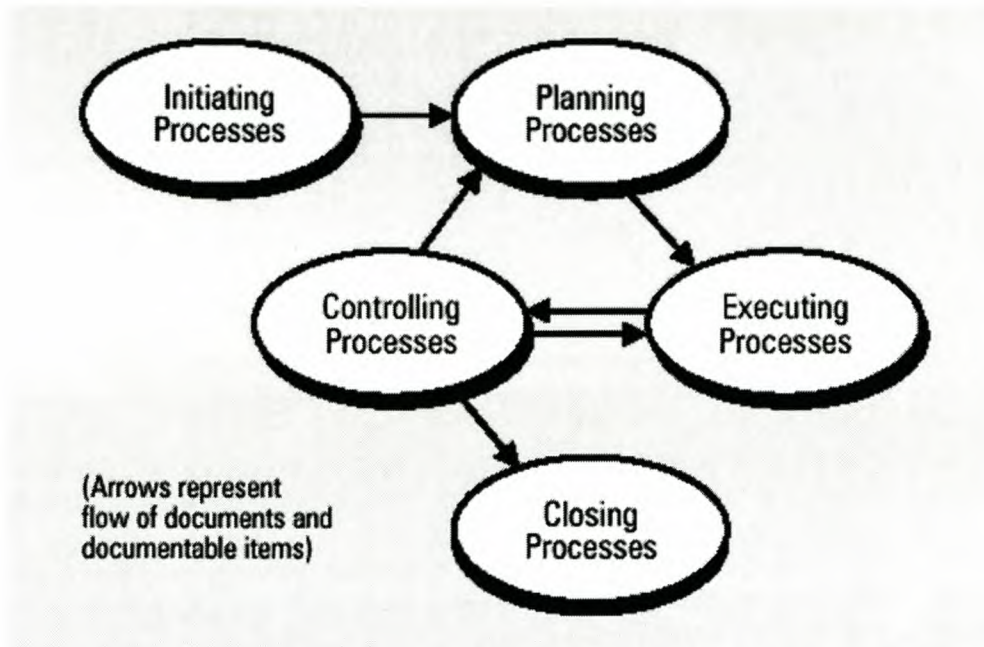


Figure 2.1 Process Groups in a Project/Project Phase [PMBOK, 1996, p. 28]

Two types of processes interact throughout a project, but are not inherently the same. Project management processes (e.g. risk identification or material procurement) will be similar for various projects, but product-orientated processes (e.g. cost calculation when building a house or a dam) will differ with the product or service that the project must create. Because of this similarity in project management processes for various projects, a generic business model should be possible. In this study of project management, the focus will be on the five project management processes. The arrows in Figure 2.1 illustrate the links between the five process groups. Each process group has processes that are required to complete that step in project management. The processes have inputs and outputs, which are documents, and in most cases the arrows indicate the flow of one or more documents. These documents originate from project management processes in one process group, and trigger project management processes in other process groups.

*The project management process groups are not discrete, one-time events; they are overlapping activities which occur at varying levels of intensity throughout each phase of the project [PMBOK, 1996, p. 28].*

All the processes have inputs to act on, and outputs as a result. They also have tools and techniques to transform the inputs to outputs. The outputs of some processes will be inputs for other processes. Figure 2.2 illustrates how the process groups overlap and how the level of activity varies within a project or project phase.

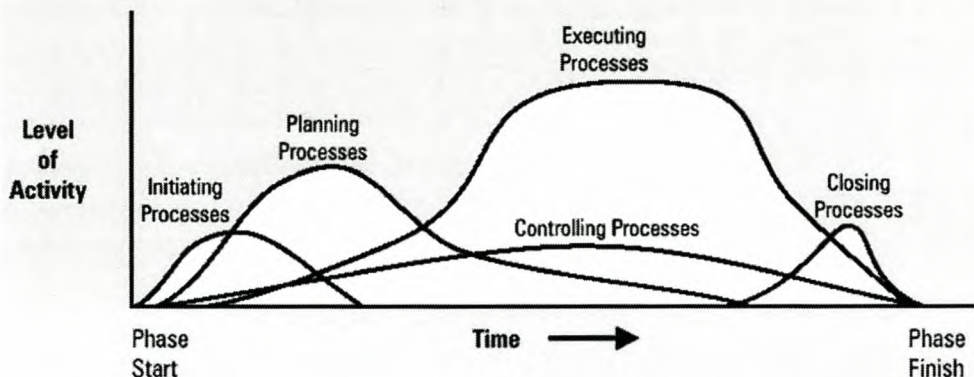


Figure 2.2 Overlap of Process Groups in a Project [PMBOK, 1996, p. 29]

The most significant overlap occurs with the controlling processes. A project must be controlled from initiation to closing. Furthermore, the planning processes are tailing off towards the end of execution. As the execution processes come to a close, the opportunity to adjust the project plan fades away.

In the section that follows, attention will be given to the five process groups.

**Initiating processes** constitute that stage where the project manager or team recognises that the project or project phase should begin. During this stage the stakeholders should commit themselves to funding the project. The sole process in this group is the initiation of the project.

Initiation of a new project could arise from a market demand, business need, a customer's request, technological advance or a

legal requirement. These stimuli could therefore be a problem, an opportunity, or a business requirement.

*Planning is of major importance to a project because the project involves doing something which has not been done before [PMBOK, 1996, p. 30].*

The aim of the **planning processes** is to devise and maintain a workable scheme to accomplish the business needs for which this project was undertaken. Planning should reflect the demands stated in the project scope documentation and it should develop information useful for achieving the defined project deliverables. Planning can, and in some cases should, be reiterated to ensure that it is still feasible in the present project situation. Reiteration is triggered by outputs from the controlling processes, which indicate the need for repetition of the planning processes in order to adjust the project plan or to incorporate scope changes to achieve desirable adjusted or new outcomes for the project.

*Planning is not an exact science – two different teams could generate very different plans for the same project [PMBOK, 1996, p. 30].*

Even though it is not an exact science, some benchmarks can be provided to steer the project planner in the right direction. The core planning processes are:

- **Scope planning** is the statement of the project scope which can be used as a reference for future project decisions.
- **Scope definition** is defining smaller components of the major deliverables to make the project more manageable.
- **Activity definition\*** breaks the deliverables down to specific activities.
- **Activity sequencing\*** states the sequence and interdependencies of the various activities.

- **Activity duration estimating\*** estimates the time required to complete each activity with the resources available.
- **Resource planning\*** estimates the amount of resources required to complete every activity within the estimated duration.
- **Schedule development** analyses the previous four planning processes (marked \*) and defines the project schedule.
- **Cost estimating** is done from the resource plan and project schedule to establish an estimate of activity costs.
- **Cost budgeting** is allocating the project cost to individual work items and planning for the availability of financial resources.
- **Project plan development** is the establishment of a project document containing all the information for the execution of the project by integrating all of the above.

The **executing processes** have to do with coordinating people and other resources to carry out the planning done in the previous section. The core executing process is **project plan execution**. This process is merely the execution of the project through performing all the activities in the project plan as and when scheduled. Details on actual duration, expenditure and progress are captured throughout the project plan execution.

The **controlling processes** ensure that project objectives are met through monitoring and measuring the project progress against the project plan. The variance of the actual performance is monitored and compared to the budget or baseline. This variance should be tightly controlled. When required, corrective action has to be taken.

The four most important elements to control in a project are:

- Scope
- Cost
- Time
- Quality.



Performance reporting regarding these four areas should always be informative, so as to communicate the performance achieved to the stakeholders. Reports may either be prepared comprehensively on a fixed time interval or on an exception basis where differences from the planned results occur.

Project control must lead the project to successful completion of all the deliverables within the scheduled scope. The baseline plan is the major input. The project control cycle monitors project performance and compares it against the baseline plan. According to Burke, the control steps are:

- *Work authorisation (providing a project team member with the mandate to perform an activity)*
- *Expedition*
- *Tracking and monitoring progress*
- *Change control*
- *Evaluation and forecasting*
- *Decision-making*
- *Revise baseline plan*

*[Burke, 1999, pp. 92-93].*

The two core controlling processes according to PMBOK are:

- **Performance reporting** is concerned with collecting and disseminating performance information in order to provide stakeholders with information on how the resources are allocated to achieve the project objectives. This includes status reporting, progress reporting and forecasting.
- **Overall change control** is concerned with the coordination of changes across the entire project to ensure that changes are immediately visible when they happen, are managed, and are to the benefit of the project. All changes should be reflected in the project plan, and scope changes should be reflected in the project

scope and baseline as well. Changes to the product scope should be reflected in the definition of the project scope.

*Project performance must be measured regularly to identify variances from the plan [PMBOK, 1996, p. 32].*

Regular measurements are done in the controlling processes. These measurements might indicate that the project plan needs to be revised, and that the appropriate planning processes therefore need to be repeated. The project manager should be able to anticipate problems from performance reports and could then take early preventive action.

*The frequency of the reporting cycle should reflect the needs of the project. Short reporting periods, when there is a high level of change and uncertainty in the project, long periods when there is little or no change [Burke, 1999, p. 93].*

In the planning stages, a short cycle could be beneficial, as the amount of change is still high. In the implementation phase reporting cycles could be longer, as there is little or no change in the scope of the project. The key factor is the ability to track and re-act to possible problems that could influence the outcome of the project. Early recognition is better than late curing. Within this context, ERP systems have changed the thinking on reporting cycles (more about this in Section 2.4).

Performance reporting in SMEs is discussed in Chapter 4. The focus will be on using an ERP system to capture project data and to present the data as information, to the project manager, in a usable format. The ERP system should provide sufficient information for the project manager to make decisions and take the required action during the controlling processes.

The purpose of **closing processes** is to formalise the acceptance of the project deliverables, and to bring the project to an orderly end.

Three closing processes are worth mentioning:

- **Scope verification** ensures that all planned project deliverables have been satisfied.
- **Administrative closure** is the formal closure of the project by documenting the results, and ensuring the acceptance of the product of the project by the sponsor or customer. This includes the post-mortem meetings, updating the final progress report information and documentation of reference material for future use.
- **Contract close-out** involves the establishment of whether the project has satisfied the demands stated in the contract, and the resolution of any outstanding items. It provides an answer to the question whether all work has been completed successfully and satisfactorily.

### 2.2.5. Project Management and Information

Information is important to the project manager and the complete project team. The availability and accuracy of information influence the final deliverable of the project and can influence the project objectives regarding the scope, cost, schedule and quality of the project product or service. Two topics of importance are:

- Project management software, and
- The information requirements of the project team.

**Project management software** is widely available. Sophisticated information systems can be found throughout the project industry. The cost associated with these systems varies widely with the size and functionality provided.

*These organisations tend to have management systems in place to facilitate project management. For example, their financial systems are often specifically designed for accounting, tracking and reporting on multiple simultaneous projects [PMBOK, 1996, p. 17].*

The PMBOK emphasises the importance of an information system to project-orientated companies. These systems should be designed to support and facilitate project management.

*The absence of project-oriented systems usually makes project management more difficult [PMBOK, 1996, p. 17].*

Companies that have limited information systems struggle to perform projects because of the difficulty associated with manual calculation of performance reports. Because of the human factor the accuracy of manual reports is questionable.

*Today, powerful but inexpensive project management software is readily available for the personal computer [Burke, 1999, p. 5].*

MS Project is an example of a planning and scheduling tool. The software assists the project manager to see the project progress from his/her desk. This program is limited to the planning data. Actual expenditure by the finance department is required to compare the MS Project budget with the actual expenditure. In many companies the actual data can only be seen after the financial month-end has been completed. An integrated system with immediate access to in-time information will be a considerable benefit to project managers.

*... if your company is involved in a number of projects which all draw from a common labour pool, the other projects' requirements must also be considered [Burke, 1999, p. 165].*

Resource allocations can be one of the main causes of conflict in any company, especially when resources are shared between projects and certain resource skills are in greater demand than others. Companies with integrated project management information systems can at least see the existing allocation of resources when they plan for new projects. Resource requirements can be loaded months in advance during the planning phase to ensure that critical resources will be available to specific activities. Although integrated project management software will not solve conflicts of interest, the visibility it provides can assist project managers in communicating with each other and in coming to a mutual agreement.

*The information and control system compliments the lines of communications and the project control system by focussing on the flow of information [Burke, 1999, p. 248].*

Project management software can assist the flow of information by applying workflow in the system. In other words, a project manager will receive e-mail to indicate that his/her approval is required on an employee's timesheet booked on one of his/her projects. PM software assists in the communication of the project team.

*Resource analysis requires a tremendous amount of mathematical calculation [Burke, 1999, p. 174].*

Computers do repetitive calculations with speed and accuracy, minimising the project manager's tasks. Built-in algorithms assist the project manager in compiling the set-up, and the resource levelling and planning will be done for him/her. The project manager can then make adjustments if and where required.

The **information requirements** of the project manager and project team can be summarised by focussing on a single project. The major information requirements can be found in the project controlling

process groups related specifically to performance reporting and decision-making during project change control.

In the **single project** there are some specific information requirements for controlling. A list of measurements can be made of values that will display the project status in time over for the past and the future of the project at a given date. These values are:

- Actual Cost of Work Performed (ACWP)
- Budgeted Cost of Work Performed (BCWP)
- Budgeted Cost of Work Scheduled (BCWS)
- Cost Performance Index (CPI)
- Cost Variance (CV)
- Earned Value (EV)
- Estimate At Completion (EAC)
- Percentage Completed (PC)
- Schedule Performance Index (SPI)
- Schedule Variance (SV)
- Target Completion Date (TC)

With the above-mentioned variables known, a project manager can provide feedback to top management on the status of his/her project(s). These values indicate what the present project status is in terms of cost and time. It also indicates the expected final cost and end date. The variance values have an indirect but noticeable influence on the scope and quality of the project. These values should therefore provide a complete picture of the project status at a given date.

These values could be rolled up to **company level** where all project data at a given date in time are collaborated into a single performance report. Thus a snapshot can be taken of the company project status at present date or any date in the past.

The information system used for the project company should function as supporting software for project management and should provide in the information requirements for the project manager to perform project management.

#### 2.2.6. Conclusion

This concludes the literature study on projects and project management. The terms **project** and **project management** have been defined. The relationship between these two and the project manager, the project organisation and project information management has been defined. The project management processes and the relation between them have also been defined and will be discussed further in Chapter 3.

The following two sections will elaborate on MIS and ERP respectively, with the focus on projects and project management.

### 2.3. *Management Information Systems (MIS)*

#### 2.3.1. Introduction

*An **information system** is an arrangement of people, data, processes, interfaces, network(s) and technology that interact to support and improve day-to-day operations in a business, support the problem-solving and decision-making needs of management [Whitten and Bentley, 1998, p. 7].*

*US business corporations typically spend 4% of their annual revenue on information systems [Zwass, 1992, p. 10].*

The amount of money, time and effort that is invested in information systems should somehow be justified. Whitten and Bentley specifies a few key issues in this justification. Firstly, information systems provide support to employees regarding the day-to-day operational

activities in the company. Secondly, management support is provided with summarised information to the various management levels of the company.

The following paragraphs aim to provide a theoretical study of MIS and its role in companies. The different levels of management and their different resolutions of information requirements will be discussed. This serves as background for the project management reports presented in Chapter 4.

### **2.3.2. Integrated Information Systems**

*Computers and telecommunications are the fundamental technologies of MIS [Zwass, 1992, p. 27].*

Fast-reacting and in-time information systems have only been available since the desktop personal computer has become available to every worker. The Internet and other communication facilities have brought the world to the decision-maker's office. The two factors in the quotation above play a significant role in the development of MIS.

*An understanding of computer and communication technologies is not sufficient for MIS practice. Rather, this knowledge needs to be combined with an understanding of organisations and management, as well as cognitive and behavioural aspects of human psychology. To this end, the discipline of MIS combines contributions from several reference disciplines [Zwass, 1992, p. 27].*

Three major skills are very important in the MIS Practice:

- Technical expertise
- Business management
- Human psychology

The technical person is responsible for extracting data from the database and presenting it in the format the human psychologist and



business analyst had specified. The business analyst is responsible for the content and format in which data is provided to business management. The data should be presented in context for the end user to understand the data and interpret it as information. The human psychologist knows the human mindset for interpreting data and information, and provides valuable inputs for the visual presentation of data and information to the end user.

Integration of Information systems has been a topic of discussion for several years. John Dearden, of the Harvard Business School, published an article *MIS is a Mirage* in 1972, saying "The question is whether one system can be developed that will be sufficient to support all three information requirements from Zwass". Dearden answered this question, with a touch of humour: "Only if Superman lends a helping hand [Dearden, 1972].

*An ideal system with this capability, a "total system" would be designed from the outset as a single system, giving its users all the informational support they want. But a total system is a mirage, as we will presently see [Zwass, 1992, p. 10].*

Most information systems in companies have evolved over time. Small islands of data have emerged over the years. The islands of data must be compatible before the data can be merged into a single system. Zwass contemplates whether integrating these islands of information into one system is achievable, or indeed advisable. The constant presence of change in the business environment forces company information systems to adjust to the dynamic nature of the business environment. The aggressive business environment even leads to company mergers or take-overs. These business evolvments make it difficult or even almost impossible for the information system providers to integrate all systems into one suite.

*Integration of systems in an MIS Portfolio is an important and continuing goal. Total integration is usually impossible; in particular, it would be too costly [Zwass, 1992, p. 27].*

ERP systems have introduced an all-inclusive integrated information system to companies. The measure in which these systems achieve a fully integrated business system varies from one ERP system to another, but more on this topic in Section 2.4.

Aristotle once said that the whole is greater than the sum of its parts. Likewise the information system as an integrated unit should be able to provide more value to the company than the sum of the island information systems. Only then the integration of these island information systems is successful.

### 2.3.3. Types of Organisational Information Systems

*MIS encompasses systems supporting both the management and the business operations of an enterprise [Zwass, 1992, p. 26].*

Zwass explains three types of information support that are required from information systems in a business. The primary requirement is for **knowledge work support**, which is fulfilled by the **office information systems (OIS)**, which includes word processing, mail and spreadsheet applications. Typical examples are MS Office, Star Office and other similar packages. A second type of information support required is **transaction processing systems (TPS)**. This includes the capturing and management of business transactions, and the necessary information that flows in the business. The third level of information support is **management support**. This level consists of all the decision-making data preparation and storage, and can be subdivided into three further levels, **management reporting systems (MRS)**, **decision support systems (DSS)** and **executive information systems (EIS)**. These three levels of information

demand have led to five types of information systems, illustrated in Figure 2.3.

*Five types of systems may make up an organisational MIS: transaction processing systems (TPS), management reporting systems (MRS), decision support systems (DSS) and executive information systems (EIS), and office information systems (OIS) [Zwass, 1992, p. 84].*

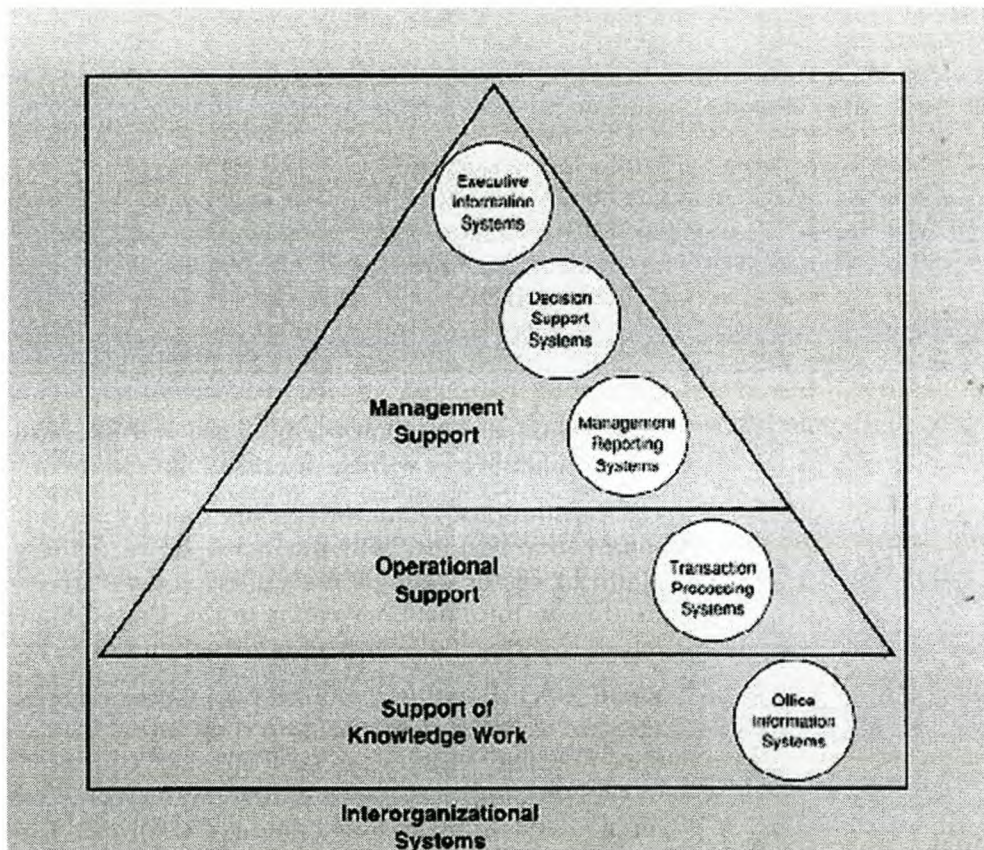


Figure 2.3. Five Types of Information Systems [Zwass, 1992, p. 9]

The difference between the five types of information systems lies in the tasks involved with respect to the processing and presentation of data to the end user. TPS is primarily involved in the capturing of all transaction data into the database. MRS, DSS and EIS are the extraction and presentation of captured data in different quantities of filtration and summarisation to the various levels of management in

the organisation. OIS is used to filter, formalise, document and communicate information in the company.

#### **2.3.4. Information for Management**

*Information distribution involves making needed information available to project stakeholders in a timely manner. It includes implementing communication management plans as well as responding to unexpected requests for information [APMBOK, 2000, p. 30].*

Managers require information to steer the company. It is like a pilot that requires continuous feedback from his/her instruments. If the feedback comes late or is inaccurate, the plane and its cargo and/or passengers will be in danger. The same applies for a company. If the managers have inaccurate or if the information becomes available at a very late stage, the company and its employees are in danger. Systems must be in place to accurately both capture data and return information for management purposes when and as it is required.

*Data are only the raw material for obtaining information. Information systems use data stored in computer files and databases to provide needed information [Zwass, 1992, p. 15].*

The evolvment from **data** to **information** to **knowledge** is an important concept to grasp. Data is pure figures or amounts that are not placed in context, i.e. 5, or buy, etc. Information is data that is placed in context, i.e. \$5, or buy 100 roses, etc.

According to Whitten and Bentley, management desires three types of information:

- *Detail information*
- *Summary information*
- *Exception information*

*[Whitten and Bentley, 1998, p. 39].*

The format in which information is presented to the user must correspond with the requirements of the user. The level of detail required might vary between detail and summarised information, or the user might only be interested in exceptions and not in what is expected. By this means the user's information requirements will be satisfied. The user does not need to investigate further by him/herself, because of the wrong information format presented by the information system.

The information system is primarily responsible to capture, process and store company internal and external data. Figure 2.4 graphically illustrates this concept.

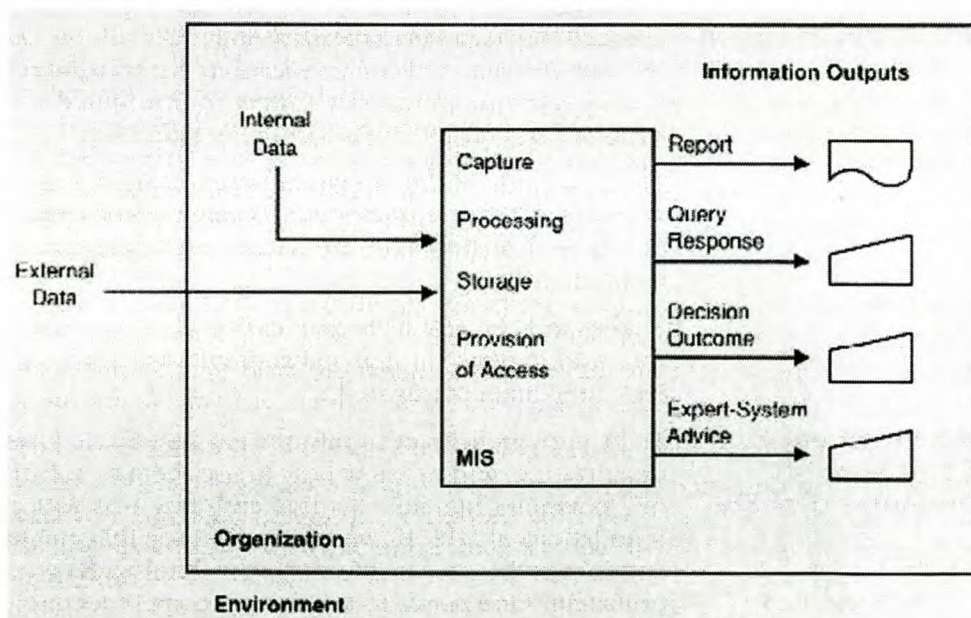


Figure 2.4. Information in the Information System [Zwass, 1992, p. 14]

The accessibility of data to the user is a secondary functionality. A user might require a report, a query for certain data, or assistance in decision-making. The user could even require the system to provide advice in making decisions. These information outputs are the function of what is called **management information systems (MIS)**. The information system thus captures data, while the MIS transforms

this data into usable information for the user. The user can then by contemplating the provided information transform it into knowledge.

A company uses certain resources to produce the required outputs, and thereby meeting objectives set by the company management, the shareholders, or both. For an MIS to achieve its goal, it must support the function of the business it supports.

*Generally speaking, organisations are formal social units devoted to the attainment of specific goals [Zwass, 1992, p. 16].*

It could be required of the MIS to support the company as a whole, or only a specific business unit. The MIS must be able to support all the required information needs of the area that it is responsible for. The MIS is not responsible to meet the company or business unit objectives, but to support the employees in their quest to achieve them. The objective of the MIS is to provide information support to the members of the company or business unit.

### 2.3.5. Conclusion

This chapter has defined the term **management information system**, and the necessity to provide information to management. Different levels of information systems for the different levels of management in the company were described.

The next section focusses on ERP systems, which are information systems focussed specifically on the management of business data.

## 2.4. ERP Systems

### 2.4.1. Introduction

*These organisations tend to have **management systems** in place to facilitate project management. For example, their financial systems*

*are often specifically designed for accounting, tracking, and reporting on multiple simultaneous projects [PMBOK, 1996, p. 17].*

The PMBOK emphasises the necessity for companies to have systems in place. Whether they are computerised or manual systems, as long as systems are in place, in terms of which the employees should function. The employees will know what is expected, and the company will be able to perform its objectives. This section focusses on the present status of computerised systems, more specifically ERP systems, which exist.

Before ERP systems were used, many companies had monthly financial periods with related monthly financial reports. These reports were either manually calculated, or figures were entered into a financial system. The financial system, where present, was isolated from the other business systems, and thus data from various departments was fed into the financial system at month-end. The month-end reports were usually only available a week or more into the next month. Thus the actual expenditures on a project were only visible by the middle of the following month.

A short example of the time delay involved with the mentioned reporting cycle is appropriate. Company XYZ's management could only see problems in their reports from month one on the tenth of month two. Company XYZ's management could make a change to their business on the fifteenth of month two, and had to wait until the tenth of month three to see how the changes would reflect on their financial situation. If the change did not add positive value to the company bottom-line, a correction could be made, and management had to wait until the tenth of month four. This describes a control process with a delay of one month regarding the feedback loop. To control projects by this means can be very annoying and almost impossible.

### 2.4.2. The History of ERP Systems

Before ERP systems were developed, business processes were scattered among various departments, and little conformity was found in performing the same task between departments or even between company facilities. Companies started to develop their own in-house integrated systems and maintained these systems in-house as well. Some of these companies, like Phillips, realised the market potential that was inherent in the value added to these systems. The business system used by Phillips in the 1970s has developed into the ERP market leader of today, SAP. Although the first ERP type systems were already used in businesses since 1972, the industry really had its peak growth rate in the 1990s with most Fortune 500 companies taking on ERP implementations. The Gartner Group coined the term ERP in 1990, describing it as a “total” business system.

ERP systems were part of the Y2K solution, as many companies implemented ERP systems as an alternative to upgrading their old mainframe Y2K incompatible, information systems completely. These mainframes were isolated islands of information.

Today ERP systems can be seen as integrated systems that provide in-time information to various management levels in the whole company. *In-time* means that information loaded onto the system is immediately available in various reports that can illustrate the financial situation of business units, the completeness of a customer order or even the status of a project. Information is at the fingertips of management. It is important to note that information from the system database is only as accurate as the information entered into the system.

What is the future going to be for ERP?



ERP has become the backbone system to add on new “flavour of the month” systems. CRM, Supply Chain, and e-Commerce systems are the newest additions available to IT solutions. These systems all need the information basis of ERP to extract data and to provide the functionality as promised. Without ERP system data these new add-on systems are paralysed. The Internet has provided access to the company database at headquarters from around the world. An employee can book his/her time over a web timesheet, can fulfil his/her daily tasks from home with a dedicated link to a PC at home, or even present a project performance report over a web-link at a client’s site, all directly from the ERP system database.

Goldratt explains the requirement for businesses to implement ERP systems in his business novel, *Necessary, but not sufficient* [Goldratt, 2001]. His book explains that although ERP systems will not be the answer to all the questions, it will become a distinguishing factor for companies that want to compete in the international market. The difference between ERP enabled companies, and those not enabled by ERP will become more and more apparent from the way they do business.

ERP vendors have already made the smaller businesses their target for the future. Most of the larger companies in the world have already implemented ERP systems, and ERP vendors see the market potential in the larger number of small companies that exist.

ERP systems assist in the capturing of project actual expenditure in the project executing processes, and also provide this information in a summarised or detailed format for performance reporting to fulfil the project controlling processes. More detail will be provided in Chapters 3 and 4 regarding the assistance ERP systems provide to project management.

### 2.4.3. ERP Implementation

The first important step in the implementation of any information system is the decision on the **correct product**. The ERP system should provide all or most of the functionality required by the company's processes. Proposals should be requested from various vendors in order to compile a short list of products. From the short list of possible products, the best functionality fit can be found. The vendor company should be analysed to ensure that a durable relationship could be sustained.

In some cases business process re-engineering will need to be done in order to fit the company to the ERP system. This process is required where the ERP system and the company are not a perfect match, which is the situation most of the time. Both the company and the ERP system business processes will have to be changed to enable the company and ERP system business processes to be similar. Expert help should be sought if a company is not familiar with this process.

The second important step is choosing the **implementation partner**. The team that will perform the implementation work can make or break a company. References for both the company and individual employees should be carefully scrutinised. The project manager and team members, with whom the receiving company are satisfied, should be assigned for the duration of the project. This will ensure that the experienced team is not allocated to other projects and that less experienced employees are shifted to the project and enlisted to implement the system.

The third and probably most important step is choosing the companies own **key users**. Key users are the responsible people in every functional area of the business for decision-making during the period of implementation. They will be responsible for the

development of business models and for the implementation and communication to other employees throughout the company. These employees should have the time available that is required, and also the mandate to make decisions and carry out changes. Employees that communicate naturally to others in the company are the best to involve, because this will ensure that other employees know about the project well in advance before getting involved themselves. The importance of this cannot be over-emphasised, as a lack of change management is one of the main causes of failure of ERP system implementation.

During a fast implementation, change will be more abrupt and severe, and all the employees will feel the pain of change. The receptiveness to change in the receiving company is important to ensure that resistance to change does not stop the project or reduce the quality of the deliverables.

The conclusion in Chapter 5 will revisit the issue of ERP implementation, especially regarding the influence it had and will have in future on the business processes and reports.

#### **2.4.4. Benefits of ERP Systems for a Project Manager**

*In the past we may have had to substantiate why we need computers – now they are part of the project office and you may have to substantiate why you are not using a computer! [Burke, 1999, p. 293].*

A project manager that has an information system to his/her use, can function much easier and better than one who does not. Some of the key benefits of ERP systems for a project manager are:

- A complete audit trail of transactions and tasks fulfilled can be seen on the database. It is also easy to see who has done what and when it was done. No more guessing is needed to determine who has performed a task well or incorrectly.

- Estimating provides a baseline against which the project team's performance can be measured.
- Project integration helps communication between participants of the project.
- Reporting interfaces can provide company and project views of data to fulfil the information needs of both parties.
- Response time on project controlling should be more frequent than the monthly reports by the organisation's financial system. With an ERP system's real-time information availability, this is possible.
- Trends can be monitored to see variation in time, cost and performance.
- Data capturing (i.e. timesheets and requisitions) at the lowest level is important to ensure accurate progress reporting and management of project resources so as to achieve the desired deliverables on time and at the expected quality within the cost limits.
- Single point of responsibility ensures that no division of scope can lead to underperformance of the final deliverable.
- Reporting to the client is much simpler with the single integrated planning and control system.
- Fast calculations can be done repeatedly.
- The standardised methods and data structure within the information system provide uniformity and discipline throughout business units and the company.
- If required by a specific project, procedures can be developed inside the ERP system to meet the requirements for that project. This will be costly, and should be limited to definite requirements and for very large projects only.
- Projects with thousands of project activities can be handled by ERP systems that have a project module. Reports can show the performance and status of the complete project or parts thereof.

- The project database is linked to the corporate database and data is shared. Other than in MS Project and PS 7/8 the actual expenditure is calculated directly from timesheets and requisitions loaded on the same ERP database.
- Manual calculations take up valuable time of project managers. ERP systems provide quicker calculations and the availability of data can lead to quicker reporting periods. This provides greater control and more accurate trend analysis. Reaction of the project manager to changing situations will also be faster.
- Reports can be structured to see the performance from a project or a business unit/cost centre view.
- The project manager does not need to perform project management tasks like calculations manually. This will make high-cost employees available to perform more project management related tasks.
- Project data is saved and back-ups are made and stored in a safe place. Risk management of losing data can thus be minimised to a point where it is almost non-existing.
- Managers compile their own reports and function from their own office PC, home office or even mobile office when on site

[adapted from Burke, 1999, pp. 8-9, 293-4].

Some disadvantages of an ERP system are:

- The cost of ERP systems is extremely high.
- The BPR process during implementation can lead to a complete company restructuring.
- The new system could cause a resistance to change from employees, which could influence morale and productivity negatively.
- Computer downtime can effectively stop the business from performing any tasks.
- Data safety precautions are necessary to ensure that data is not lost due to theft or computer problems

[adapted from Burke, 1999, pp. 293-4].

#### **2.4.5. Affordable ERP Systems**

SMEs, like CAE, have the dilemma of not being able to afford ERP systems. They cannot spend more than a few percent of their annual revenue on information systems. This limits many companies to systems that provide financial support, but no logistical or project support.

*The absence of project-oriented systems usually makes project management more difficult [PMBOK, 1996, p. 17].*

As the PMBOK specifies, companies struggle to perform their business processes properly without project-orientated systems. These systems are not necessarily computer systems, but can be manual and paper-controlled systems. The ability to control larger projects without computer systems becomes more difficult proportional to the size of the projects. Although a computer system is not mandatory to have business processes in place, the support it provides to the users assists them to a large extent. Within an ERP system, business processes are defined. An implemented ERP system automatically provides a business model and structured business processes.

#### **2.4.6. ERP Systems Conclusion**

The major benefits of ERP to the SME are an integrated information system with one data store, a complete audit trail and business processes included in the system.

ERP systems supply the project manager's desk immediately with detail and summary information. The availability of information

enhances the project manager's functionality and enables him/her to control his/her projects.

If ERP can be made affordable to small SA businesses, it will assist them to be globally competitive.

## **2.5. *Business Process Modelling***

The project was done in cooperation with ESi, ERP implementation specialists. Their standard business modelling procedure was used for the modelling of the business processes described in Chapter 3.

Appendix A describes this modelling process that is based on the ESi White Paper [De Kock, 2000] on process modelling.

## **2.6. *Conclusion***

Project management is a field that many people use in their day-to-day task at the office. It is clear that management information systems and especially ERP can provide considerable assistance. The business process modelling section ensures the reader that standard business modelling procedures were used to develop the business models and reports. This was the aim of defining the terminology and the relationships between these four fields, and it is also the foundation for the work that will follow in the next two chapters.

The next chapter will deal with the development of the project management business model, before the project management reports follow in Chapter 4.

### **3. PROJECT MANAGEMENT BUSINESS MODEL FOR SMES**

#### **3.1. *Introduction***

The project management business model, which was developed for CAE, is introduced and briefly discussed in this chapter. The business models were developed with the recognised PMBOK processes as baseline. The detail of the PMBOK processes has been discussed in the literature study in Chapter 2 and will not be repeated, but will be taken further in this chapter to suit the business processes of Qmuzik, the ERP system.

The development methodology and business model deployment will be discussed in section 3.2. This will provide the reader with the background to the development process. CAE, and any other project company, should feel comfortable, knowing that the models have been thoroughly analysed and revised during this development process. The development procedure is included in Appendix A.

In section 3.3 a few comments are given regarding the project management models and the specific steps that had to be added to the standard PMBOK in order to make the models more streamlined for use within ERP systems. The shortcomings of the business model previously used by CAE are mentioned a few times in order to explain the importance of certain steps in the generic project management business models better.

In section 3.4 CAE's perception of the business models and the company's readiness to implement and use these models are evaluated. The last section concludes this chapter on PM business models for SMEs, by looking at the results that were achieved.



### 3.2. *The Methodology of Business Model Development*

The business model was developed and implemented according to a standard procedure used by most ERP implementation consultants. This business process modelling procedure is discussed in detail in Appendix A.

A generic business model of a project-driven SME was generated to function within the ERP system. This generic model has to portray all the processes and functions that should typically be fulfilled to operate any project-driven enterprise. Seven functional areas, shown in Figure 3.1, were defined to divide the business model into logical segments. These functional areas divide the business model in seven areas of responsibility, which are assigned to different employees in a project-driven SME.

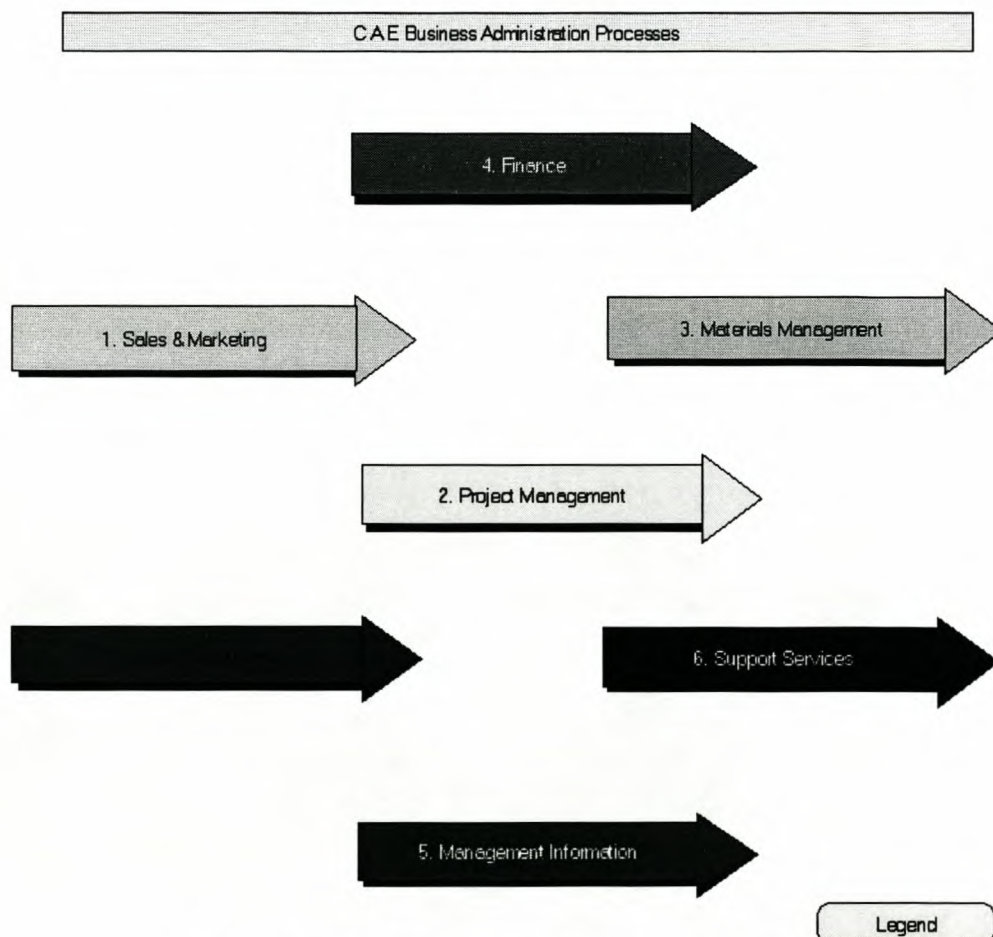


Figure 3.1 The Generic Level 0 Business Model

The two functional areas that consumed about 70% of the time invested in the business models are *finance* and *project management*. The GAAP and PMBOK models were respectively used to ensure that the models are generic and according to acceptable financial and project management standards.

In order to develop such a generic business model for project-driven enterprises, knowledge and experience in the following areas is a prerequisite:

- Project management
- Finance
- Business modelling
- ERP
- Qmuzik.

A team of people was used to ensure that a pool of knowledge was involved. The team consisted of individuals from different companies who provided the following inputs:

- CAE provided their key users in the seven functional business areas to develop the CAE AS-IS business model.
- GCC, assisted by the Department of Industrial Engineering (University of Stellenbosch), provided the theoretical background for the areas of project management and materials management.
- Enterprise System Implementers (ESi) provided practical experience in the related functional areas, ERP systems and ERP system implementation.
- Accurate Bookkeeping (Pty) provided and ensured sound financial and auditing principles.

The following stages occurred during the development of the business model:

- An AS-IS business model was created for CAE.

- A generic business model was created for project-driven SMEs.
- CAE key users reviewed the generic business model.
- Qmuzik, the ERP system provider, reviewed the generic business model.
- The project team reviewed the generic business model.
- The project team incorporated proposals from the reviews.
- The first draft generic business model was presented to the CAE key users in a three-day training session.
- Feedback from the CAE key users was sifted and incorporated where it was deemed fit by the project team.
- CAE accepted the final draft generic business model as their TO-BE business model.
- CAE key users took ownership of the TO-BE model, and will incorporate minor customisations when required by users for CAE specific application areas.

The generic business model can be re-used for any other project-driven SME. The prerequisite would however be that the SME is willing to accept the generic business model that was developed.

### **3.3. *The Project Management Models***

#### **3.3.1. Introduction**

The project management business model was assigned the number 2 (see Figure 3.1, p. 51) in the level 0 business model, hence the repetitive use of this number in the business model diagrams. The other six functional business areas are not discussed, except for the links that exist. The legend used in the business modelling is shown in Figure 3.2, and the entities explained in Table 3.1.

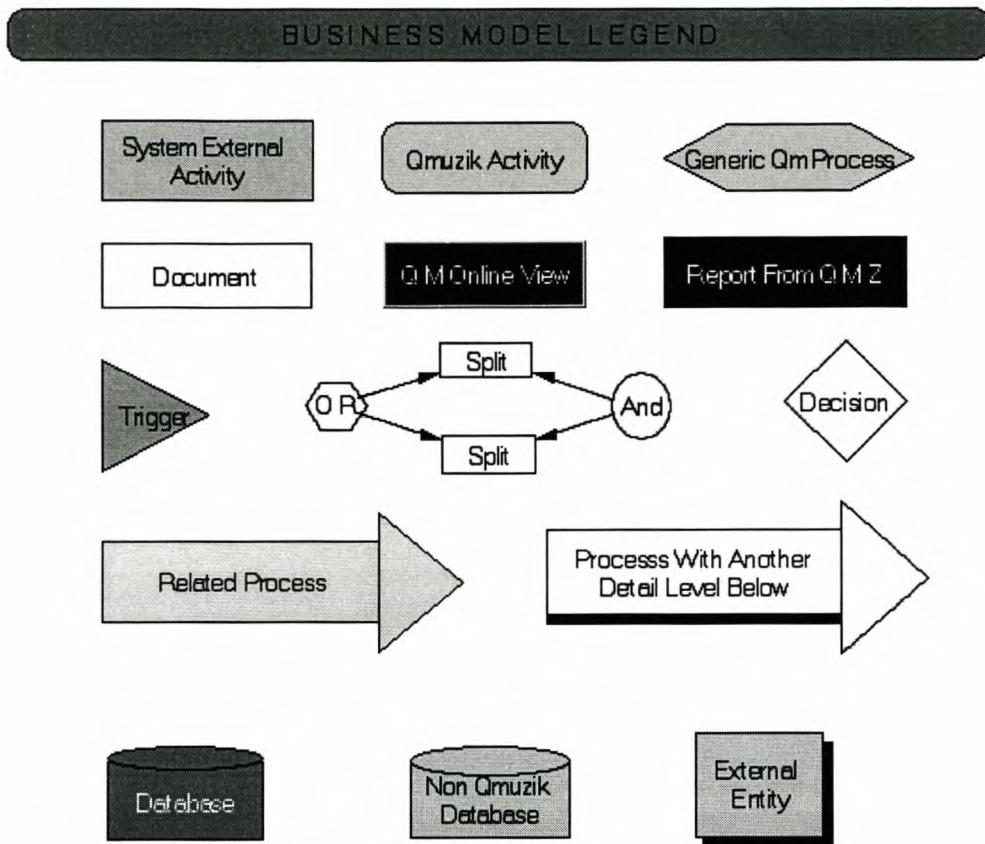


Figure 3.2 The Business Model Legend

Subject	Notes
System External Activity	This represents a non-Qmuzik function that the user must fulfil in the business process.
Qmuzik Activity	This represents a Qmuzik function that the user must fulfil in the business process.
Generic Qmuzik Process	This represents a process, e.g. cycle counting in Qmuzik, which is a generic, automatic function in Qmuzik.
Document	An external document that acts as an input to or output of a business process.
Q M Online View	Data can be viewed on Qmuzik front-end to use as input for or output of a business process.
Report from Q M Z	A physical report that is generated from a Qmuzik business process, and which acts as output of this business process or as input to another business process.

Subject	Notes
Trigger	A business model entity that starts a business model process flow. The entity is labelled to be from either a periodical interval or another business model.
OR/AND Split	This entity provides for multiple options and connections in the business processes.
Decision	This entity provides the decision-making in the business process.
Related Process	This indicates another process that is triggered by the end of this process through a relation, e.g. a requisition from <i>project management</i> triggers a process in <i>materials management</i> .
Process with another Detail level below	This entity is used in the higher-level business models, and indicates that a lower-level business process is lying below it.
Database	This entity represents the Qmuzik database and is labelled with the table name where data is stored during the related business process.
Non-Qmuzik Database	This entity caters for data requirements in the business model not met by the Qmuzik database. The data is necessary for business model processes additional to Qmuzik functions.
External Entity	This is an entity external to the company, e.g. a customer.

Table 3.1 Explanation of the Business Model Legend

The project management business models were built around the five project process groups of the PMBOK. Figure 3.3 shows the level 1 project management business model as it was inserted into Qmuzik by using the *Business Model Maintenance* function. The similarity between these and the PMBOK process groups emphasises the extensive use of the PMBOK in the business modelling.

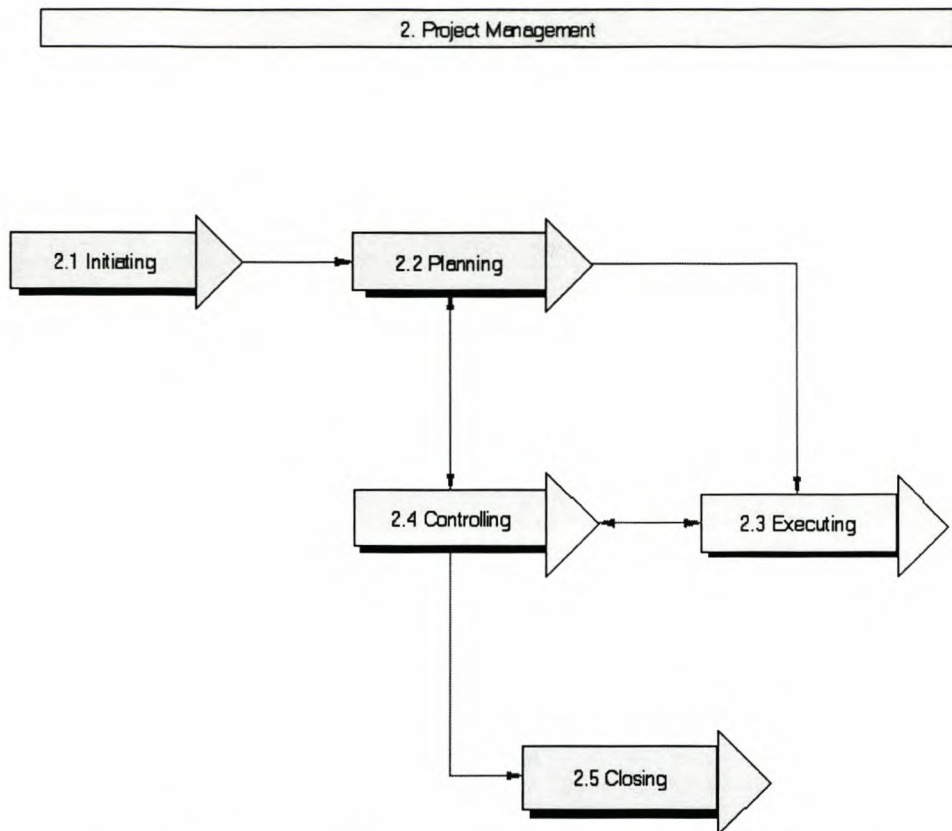


Figure 3.3 The Level 1 Project Management Business Model

The PMBOK is a generic *Project Management Body of Knowledge*, and in some instances the business processes are not comprehensive in the project management specifically applied to information systems. To develop the business model for use on an ERP system, some minor adjustments and reroutings had to be introduced.

One such example of an adjustment is the link between the planning to the controlling process groups. This link, which is not in the PMBOK model, was added to support the release of project activities, a controlling process, before the activity execution could be performed. The project manager changes activities to the status of “released” whenever work on those activities should start. The project team is not allowed to execute an activity before the project manager authorises it. If project team members are allowed to work

as they want, project cost and scope might very soon be out of control. This change gives more control to the project manager.

The level 0 and level 1 project management business model have now been introduced. The level 2 project management business model of every process group is introduced and discussed separately under the following headings. The more detailed level 3 project management business model, with Qmuzik specific applications, is included in Appendix B.

### 3.3.2. Project Initiation

The project initiation business model is shown in Figure 3.4. The high level processes of project initiation are included in this chapter. The inputs and outputs of this process can be seen in the illustration below.

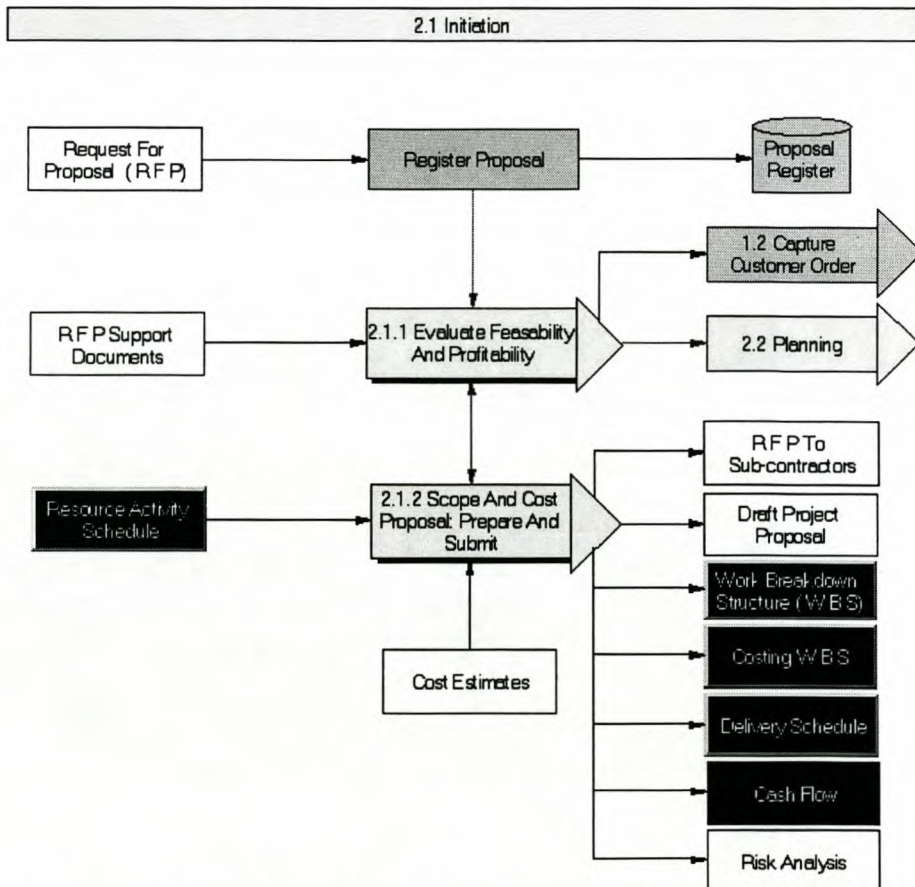


Figure 3.4 The Level 2 PM Business Model: Project Initiation

The initiation process is to acknowledge that a prospective customer has submitted a RFP. This RFP can be from any number of customers:

- An existing or new customer demands a project extension, a previous project repetition or a completely new project demand.
- A business need realised within the company, and a new project is engaged to explore this business opportunity.
- A legal requirement forces a company to enter a project to comply with a new law that has been approved by parliament.

The type of request and the person or company who issued it will influence the detail of the process. The complete initiation process is:

- The received RFP is registered on the company database.
- A feasibility study is done to ensure that the request is within the scope of business that the company intends.
- A profitability study is performed to quickly see whether a project can be established that will be to the best interest of both the performing company and the customer.
- If the performing company deems the project risks to be uncomfortably high, the prospective customer will be notified regarding the company's decision not to quote on the RFP.
- If the performing company wishes to become involved in the project, a high-level WBS is created. A material and labour budget is compiled by using inputs from various role-players inside and outside the performing company. The company resource schedule and cost estimates are used as inputs to facilitate this process. The outputs are the high-level WBS, the costing of the WBS elements, a delivery schedule and a cash flow and a risk analysis.
- RFPs are submitted to subcontractors in order to receive quotes on activities to be performed outside the performing company.
- A formal project cost and scope proposal is formulated.



- The performing company completes another profitability study on the project proposal before it is submitted to the prospective customer.
- The proposal is formally submitted to the prospective customer.
- The customer responds with either a request for a new/more detailed quotation, or with an order number.
- The prospective customer can make amendments to the initial RFP or require more detail on the quote as provided. An iteration of the proposal process can be done.
- If a customer order number is received, a customer order is loaded onto the database.

The loading of a customer order ends the initiation process and triggers the planning processes, as discussed in the next section.

### **3.3.3. Project Planning**

The project planning business model is shown in Figure 3.5.

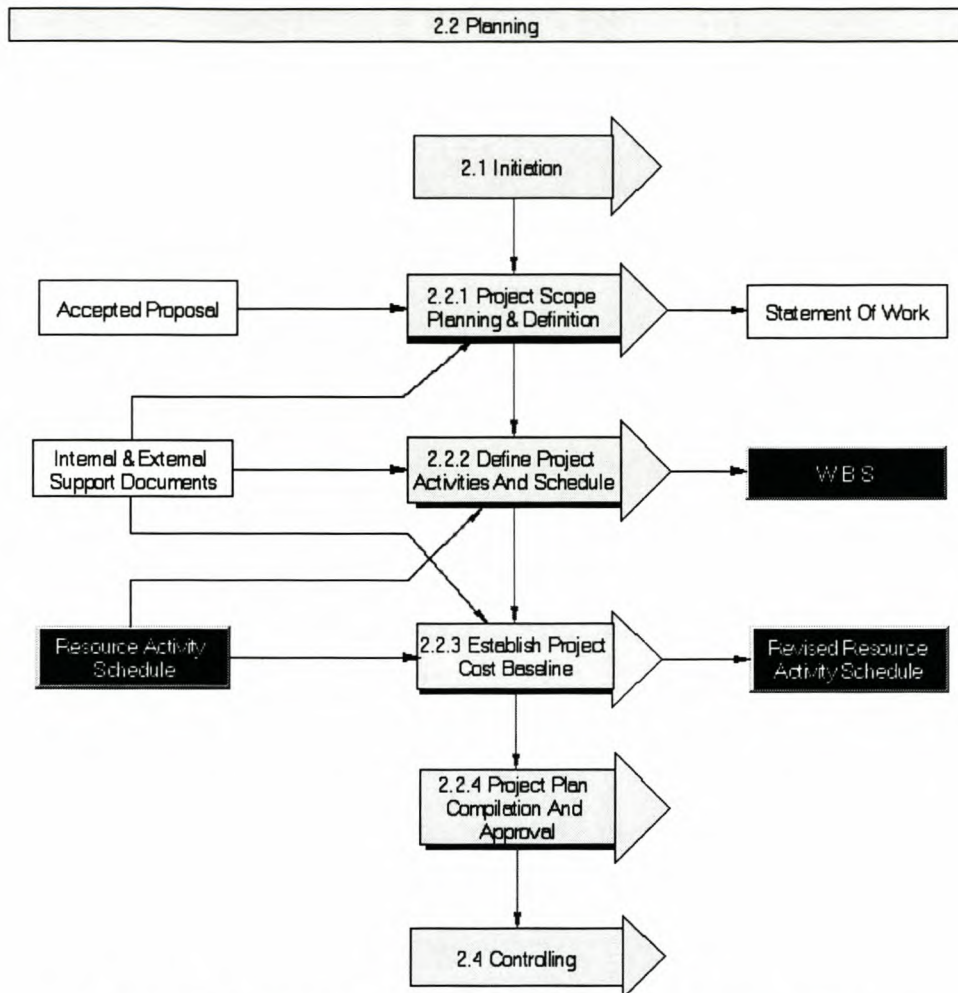


Figure 3.5 The Level 2 PM Business Model: Project Planning

The performing company has now received an order from the customer, and the customer order has been loaded onto the database. Before the project team can start executing the project, the project must be thoroughly planned. The purpose of the planning processes is to provide the project team with a baseline against which to perform the project activities.

The complete planning process includes:

- The **project scope** is defined to pin down the boundaries of the project. The *scope statement* defines what is included in the project, and what is excluded. Any scope changes in future processes will be measured against the stated scope. The inputs to this process are the accepted proposal document and other

internal and external supporting documents. Similar previous project or company policy documents can be used as input. The output of this step is a *statement of work*, which describes all work that is to be performed by means of this project.

- The ***detailed project activities and schedule*** are established. The *project scope* is then divided into measurable *project activities*. This is done in order to ensure that all the desired results defined in the *project scope* will be performed. The *activity schedule* is compiled in conjunction with the available company resource schedule to ensure that the necessary resources are available when the activities are performed. Conflicts of interest between this new project and other existing projects should be resolved at this early stage. The detailed WBS is the output of this process.
- The ***project baseline*** is established by budgeting for every activity in the WBS. The *resource schedule* is used to budget, and resources are allocated for the project by budgeting on the ERP system. The *material budget* is also defined per activity. Cost centre managers approve or reject the *proposed resource schedule*. If some of the resource budgets are rejected, the budgeting must be revised until the cost centre managers are satisfied with the usage of their resources.
- The ***project delivery schedule*** is loaded onto the database by making provision for shipment of project deliverables. The customer order is divided into the milestones specified in the project scope. The cash flow of the project will be influenced by the schedule of project deliverables. Deliverables should be planned to ensure a reasonable flow of income to the project.
- The information developed in the planning processes is compiled into a ***project plan*** and a *project plan document*. This document is presented to senior management for approval. When the project plan is accepted, a cost baseline is fixed against which performance can be measured for the duration of the project.

Only one thing is constant in any project, and that is the presence of change. As the project evolves, priorities of resources could change, and the activity schedules and planning should then be revised. The project plan can and will be revised again in different stages of the project, but the project baseline should be cast in stone. The performance of any project is measured against the project baseline, which should therefore remain fixed.

The acceptance by top management of the project plan indicates the start of the execution processes. The project manager controls the start of all project activities and, as mentioned earlier, acceptance of the project plan indicates that activities can start, but the process flow should be through the controlling to the executing processes.

The planning processes could require revision at any stage of the project. Revision will however be triggered by the controlling processes.

#### **3.3.4. Project Execution**

The project execution business model is shown in Figure 3.6.

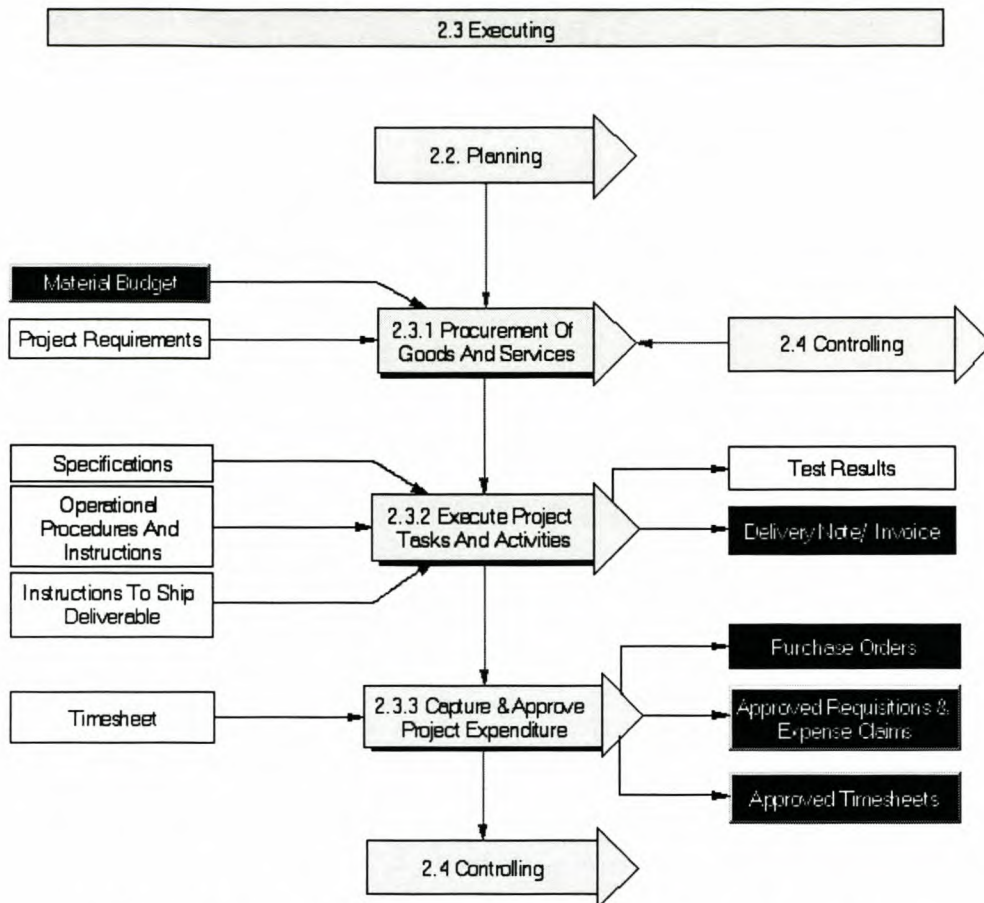


Figure 3.6 The Level 2 PM Business Model: Project Execution

The project manager releases activities on their respective start dates by using the controlling processes. The actual expenditure is captured and the percentage activity progress reported into the ERP system. This is done when employees capture time and load requisitions for material requirements. The largest part of the project budget will be consumed in this stage of the project. After the completion of the activities, the controlling process continues into closing the project as soon as all deliverables have been met.

The complete executing process includes the following steps:

- The activities that have been released by the project manager according to the project plan are executed.
- Procurement of the required goods and services. Whether it is a service from a subcontractor or material needed to perform an activity, it is ordered and used or consumed in this process. The

project team members load requisitions onto the ERP system, get the approval from the project manager, and the buyer creates a purchase order from a released requisition.

- The project team is responsible for actually executing the project tasks and activities. The project team does the technical and functional task as defined in the project charter and WBS. Timesheets are completed to reflect the time and cost spent by the resources on each activity.
- The work results are recorded and documented as the project activities are completed. Documents that flow from this process can be linked to the project directly on the ERP system, or stored in a folder structure on the company's intranet.
- Communication between the project team members is critical for the successful completion of every project activity.

It is in this phase of any project where the ERP system is invaluable. The system gathers data as the activities commence, and stores it away in an intelligent format in the database. Here again computers prove their value, as they perform these tasks automatically and fast.

An important output from these steps is the raw data of actual expenditure that is available on the ERP database. Performance reporting and other information requirements from various levels in the organisation can be met by careful representation of this data.

### **3.3.5. Project Controlling**

The project controlling business model is shown in Figure 3.7.

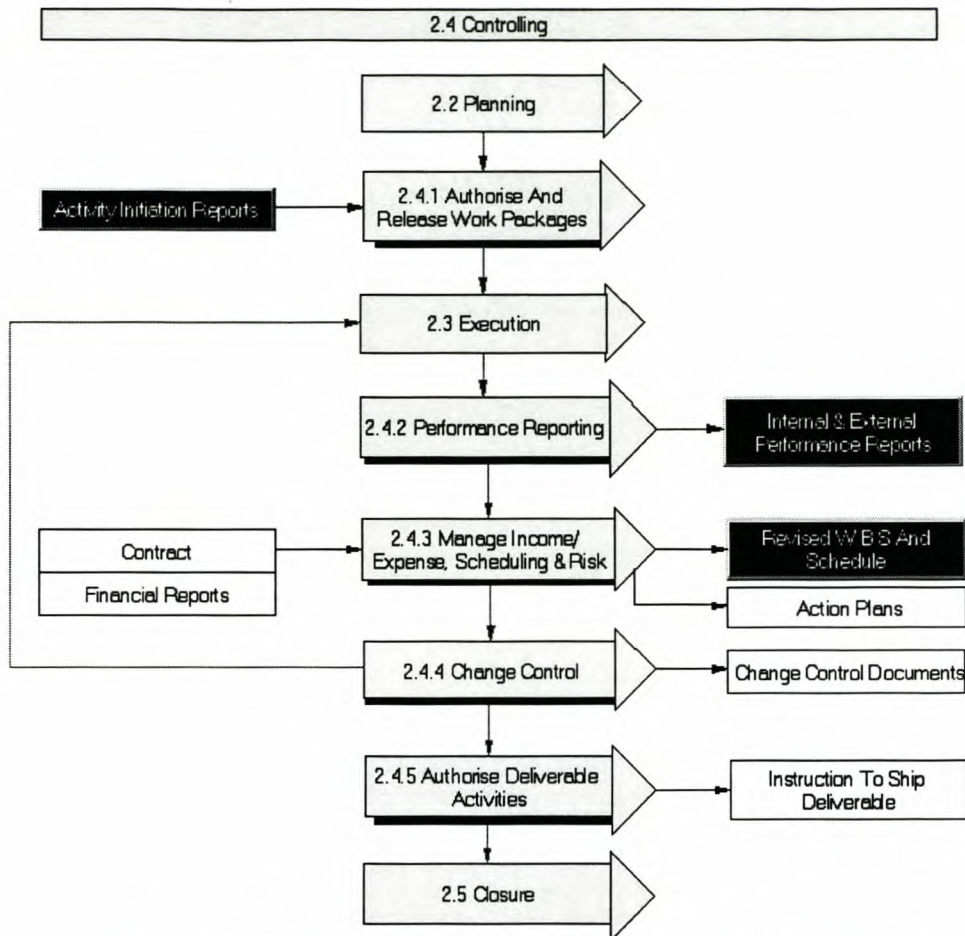


Figure 3.7 The Level 2 PM Business Model: Project Controlling

Project *controlling* comprises evaluating and comparing the data that was entered during the planning and executing processes. Project controlling occurs when the actual expenditure and the total project progress are compared to the project baseline and the project plan that were developed during the planning processes. During this evaluation the project manager acts on any deviations and variances to ensure that the project is completed on target as far as the scope, cost, schedule and quality of work are concerned.

The project controlling process includes:

- The project manager must control work authorisation. He/she provides a project team member with the mandate to perform an activity. The timing for releasing activities is crucial in order to stay with the defined project plan. Too early releases can cause

resource schedule problems or project cash-flow problems. Late releases cause a project to overrun the final completion date.

- The project manager is required to table a performance report on his/her project status at regular reporting frequencies. A report like this needs to reflect the project status by presenting the latest status. ERP systems provide the opportunity for the project manager to print reports a few minutes in advance of such a deadline.
- The project takes place in a changing environment. The variables that influence the project execution can change over time. For this reason the project manager needs to manage the project income and expenditure as well as the project schedule and risks. The project cash flow should be controlled to ensure that the project is not a burden to the rest of the company. The schedule and resource loading should be controlled to ensure that the necessary due dates are met, and that resource conflict does not jeopardise the project deliverables. Risks should be recognised early and should be managed carefully. Action plans should be compiled and documented to ensure that the project stays on the planned route.
- Because external factors can influence the project, careful change control should be exercised. The project manager should not be blind to possible advantages that could be added to the project scope, but should ensure that scope creep does not influence any project deliverables negatively. Changes to the project plan or project scope should be carefully considered and presented to the correct forums that can decide on whether the changes should be included or excluded. Changes that are going to be implemented should be properly planned and documented before execution starts.
- The project manager authorises the deliverable activities to be signed off. As the project milestones are finished, the controlling processes will indicate that some of the project deliverables have



been finished and need to be closed. The performing company invoices the customer for the agreed deliverable amount while the remaining deliverables continue. When the final deliverable has been achieved, the project enters the closure process.

*Performance reporting* is the main process in the controlling processes. The assistance of an ERP system to help the project manager with performance reporting is discussed in Chapter 4.

### 3.3.6. Project Closing

The project closing business model is shown in Figure 3.8.

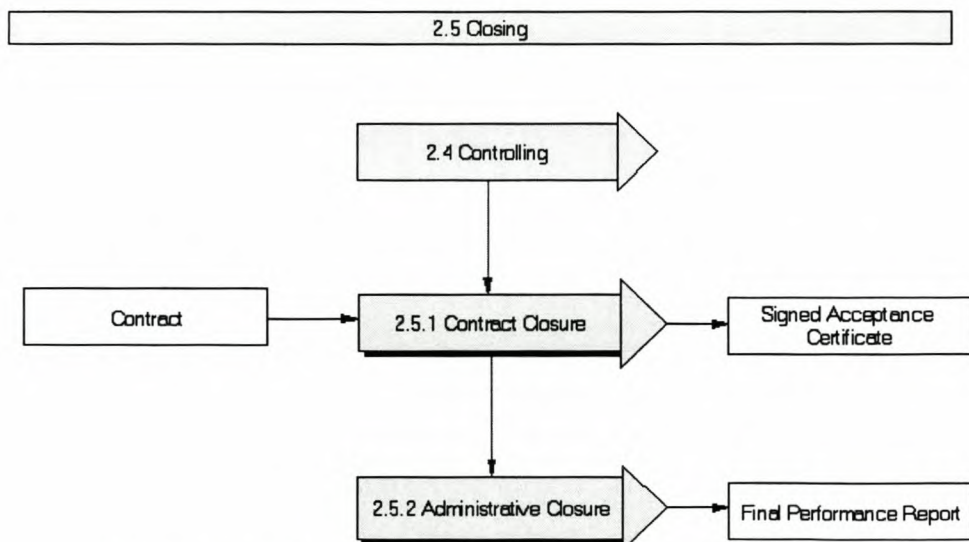


Figure 3.8 The Level 2 PM Business Model: Project Closing

When all project milestones have been completed, the controlling processes will indicate that all the project deliverables have been achieved and need to be closed. When the final deliverable has been achieved and all work in process has been signed off, the project enters the closure process.

The complete project closing process comprises:

- A contract closure meeting is arranged where the project manager will present all the stakeholders with a contract overview and the status of the final deliverables.
- The stakeholders raise all unfinished issues on the contract.
- If no outstanding issues exist, the stakeholders formally sign the final acceptance certificate.
- The administrative closure of all project data can then commence. This includes the presentation of a final performance report at the project closure meeting.

### **3.3.7. Conclusion**

The business model was kept as generic as possible and was not customised for CAE's processes. The reason for this strictness was for the purpose of adhering to the aim of developing a model for a quick ERP implementation methodology in a project environment. There might therefore be a company or business sector where specific additions will be necessary before an implementation can be made. In different application areas there might be a specific need to

- identify additional processes,
- subdivide common processes,
- define different sequences or process interactions,
- add elements to the common process definitions.

In general little or no change to this initial project management generic framework should be required.

Senior management must decide on the level of project detail involved with every project in the first planning processes. A three-hour project will not require the same detailed planning and control as a three-year project.

Projects are the core function of a project-driven SME. The project management business model is therefore the centre of the complete business model. The project management business model

consumed about 40% of the time invested in the development of the total generic business model.

### **3.4. *Implementing the Business Models in CAE***

The generic model was developed to suit the general project-driven SME in SA. After the development, CAE key users took ownership of their business model. The models can be updated by CAE key users to incorporate and address CAE-specific business application requirements where and if required.

Difficulty was experienced in some areas of the business model implementation in CAE. These problems can be ascribed to the company and employee profiles. Although CAE has a very knowledgeable base of employees with an extremely high computer literacy, its employees have a clear lack of business and specifically project management experience. CAE employ many recent graduates, and thus have few experienced employees. Their receptiveness to the change that was experienced eased these pains.

CAE, being a young and upcoming company, also showed a limited amount of standardised processes and structures. This could have impacted the implementation negatively, but the reverse side of the coin could be a company where processes and structures are so rigid that no change of any extent will be accepted. The lack of rigid processes therefore allowed the generic business models to be implemented with little difficulty. CAE was aware of the lack of rigid processes and the lack of uniformity. They gladly accepted the business models as their own and are using it fully. Before this business model was presented to CAE, they had no formal standardised business processes at all. Now they have a business model, which the employees can use as a standard practice.

### **3.5. Conclusion**

From the case study implementation, and more specific the business modelling activity, a few recommendations can be made to optimise future implementations. Some of the desired features experienced from the case study (to make the implementation easier for the company and the project team) are:

- an established company structure,
- an established business culture,
- employees with acknowledgeable business and project management experience,
- employees whom are receptive to change,
- computer literate employees,
- a company receptive to the generic business model.

All these criteria will not be met in any single company. Some of the above criteria were experienced to be conflicting when found in a single company and employee. A balance of these requirements rather than a good fit in specific areas will make the implementation of the business models in any SME easier.

The Qmuzik ERP system does not handle all the processes included in the business models. A project plan document should therefore be created in a word editor. The processes that are performed external to the ERP system are clearly indicated as such by the legend.

The lack of structure that existed previously, limited CAE knowledge as to whether they had completed projects successfully. The business model now provides the required structure to their business processes. The reports are a natural output from, and are also used as inputs to the business model. The next chapter will look specifically at the reports for the project-driven SME that evolved from the project management business model developed during the implementation of the ERP system at CAE.

## 4. PERFORMANCE REPORTING IN PROJECT-DRIVEN SMEs

### 4.1. Introduction

*A management information system (MIS) is an information system application that provides for management-oriented reporting, usually in a predetermined fixed format [Whitten and Bentley, 1998, p. 39].*

The aim of this chapter is to establish the fixed format in which information, as determined in Section 2.2, will be reported. Project control is achieved by measuring and monitoring the project performance against the project budget or baseline. The variance between the budgeted cost and actual expenditure should at all times be minimised. The stakeholders will, for instance, always desire more functionality in less time, at a reduced cost and of a desired quality. This is rarely achieved. But to measure performance, a budget is required as a baseline against which to measure performance.

The business models were discussed in Chapter 3. In this chapter the focus will be solely on the controlling processes, i.e. *performance reporting* and *change control*. Performance reporting provides the reason for and the input to how change control should be done. No change control is required unless a performance report indicates the necessity. The focus will therefore be specifically on **performance reporting**.

**Control.** *The process of comparing actual performance with planned performance, analysing variances, evaluating possible alternatives, and taking appropriate corrective action as needed [PMBOK, 1996, p. 161].*

**Monitoring.** *The capture, analysis and reporting of project performance, usually as compared to plan [PMBOK, 1996, p. 165].*

*Almost all projects suffer change to their current “definition” at some point in their evolution. Changes may be proposed by any of the stakeholders associated with the project. Change may be unavoidable or highly desirable; it may equally be unnecessary and not useful. It is essential that any proposed change to the project be formally controlled [APMBOK, 2000, p. 26].*

In this chapter the reporting and information situation in CAE will be assessed before and after the Qmuzik implementation. The reports that originated from the project management business models and those realised for CAE, and the generic project-driven SME are discussed. CAE’s AS-IS report list is shown in Appendix C, and the TO-BE report list is shown in Appendix D.

Reports result from actions, but also are the triggers for secondary actions. The *released requisition* report is therefore used as an input for creating purchase orders, and the *outstanding purchase order* reports are used as input for the goods-receiving function. The reports are an output from the models developed in Chapter 3.

## **4.2. AS-IS Reports at CAE**

### **4.2.1. Past Reporting**

In the past CAE did not do any detail project budgeting. The only budgets were high-level budgets, calculated by project managers and based on previous similar projects. These budgets were better than nothing, but not at the level of detail required in performing project control as intended by the PMBOK. Hence there were no detailed baselines against which to measure performance. Project execution

is possible with a project plan, but control is impossible when there is no baseline.

The **AS-IS reports list** is a list of all reports as found by the project team at the initiation of the ERP implementation. This report list is included as Appendix C. The reports on this list were seen as the minimum requirement for reports to be realised for CAE by the project team. For the generic ERP implementation methodology however a complete set of reports is required.

The AS-IS project management reports and the information CAE provided can be summarised as below:

- The **project plan** was intended for breaking up the project into smaller activities and for performing resource planning. The resources to be planned were specifically the people and test cells with test cell equipment.
- The **project status list** is a project list defining the amount of money spent per project up to the previous month-end. The list provided the project manager with an idea of the amount of money spent to date on the project.
- The **proposal** is a company template document used by project managers for the purpose of presenting uniform proposals to prospective customers.
- The **quotation** is a standard document used for presenting standardised quotations to customers.
- The **project report** is the end product presented to the customer regarding the outputs achieved in the project. Test results were included in this document. No uniformity was found for this document.

Neither of these reports provides the amount of information that can be used by a project manager to perform project control. The only report that provides sensible information in this regard is the project

plan. By making use of this document the project manager knows when to start which activities and when they should be completed.

Financial information was limited to the project status list provided monthly by the financial department. The data was therefore old and under the previous system not 100% accurate. The project managers had a desire for more information at more regular intervals to support them in performing proper project management.

#### 4.2.2. CAE Project Management Information Requirements

At the initiation of the project the project managers were prompted to list all their needs and requirements. The list of problems for which they required solutions reached wider than only project management. The project managers' needs, requirements and problems are listed in Table 4.1. The needs, requirements and problems are classified as ERP-related, or as *Not Applicable* to the ERP implementation.

Requirement	Description	Classification
Templates for forms and reports	Project managers use their own templates for forms and reports. The data is thus not comparable.	ERP
Bad filing	No organised filing system is in place. Files are often shared between project managers, misplaced or difficult to find.	N/A
Conflict resolution	Due to data unavailability, conflicts sometime arise amongst project managers about the content of a projects work or administration.	N/A
Time management	The weekly timesheets from every employee generate too much work to calculate project costs from.	ERP
Project planning, costing and cost control	Project planning is either not done, or to no common structure.	ERP
Project budgeting	Project budgeting is either not done, or done by each project manager in his/her own way.	ERP



Requirement	Description	Classification
Project change control	Formal scope change management is not done. The projects scope expands, but the sales value often remains the same.	N/A
Project priorities	If project requirements exceed the resources available, no prioritisation exists to steer project managers to what is the most important projects.	ERP
Project progress reporting	Progress is measured against budgeting. With the little budgeting done, progress reporting is inadequate or non-existing.	ERP
Project financial status reports	An accounting firm generates these reports. The report on the previous month reaches CAE by the middle of the following month.	ERP
Uncoordinated buying	Every project manager buys his/her own material. Often the same supplier delivers more than once on the same day. No standard buying procedure exists.	ERP
Approval of requisitions	No formal procedure exists. This often causes cash-flow problems.	ERP
Reflecting overhead cost/petrol/telephones to projects	Overhead costs of people working on a project are not allocated to that project.	ERP
Tracking of resources and stock	No reporting is available on what human and material resources are used where and when.	ERP
Acceptance of quotation	Project managers use different procedures for the acceptance of project quotations by customers. Often the same customer is exposed to different procedures.	N/A
Resource allocation and planning	Detail allocation of resources to projects is difficult with no central database.	ERP
Manpower control	Detail allocation of human resources to projects is difficult with no central database.	ERP
Electronic timesheets	Electronic timesheets are easier to search and to allocate resource costs to projects. The paper timesheets are difficult to process.	ERP

Requirement	Description	Classification
Information management	Islands of information exist within the company. Little data sharing between projects make advanced planning impossible.	ERP
Project managers do not have time for project planning, management or budgeting	Project managers are too busy, and do not find the time for project administration. They are not only the project managers, but also the technical managers.	N/A
Increased parking space	The employees share parking areas with lectures and students of the university. Too little space is available.	N/A

Table 4.1 CAE Project Managers' Needs, Requirements and Problems

CAE's employees tabled these requests because they required solutions for them. The problem with this list is that many of the problems, like parking, cannot be solved by the ERP system, because these problems are inherent to the company culture and the business structures within which CAE operates. The lack of time for project managers to perform planning and budgeting can therefore be ascribed to the lack of a formal project office that can coordinate projects and which can take the administration burden away from the project manager. The project team had to address the issues that could be solved by ERP, and at the same time they had to try to incorporate some of the other changes in the business models and training in order to provide a more complete solution to the customer.

During the ERP implementation, many hours of business consulting were spent to enhance CAE's use of the business model. The business model developed already dealt with many of the requests. The other requests had to be dealt with by intelligent reporting and by doing some business structure changes, like establishing a project office. Chapter 5 comments on the solutions the ERP system and the bigger ERP implementation project provided. The reports that originate from the business models must however first be discussed.

### **4.3. Reports from the Business Models**

In this section the reports envisaged for an SME, with the development of the generic business models, will be listed and discussed. Both reports that are outputs from the business model and reports that are inputs to the business model are discussed.

ERP system external reports are documents created outside the ERP system, and they are therefore not based directly on data from the ERP system. A risk analysis can thus be based on data from the ERP system, but is not included in the typical ERP system suitable for SMEs.

Two types of reports should be distinguished namely, *process reports* (PR), and *management reports* (MR). Process reports merely link two processes, i.e. the buyer uses a list of approved requisitions, a PR, to create purchase orders for suppliers. Management reports assist management at various levels in the organisation to make decisions and solve problems, i.e. the list of all outstanding purchase orders per supplier will indicate which suppliers should be approached to improve their service levels.

Reports can also be divided into *external* and *internal* reports. This indicates whether a report is generated from inside or outside the ERP system. The external reports are included in the business model to assist the users to fulfil the complete process required. However, it is irrelevant whether an external report is classified as a MR or a PR, because these reports are developed outside of the ERP system and data directly from the ERP system are not used. The external reports were included in the business models for completeness only and will not be described.

All business model reports are presented in a table, displaying the report name, whether the report is internal or external to the ERP system, whether the report is of the type PR or MR, and a description is given of the report. Reports from the five project management process groups are listed separately.

#### 4.3.1. Initiating

The generic business reports on Qmuzik for the initiating processes are shown in Table 4.2.

Report Name	ERP Internal/ External	Type*	Description
Resource Activity Schedule	Internal	MR	Use the Resource Activity Schedule on Qmuzik to view the availability of resources for the planned project dates. Suggest other suitable time periods if resource availability is a problem.
Cost Estimates	External	N/A	Manpower costs; material estimates; technical requirements; subcontractor quotes.
Request for Proposal	External	N/A	This can be any request coming from any potential customer.
RFP Supporting documents	External	N/A	Supporting documents can either be provided by 1) The potential customer 2) Internal references of similar projects.
Request for Proposal to sub-contractor	External	N/A	This is an optional report, and would depend on the monetary value of the customer proposal
Draft Project Proposal	External	N/A	Compile a draft project proposal that will be submitted to the customer.
Work Breakdown Structure (WBS)	Internal	PR	Costing WBS Risk Analysis Cash Flow Delivery Schedule
Costing WBS	Internal	MR	This is a more high-level WBS That will be used for the high-level budget. It is not necessary or viable to go into too much detail on a potential project. ( The detailed budget will follow when the project proposal has been accepted by the customer.)
Delivery Schedule	Internal	MR	Propose a possible delivery schedule. This schedule can be compiled from the customer RFP, and other internal resource availability data.
Cash Flow	Internal	MR	Do a cash flow analysis. The cash outflow will be portrayed by the budget, and the cash in-flow by the delivery dates.
Risk Analysis	External	N/A	Compile a list of possible risks to both the customer and the company, division and cost centre for this specific project. Risks that are too high should be avoided where possible. Especially where the gains from the project are low relative to the risks.

\* PR – Process Reports, MR – Management Reports

Table 4.2 Initiating Process Business Model Reports

### 4.3.2. Planning

The generic business reports on Qmuzik for the planning processes are shown in Table 4.3.

Report Name	ERP Internal/ External	Type*	Description
Accepted Proposal	External	N/A	The Accepted Proposal Notification And Proposal Are Used To Define The Scope Of The Project.
Internal and External Supporting Documents	External	N/A	Including The Contract Document
Resource Activity Schedule	Internal	MR	The Allocation Of Labour To Other Projects Reflects On The Labour Budget. The Resource Activity Schedule Is Used As An Input To Determine What Employees Are Available When The Project Activities Are Scheduled.
Statement of Work	External	N/A	Milestones: - Agreement On Deliverables - Specifications
WBS	Internal	MR	This Is A Breakdown To Task Level
Revised Resource Activity Schedule	Internal	PR	The Resource Activity Schedule Is Revised While The Project Baseline Is Established. New Employee Allocations Are Made To Projects And Updated On The Labour Budget.

\* PR – Process Reports, MR – Management Reports

Table 4.3 Planning Process Business Model Reports

### 4.3.3. Executing

The generic business reports on Qmuzik for the executing processes are shown in Table 4.4.

Report Name	ERP Internal/ External	Type*	Description
Material Budget	Internal	MR	The Material Budget indicates which materials are required at what stages of the project, and what expenditure will then be necessary.
Project Requirements	External	N/A	All the requirements, except the labour, of the complete project will be passed through to procurement to approve and obtain it. A list of requirements is provided in the project plan.
Specifications	External	N/A	Specification of standards that certain tasks and activities need to comply with.
Operational Procedures and Instructions	External	N/A	The set of business rules and procedures that the project team should adhere to while completing the tasks and activities.
Instructions to Ship Deliverable	External	N/A	A list of the dates on which all deliverables should be shipped to the customer.
Timesheet	External	N/A	Blank timesheet for employees to capture worked time. (Can be paper or electronic format)
Test Results	External	N/A	Test results will evolve from the project execution. These results must be communicated to the customer and incorporated into the final project report.
Delivery Note / Invoice	Internal	PR	Delivery notes and invoices that are incurred by the project activities.

Report Name	ERP Internal/ External	Type*	Description
Purchase Orders	Internal	PR	After requisitions have been approved and released, the buyer creates purchase orders to buy the material or service from suppliers.
Approved Requisitions and Expense Claim	Internal	PR	Approved requisitions can be viewed online or reports printed to be used by the buyer to create the purchase orders for suppliers. Employee expenses also are approved by the project manager and paid to the employee.
Approved Timesheets	Internal	PR	When the project manager is satisfied with the time an employee has booked on timesheets against his/her project, the timesheet is approved, and the project cost journalised.

\* PR – Process Reports, MR – Management Reports

Table 4.4 Executing Process Business Model Reports

#### 4.3.4. Controlling

The generic business reports on Qmuzik for the controlling processes are shown in Table 4.5.

Report Name	ERP Internal/ External	Type*	Description
Activity Initiation Report	Internal	PR	This is a list of all the activity start dates. It indicates to the project manager when activities should be released to the project team to perform the defined tasks.
Contract	External	N/A	The contract between the performing company and the customer. All planned deliverables are defined in the contract.
Financial Reports	External	N/A	Financial reports provide the project manager with a summary of the actual expenditure and planned expenditure for the future. The project manager can use this to make decisions on the project status and action to be taken.
Internal & External Performance Reports	Internal	MR	Internal performance reports are intended for presentation to the project team at project progress meetings. External performance reports are intended for presentation to the customer and other primary stakeholders at steering committee meetings.
Revised WBS and Schedule	Internal	MR	If it becomes necessary to make changes to the WBS or the schedule as a result of factors that come to the attention of the project manager, these changes should be made and reported.
Action Plans	External	N/A	Changes that occur in the project plan or activities that require special focus in the short term, are added to the action plan.
Change Control Documents	External	N/A	Changes to any area of the project must be carefully documented and decisions regarding it must be made. The change control documents are presented to the stakeholders for approval at the earliest meeting.
Instruction to ship deliverables	External	N/A	At the completion of a milestone, the instruction must be made to ship the deliverable and receive the specified monetary return from the customer.

\* PR – Process Reports, MR – Management Reports

Table 4.5 Controlling Process Business Model Reports

### 4.3.5. Closing

The generic business reports on Qmuzik for the closing processes are shown in Table 4.6.

Report Name	ERP Internal/ External	Type*	Description
Contract	External	N/A	The contract is the primary input in the final contract closure meeting. The contract is to be reviewed to ensure that all promises were met.
Signed Acceptance Certificate	External	N/A	This is the final certificate of acceptance that indicates the client's satisfaction with the project deliverables. File this document in the project folder.
Final Performance Report	External	N/A	Attach this document as an external object to the programme node. It will be a handy cross reference for future projects.

\* PR – Process Reports, MR – Management Reports

Table 4.6 Closing Process Business Model Reports

### 4.3.6. Conclusion

All reports from the business model were listed in the previous five sections. These are the reports supporting the business processes, and without these reports the system users cannot fulfil their tasks.

The internal reports are realised by extracting data from the tables in the Qmuzik database into an external report-writing tool. The data is presented in a format as required by the user to transform the data to information. No add-on application or extra data input should be required. MS Access was used to realise CAE's reports.

These internal reports should provide in the information requirements, both on process and management level. The process reports are standard for any business, whether it is an SME or not, and will not be discussed in more detail. These reports support the business processes, and an SME will reduce the risks mentioned in Section 2.2.4 by using the reports mentioned as inputs to their business processes. The management reports will be discussed in the next section.

#### **4.4. Performance Reporting Information Provided in Qmuzik Reports**

In this section three reports will be discussed in detail. The first two reports, the *program reports* and the *labour control report*, provide the information listed below, and meet the criteria mentioned. The third report, the *contract review sheet*, is a detailed report providing a one-page summary of the complete project status. This last report requires additional inputs from the project office and falls outside the capabilities and scope of some SMEs, but is nevertheless included for completeness.

These three reports were realised as MS Access reports with many sub-reports. Each sub-report is related to an internal *management report* listed in the previous section. These sub-reports are grouped into the three reports according to the similarity of the information they provide.

The types of information that must be provided to the project manager by the performance reports are:

- **Status reports.** These reports give information on the present status regarding cost, schedule and quality of the project as to date, or as at a fixed important date somewhere in time. A date like a month-end or a delivery date of an important milestone is used.
- **Progress report.** Reports on the progress made by comparing the actual project cost and schedule to the budget as planned in the project baseline during the planning processes.
- **Forecasting.** Gives an indication of the future project requirements based on the project plan, the actual expenditure to date, and the percentage of the project completed. This



provides the project manager with an estimate of the project cost and schedule at completion.

The data that is represented in the reports will be described and discussed per report. The project manager will have to interpret the data presented to him/her to define the situation of the project.

Because of the sensitivity of data presented in CAE's project reports, only few example reports can be included or displayed in this thesis. The code of conduct that was agreed on at this project's initiation prevents presentation of data in this report. An example framework of each report explained is shown in Appendix E.

#### 4.4.1. Programme Reports

This report provides a detailed drill-down of every cost element later described in the summary report, the *contract review sheet*. The report runner can choose the vertical level that the report is viewed at, i.e. *program*, *milestone*, *activity* level. The time period of interest must also be selected.

Six sub-reports are used to categorise the data:

- **Actuals and committed costs.** The actual and committed labour and material costs are displayed in either a summarised or detailed view of the selected period. Committed cost is timesheets booked, but not yet approved by the project manager, and material ordered, but not yet received. The project manager can see the total expenditure to date, and commitments that have already been made.
- **Purchase orders.** A list of all the purchase orders, outstanding and completed, for material or services ordered for the selected period.
- **Sales.** A list of all invoices that have been sent to the customer. These could reflect outstanding debts and payments received.

- **Outstanding debtors.** A debtor's schedule indicating all the paid and outstanding debtor payments and the number of days by which the payments are overdue.
- **Resource utilisation summary.** A high-level overview of the hours that resources have booked time against the project over the full report period. This gives the project manager an indication of the hours that have been spent on the project, when they have been spent, and which type of resource spent it.
- **Invoiced actual.** The actual amount regarding completed deliverables that has been invoiced to date against the project. This is a detailed list of all the invoices for the report period.

The **programme report** is data that originates from the ERP system database. No maintenance is required. CAE project managers can use this report to benefit project control best. The outputs of the report can be used to compare to the project baseline and to calculate the project control indicators used in performance reporting. The important indicators, as found in section 2.2.5, are listed below:

- Actual Cost of Work Performed (ACWP)
- Budgeted Cost of Work Performed (BCWP)
- Budgeted Cost of Work Scheduled (BCWS)
- Cost Performance Index (CPI)
- Cost Variance (CV)
- Earned Value (EV)
- Estimate At Completion (EAC)
- Percentage Completed (PC)
- Schedule Performance Index (SPI)
- Schedule Variance (SV)
- Target Completion Date (TC)

With these values on the performance report, a project manager can communicate the project status, performance and forecast to the stakeholders.

#### 4.4.2. Labour Control Report

The labour control report was specifically developed to provide in CAE's request to control and schedule resources and specifically labour.

The report provides a labour schedule and forecast over a given period, and also the values that the project manager can use in performance reporting to display the values listed below:

- Budgeted Cost of Work Scheduled (BCWS)
- Latest Cost of Work Scheduled (LCWS)
- Actual Cost of Work Performed (ACWP)
- Latest Cost Forecast (LCF)

#### 4.4.3. Contract Review Sheet

This report is essentially a summarised report of the values provided in the programme reports. The *contract review sheet* is a comprehensive single page report that provides the project manager with an overview of all the project's values at a glance. The report can be viewed at program level, or a drill-down can be made to lower specific milestones within the project structure. The project runner must decide the time period of the data that is required, and will thus only see values for that specific time period.

The project information provided on the single page is:

- **Contract price.** The total value of the project at the resolution that the project runner had chosen.
- **Sales to date.** The total amount that the customer has been invoiced to date for milestones/deliverables completed on the project.
- **Cash in.** The amount of cash that the project has earned over the specified period. This can be more or less than the expenditure, depending on the company's policy regarding advance payments.

The cash flow in and out (see payments below) can be monitored, to see when the project is becoming a cash-flow burden on the company.

- **Payments.** All actual payments for material and labour that have been made for the account of the project. The commitments for material ordered and not yet received are also shown. The project manager can use this information for cash-flow planning.
- **Total price.** The total price that all the project deliverables at present add up to. This value might differ from the contract price, especially if the scope of the project has changed and milestones have been added or removed.
- **Debtor's schedule.** The amount that the customer still owes the performing company on overdue invoices. This is displayed in a per month late category, i.e. 30, 60, 90 days, etc. The project manager can see when the customer is not paying and can stop work in advance of a cash-flow problem.
- **Cost cumulative** to the programme finish date. An estimate of the expected total amount still outstanding added to the actual expenditure to date. This is based on the calculated performance index (PI), the work performed, and the time it should have taken to perform the work.
- **Risks and opportunities.** The company can specify risks and opportunities per project. These values are indicated on the single page report, and the two values can be portrayed against each other to ensure that the project risk is not too high, and that possible opportunities are not missed.

The report requires a huge amount of maintenance to provide the mentioned information to the report runner. Every month a snapshot is taken of the monthly project situation and a forecast is done on the expected completion values of each milestone. The project office should typically perform this maintenance task.

A project company that uses a similar report spends two man-days per month just to perform this maintenance on all their projects. The benefits from this report can be vast, but they should be measured against the effort required firstly, to set up the report into a running cycle, and secondly, to keep it running with the necessary monthly maintenance. This task may seem to be too overwhelming for many SMEs, as was the case with CAE. This report was not implemented at CAE, as they do not have the resources to do the monthly maintenance. Furthermore in this specific case, the lack of project management experience makes the interpretation of this report difficult.

#### **4.5. CAE's Acceptance of the PM Reports**

The programme report provides the actual values that can be compared with baseline values from the budget. The CAE project managers were very satisfied with this report, as it was for the first time possible for them to identify at any time what the actual expenditure was to date, or over a certain period. This was a major improvement on the previous once a month two-week old month-end total expenditure report.

The CRS is a maintenance intensive report. CAE needed a project office to do the required monthly maintenance on the CRS. Also because CAE did not budget in the past, there was little information in the Qmuzik system to display on the CRS. The suggestion to CAE at this stage is firstly to establish a project office. CAE should also start to budget in order to provide a baseline for the project managers so as to compare actual expenditure and then perform the project control processes. The CRS was not implemented at CAE, and the situation would be evaluated within six months to establish whether it had become feasible to implement the CRS.

The labour control report provides the labour resource loading for the company, either per project or for all projects combined. The report compares the actual man-hours versus budgeted man-hours. Again this was a first for the CAE project managers, and the report was accepted with open arms.

#### **4.6. Conclusion**

This concludes the chapter on performance reporting in the SME. The reports that were developed and deployed, aim at providing detail and summary information to assist project managers to perform project control.

CAE accepted the reports, and it is expected that other SMEs would follow suit. The reports were kept in a generic format so as to be able to implement the reports at any other SME, where the fast implementation methodology is deployed.

## **5. SUMMARY**

### **5.1. *Results and Analysis***

#### **5.1.1. Introduction**

The results achieved during the ERP implementation at CAE can be seen as two-fold. Firstly, despite some difficulty during the project, most demands from project managers have been met. Secondly, the business model has created structure and processes for the way in which day-to-day operations are performed.

CAE has been using the ERP system for the past year. The data on the ERP system could thus be analysed and conclusions drawn regarding:

- The effectiveness of the implementation;
- The ability of CAE's employees to perform their duty;
- The benefits of the ERP system to CAE, and
- The amount of knowledge transfer that took place during the implementation.

This analysis, as far as possible, is shown in Section 5.1.3.

Furthermore, the requirements stated by the CAE project managers in Section 4.2.2 will be analysed to see the extent to which the ERP implementation has satisfied these requirements. This is done in Section 5.1.4.

#### **5.1.2. Difficulties experienced**

During the project some difficulties were experienced:

- CAE's presence inside the University of Stellenbosch IT Infrastructure requires of them to maintain high security measures. This approach caused network access problems for the project team.

- CAE employs recent graduates, and their inexperience, insofar as structured approaches and project management techniques are concerned, has shown clearly during the project. This was one of the reasons for the lack of standard business processes in the company. The employees' excellent computer skills and willingness to adjust to the new business processes made up for this lack of experience however.
- Few business models or business structures were found at CAE. Being a young company, CAE had a lot to learn, but the proposed business model was accepted very well.
- Previously no labour cost allocation to projects was visible. Project managers were initially shocked when they saw their labour expenditure for the first time. This led to change management problems. In future, project managers will be more demanding regarding the resources they require for their projects, and they will also demand harder work from the resources.

These difficulties should not be seen as a negative reflection on CAE and were not more than expected with any ERP implementation.

### **5.1.3. CAE one year later**

In reaching his conclusions about the benefits of the implementation for CAE, the author used other data as well, but the confidentiality agreement limits publication of these, except in a very general form.

The data given in this section is from the CAE database and is a representation of the company data entered into the system. The data covers the company activities for the year 1 September 2001 to 31 August 2002. Although this is not CAE's financial year, it eliminates errors from August 2001 (first month of using the ERP system), and unfinished transactions as from September 2002.



CAE **project data** is shown in Figure 5.1. The projects billable to customers are only 68% of the total project value. This is understandable, given the nature of the company. CAE is involved in research and development work and therefore the remaining 32% can be ascribed to internal projects. These internal projects could be development work that leads to products that can be sold in future. This balance between recoverable and non-recoverable projects should be closely monitored and managed in order to keep the company cash flow positive. Priority should be given to the recoverable projects to ensure that the company has the required cash flow, but capacity building, especially with regard to people and skills development, as far as non-recoverable development work is concerned, should be continued.

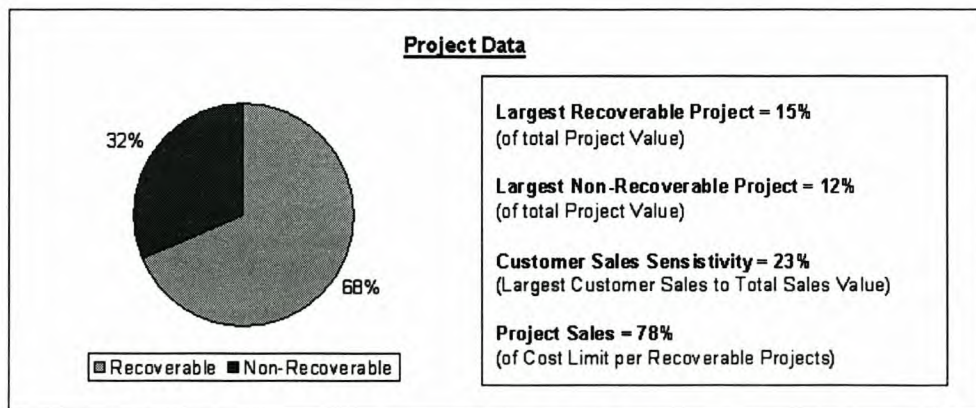


Figure 5.1 CAE Project Data

The largest single recoverable project is 15% of the total value of recoverable projects. The largest sales value per customer is 23% of total sales value. This indicates a relatively low risk of dependency on any one single project or customer. Similarly the largest non-recoverable project is 12% of the total value of the non-recoverable projects.

The project sales are 78% of the cost limit of the recoverable projects. This indicates an over expenditure of 28% allowed above the planned sales value, and therefore project managers can spend more on

projects than they will invoice for. Although this is not the actual expenditure, it is a control measure that could be utilised to ensure that every project is completed at a profit. The sales value is expected to be about 10% above the cost limit to ensure a profit mark-up on projects. Discussions with project managers indicate that this figure could be an indication of a tendency to scope creep on projects, without the project sales value increasing along with it.

CAE **project managers' data**, for recoverable projects only, is shown in Figure 5.2. The 14 project managers manage a total of 50 recoverable projects. These project values are not very evenly distributed between the project managers. Four project managers manage 77% of the total project sales value, with the one specific project manager managing 27% of the total value. This indicates that some individual project managers manage most of the high value customers, and therefore specific managers need to be highly skilled. They should be carefully trained in project management and customer relationship skills.

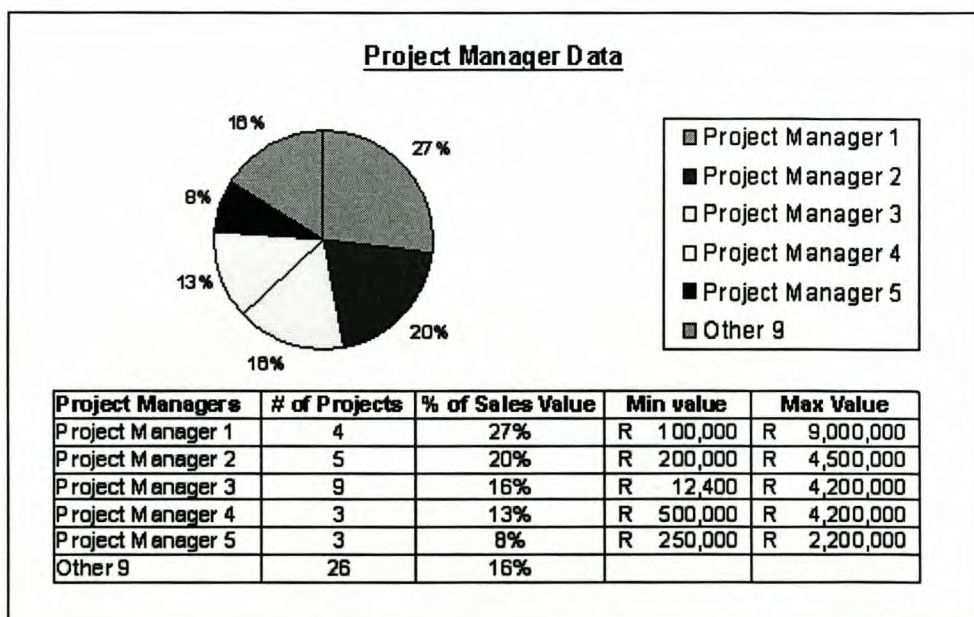


Figure 5.2 CAE Project Managers' Data

The number of projects managed by each project manager varies between 1 and 9. The average number of projects per project manager is 3,6. This is on par with the author's perception of 3 to 5 projects that are manageable per project manager, depending on the scope and uncertainty of the project. If the non-recoverable projects are added to this number, the average number of projects per project manager increases to 5,4. This value is high, and especially project managers with up to 9 projects could lose their efficiency as a result of too much changing between projects.

Project manager 3 has nine recoverable projects. The minimum and maximum sales values of these projects are R12 400 and R 4,2 million. This variance can lead to smaller projects dropping behind schedule due to lower priorities. Some of these lower priority projects can be large customers' projects, which could be detrimental to these customers' overall satisfaction with CAE. Priority of projects and allocation of projects to project managers should be carefully managed.

The **electronic timesheets data** is shown in Figure 5.3.

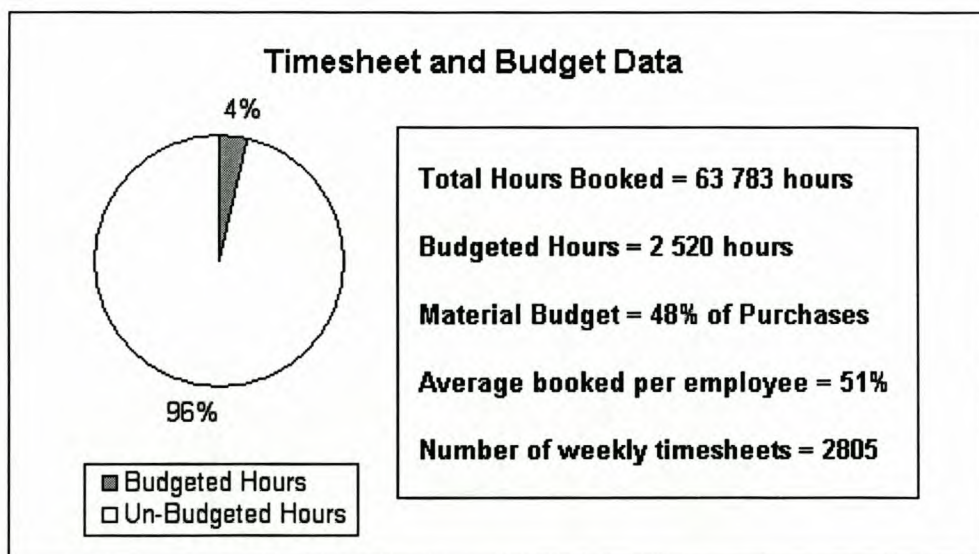


Figure 5.3 CAE Timesheet and Budget Data

The timesheet function is used by CAE. This provides the project managers with quick and accurate labour expenditure costs at the click of a button. The timesheets booked amounted to 63 783 hours. The previously used paper timesheets would have related to 2 805 weekly timesheets. The time saved by a project manager to establish the project labour cost is significant. Instead of having to work through each timesheet manually, the ERP system can make the same calculation in seconds.

CAE has not fully used the labour budgeting facility of Qmuzik. Labour budgets have been loaded for 2 projects only, and only 4% of the total hours worked have been planned for. These planned hours were in the later stages of the year of calculation and indicate that CAE has indeed started, though only recently, to use the planning and budgeting functionality. The material budget facility has also not been used to its fullest. Only 48% of all materials purchased during the year had been budgeted for, but like labour budgets, used functionality is increasing.

The average time booked per employee for the year indicates that some of CAE's employees are not required to book their time, or at least not all of their time. It could be that many employees do not work directly on projects, but fulfil an administrative role as well. This figure is therefore not expected to be 100%. An internal benchmark should be set for CAE employees to follow nevertheless.

The above analysis provides an overview of the way CAE has adapted to the new system during their first year of using it. Many possibilities for improvement still exist in the unused or ill-used functionality. If CAE can utilise this functionality in their second year of using the ERP system, the company could benefit from the ability to plan, perform, control and measure project progress and status all the time.

#### 5.1.4. Answers to CAE Requirements

Many of the ERP-related project management needs, requirements and problems defined by CAE employees, were addressed. The problems listed in Section 4.2.2 are repeated in Table 5.1. In each case an indication is given as to whether the problem is ERP-related or not, whether the ERP system provides an answer to the problem, and whether CAE is at present using the available functionality to its full extent. Each area will then be described briefly.

Requirement	Classification	Possible/ Available	Used by CAE
Templates for forms and reports	ERP	Yes	Yes
Bad filing	N/A	Some	No
Conflict resolution	N/A	Some	Some
Time management	ERP	Yes	Yes
Project planning, costing and cost control	ERP	Yes	No
Project budgeting	ERP	Yes	No
Project change control	N/A	Some	No
Project priorities	ERP	Yes	No
Project progress reporting	ERP	Yes	No
Project financial status reports	ERP	Yes	Yes
Uncoordinated buying	ERP	Yes	Yes
Approval of requisitions	ERP	Yes	Yes
Reflecting overhead cost/petrol/telephones to projects	ERP	Yes	Yes
Tracking of resources and stock	ERP	Yes	No
Acceptance of quotation	N/A	Some	Yes
Resource allocation and planning	ERP	Yes	No
Manpower control	ERP	Yes	No
Electronic timesheets	ERP	Yes	Yes

Requirement	Classification	Possible/ Available	Used by CAE
Information management	ERP	Yes	Some
Do not have time for project planning, management or budgeting	N/A	Some	Some
Increased parking space	N/A	No	

**Yes** – It is possible with Qmuzik/CAE uses the functionality

**Some** – Some assistance is provided by Qmuzik/CAE uses some of the functionality

**No** – No assistance from Qmuzik/CAE does not use this functionality

Table 5.1 CAE Project Managers' Requirements and Answers

- **Templates for forms and reports.** Standard reports provide all project managers with data in the same format. Previously no standard was used, and little conformity was found.
- **Bad filing.** Electronic documents can be attached as external objects on Qmuzik. MS Word documents, pictures and even CAD drawings can be added to projects, parts, etc. CAE is implementing a complete file management system along with their ISO project.
- **Conflict resolution.** Data on Qmuzik is there to view. Conflict can be resolved by analysing the data on Qmuzik. This will however not solve all conflict.
- **Time management.** Timesheets and the visibility of data assist the project manager to improve on his/her time management. Paper timesheets could create 52 timesheets per employee per year, or more than 2 800 per year for CAE. To sift through these amounts of paper to create labour reports, is time consuming. (Also see *Electronic Timesheets.*)

- **Insufficient time for project planning, management or budgeting.** Refer to *Time Management* above. A project office can lighten some of the administrative burden.
- **Project planning, costing and cost control.** Material and labour budgets can be entered into Qmuzik. All expenditure is captured directly in Qmuzik and users can view data immediately. Cost control is done either automatically by the ERP system or manually by the project manager. At CAE, budgets must first be entered before the automatic option can be used. All the data is visible for manual cost control.
- **Project budgeting** is done by planning for material and labour over a monthly planning interval. Labour budgets are entered for employees or resources, i.e. designers, engineers, etc. respectively. Material budgets are loaded per type of material required, i.e. consumables, consulting, etc. As discussed previously, CAE did not really use the material or labour budgeting functionality up to now, but this is changing, with more and more managers actually starting to use it.
- **Project change control.** Changes in scope require a change in the cost limit of the project. Only the division manager can up-adjust the cost limit on programmes, providing him/her with the cost change control. Project managers must still perform scope change control to ensure that the work as planned, is performed.
- **Project priorities.** Projects can be assigned priorities on the basis of characteristics. This provides a means for indicating which project should receive the highest level of attention. From a cash flow perspective, recoverable projects should have the highest priority. In some instances, however, a non-recoverable

project, perceived to have huge returns in future, might have a high priority.

- **Project progress reporting.** Standard reports were developed to compare the actual expenditure to date with the budget. With no budgets available, these reports cannot be used.
- **Project financial status reports.** Standard reports were developed.
- **Uncoordinated buying** is terminated by giving the “buyer profile” to one employee. This employee alone can then enter purchase orders. The project managers load requisitions to state their needs. The buyer reacts to the approved requisitions and creates purchase orders.
- **Approval of requisitions.** Both the project manager (per project), and division accountant (per division) approve requisitions. The project manager controls expenditure on his/her project, and the division accountant controls company cash flow.
- **Reflecting overhead cost/petrol/telephones back to projects.** The standard cost reports provide detail on all costs. Overhead costs of a cost centre are included in the cost centre’s employee rates as variable overhead rates. The employees’ salary and other overhead and office costs are thus distributed to the projects.
- **Tracking of resources and stock.** Requisitions can be tracked to determine the status of ordered material. Stock can be traced by using the *Supply and Demand* function within Qmuzik. In this way all movements of the specified part can be viewed.



- **Acceptance of quotation.** Accepted quotations are recognised by entering a customer order, or by releasing a quotation order that had previously been loaded. The customer order is then the project manager's mandate to perform the detailed project planning.
- **Resource allocation and planning** is done by entering labour and material budgets. The *Labour Control* report provides this information over a specified period. Employees are allocated to project activities according to the hours planned.
- **Manpower control** can be done by planning and allocating labour resources to projects, as explained. Re-allocation can be done when new projects require critical resources presently consumed by other projects.
- **Electronic timesheets.** Timesheets are captured electronically and on a daily basis. The project manager should approve the timesheets before the journals are written. The timesheets are available and accessible in various reporting formats for the project managers' convenience. CAE employees booked almost 64 000 hours in the first year. (See *Time Management* also.)
- **Information management.** ERP systems are known for their capability to manage data. Qmuzik has greatly assisted CAE in the field of information management. All data is available, searchable and presentable to indicate progress or performance and to execute future planning.
- **Parking.** This issue cannot be resolved within an ERP system.

The business model has provided structured business processes for employees to perform their daily tasks. While these daily tasks are

performed on Qmuzik, transaction data is captured and stored in the company database. No recapturing of transaction data is required. Data can be viewed by all users, provided the necessary profiles are given.

## 5.2. **Recommendations**

Considering all the data provided in Section 5.1, the following recommendations could be made in order to benefit CAE during their second year of using the ERP system:

- **Establishment of a project office.** The project office could assist the project managers with project administration. This would enable the project manager to focus on the technical project management issues. Employees in the project office are dedicated specifically to project administration. An experienced project manager in the CAE project office could make a huge difference in the assistance given to other project managers. The project office could also assist the project managers with project planning and budgeting. The bulk of the functionality not used by CAE, as mentioned in Table 5.1, could be achieved by establishing a project office.
- **Assigning project priorities.** Criteria should be defined to identify the priority of each project. A structure with five different priority levels is suggested. Project-related criteria to be considered and weighed are:
  - Whether a project is recoverable or not;
  - The customer priority;
  - The project sales value, and
  - The future benefit from the project.

The weight of each project criterion will be company specific, and could vary during a company's life cycle.

- **Assigning Project Managers.** The author's perception of the number of simultaneous projects a project manager can manage successfully, is somewhere between three and five, depending on the size and complexity of the relevant project. Discussions with various experienced project managers have confirmed this perception to be acceptable. In the case of the project manager who is currently managing nine projects, the number of projects should be reduced. Too much time could be lost each time attention is switched to another project. A project manager with more than five projects at any one stage could neglect some or all of them. At present the average number of recoverable projects per project manager is 3,6. The average number of projects per project manager for all types of projects is 5,4. The project office could reduce the administrative burden to make this high number of projects more acceptable.
- **Choosing projects.** At present the largest project constitutes 15% of the total sales value, while the largest customer is responsible for 23% of the total project values. A single large project that generates a huge percentage (>50%) of total company revenue could cause financial problems, should the project be terminated, or should the customer fail to pay debts. CAE should remember this with all new projects that are accepted. Furthermore, the dependency on one customer could place CAE in an undesirable position. Projects with a value that is too large, could jeopardise the level of service to other existing customers. In a research and development environment it is sometimes desirable for an SME to focus on recoverable projects that would improve the cash flow situation. At other times the opportunity should be exploited to use extra cash for new development and thereby to increase potential future sales.

- **Cash flow.** Qmuzik provides CAE with the benefit of controlling the company's cash flow. This control should be used to ensure that high priority recoverable projects are not terminated as a result of a lack of funds. Project managers should maintain tight control over all expenditure on all projects. They should prioritise projects so as to reflect the perceived return on the project and should also revise priorities regularly. This would provide project managers with the necessary guidelines regarding the amount of resources to be allocated per project at any time.

Many small companies do not have the necessary infrastructure and they therefore rely on manual planning and controlling methods. CAE should budget for time and material, should draw activity schedules and should perform financial planning for invoicing of project deliverables. The controlling of actual expenditure against a well-developed budget is any project manager's dream.

### **5.3. *Conclusion to Bigger Project***

The primary implementation at CAE was completed and the project signed off successfully. CAE has been using Qmuzik for just over a year now and has completed its first year-end. Some of the results were shown in Section 5.1

The implementation methodology was defined, templates were compiled and the project team is ready for the first secondary implementation. This implementation was scheduled to take place at the Global Competitiveness Centre (GCC). The criteria defined in Section 1.2.9 were measured and the criteria match for the GCC is shown in Table 5.2

<b>Nr.</b>	<b>Criteria</b>	<b>GCC Specifications</b>	<b>Met [Y/N]</b>
1	10 – 250 employees	12 employees	Y
2	Annual Turnover >= R10m ( < R400m)	Approaching R10m	Y
3	Project-driven	The GCC has three cost centres with projects ranging from 3 days to 18 months	Y
4	Technology-friendly	The GCC is open to technology. It uses various software applications and the company can be seen as extremely technologically friendly.	Y
5	Stand alone enterprise	The GCC functions as cost centre of the University of Stellenbosch. This should remain as is for the near future.	N
6	Accept Business Models	Due to criterion 5 this cannot be completely met for all business areas.	N
7	Accept Reports	Due to criterion 5 this cannot be completely met for all business areas.	N
8	IT Infrastructure	The GCC has a LAN with sufficient hardware and an IT manager.	Y
9	R300 – 600 k	The GCC jointly developed the methodology. The capacity to implement is thus in-house available, and most costs will be carried by using internal employees.	Y
10	Own employee availability	The capabilities of the GCC employees who are familiar with the ERP system will reduce training requirements.	Y
	<b>TOTAL</b>		<b>7 of 10</b>

Table 5.2 Criteria Match for GCC

Although the GCC meets most of the criteria defined by the project team, the feasibility study has indicated that the company should delay the implementation for an unknown period due to other company strategic measures. The GCC cannot afford to break away from the University of Stellenbosch and the university business

system at this stage. The GCC financial business area would have to be integrated between Qmuzik and the university system, and therefore the quick implementation methodology is not applicable anymore. The implementation project was postponed until the GCC is in a position to function as a stand-alone company.

#### **5.4. Conclusion**

This document has shown the generic project management business model (with inputs, processes and outputs for the project management business area) developed for a quick ERP implementation. This model should deal with the needs and requirements of the smaller business, the SME. The model was implemented on Qmuzik at CAE, but is generic enough to be used with any ERP system and in most SMEs fulfilling the requirements.

Project management reports were developed for project managers at middle management level. The reports provide management information and assist project managers in performing project control as intended by the PMBOK. These reports were developed and implemented and are successfully used by CAE project managers at present.

The two aims of this thesis, namely constructing and implementing the business model and compiling the reports, have therefore been met successfully and to the satisfaction of the user, CAE.

## REFERENCES

ASSOCIATION OF PROJECT MANAGERS. 2000. *APM Body of Knowledge (APMBOK 2000)*. Fourth Edition. G&E 2000 Limited. Fourth Edition.

BRITISH DEPARTMENT OF TRADE AND INDUSTRY. 2001. *Small and Medium Enterprise (SME) – Definitions*. [www.dti.gov.uk/SME4/define.htm](http://www.dti.gov.uk/SME4/define.htm).

BUCKHOUT, S. FREY, E. & NEMEC, J (Jr.). 1999. Making ERP Succeed: Turning Fear into Promise. *Technology*. Second Quarter. Issue 15. pp. 60-72.

BURKE, R. 1999. *Project Management: Planning and Control Techniques*. Third edition. PROMATEC International. : Cape Town

DEARDEN, J. 1972. MIS is a Mirage. *Harvard Business Review*. Harvard Business School.

DE KOCK, DJ. 2000. Business Modelling: Statement of Work. Enterprise Systems Implementation (ESi) White Paper. ESi. Pretoria.

GARTNER GROUP. 1997. *ERP Vendor Market Shares at the Turn of the Millennium*. [www.gartner.com/1\\_researchanalysis/vendor\\_rating/vr\\_main.html](http://www.gartner.com/1_researchanalysis/vendor_rating/vr_main.html).

GOLDRATT, EM & SCHRAGENHEIM, E. 2001. *Necessary But Not Sufficient: A Theory of Constraints Business Novel*. First Edition. Gower Publication Company.

KENDALL, J & KENDALL, K. 1999. *System design and Analysis*. Fourth Edition. Prentice Hall. : New Jersey.

KERZNER, H. 1995. *Project Management – A Systems Approach to Planning, Scheduling, and Controlling*. Fifth edition. Van Nostrand Reinhold Company. : New York.

PROJECT MANAGEMENT INSTITUTE (PMI). 1996. *Project Management Body of Knowledge (PMBOK)*. 1996 Edition. Automated Graphic Systems. : Maryland.

SOUTH AFRICAN DEPARTMENT OF TRADE AND INDUSTRY.

2001. *Small Enterprises*.

[http://www.gov.za/yearbook/2001/economy.html#Small Enterprises](http://www.gov.za/yearbook/2001/economy.html#Small%20Enterprises)

WHITTEN, JL & BENTLEY LD. 1998. *Systems Analysis and Design Methods*. Fourth Edition. McGraw-Hill. : Singapore.

ZWASS, V. 1992. *Management Information Systems*. Wm. C. Brown Publishers. Dubuque. : USA.



## BIBLIOGRAPHY

ASSOCIATION OF PROJECT MANAGERS. 2000. *APM Body of Knowledge* (APMBOK 2000). Fourth Edition. G&E 2000 Limited. Fourth Edition.

ASSOCIATION OF PROJECT MANAGEMENT. [www.apm.org.uk](http://www.apm.org.uk).

BOTHA, JP. 1991. Die Sastech Bestuursinligtingstelsel: 'n Verkennende Studie wat lei tot 'n Konseptuele Totale Stelsel. MEng thesis. University of Stellenbosch, Stellenbosch.

BRITISH DEPARTMENT OF TRADE AND INDUSTRY. 2001. *Small and Medium Enterprise (SME) – Definitions*. [www.dti.gov.uk/SME4/define.htm](http://www.dti.gov.uk/SME4/define.htm).

BUCKHOUT, S. FREY, E. & NEMEC, J (Jr.). 1999. Making ERP Succeed: Turning Fear into Promise. *Technology*. Second Quarter. Issue 15. pp. 60-72.

BURKE, R. 1999. *Project Management: Planning and Control Techniques*. Third edition. PROMATEC International. : Cape Town

*Has ERP Expired?* 1999. COMPUTER BUSINESS REVIEW, December, pp 12-16.

DAVENPORT TH. 1998. Putting the Enterprise into the Enterprise System, *Harvard Business Review*. July. pp. 121-131. Harvard Business School.

DEARDEN, J. 1972. MIS is a Mirage. *Harvard Business Review*. Harvard Business School.

DE KOCK, DJ. 2000. Business Modelling: Statement of Work. Enterprise Systems Implementation (ESi) White Paper. ESi. Pretoria.

ERP.COM. [www.erp.com](http://www.erp.com).

FERTUCK, L. 1995. Systems Analysis and Design with Modern Methods. *Business and Educational Technologies*. Dubuque. USA.

GARTNER GROUP. 1997. *ERP Vendor Market Shares at the Turn of the Millennium*.

[www.gartner.com/1\\_researchanalysis/vendor\\_rating/vr\\_main.html](http://www.gartner.com/1_researchanalysis/vendor_rating/vr_main.html).

GOLDRATT, EM & SCHRAGENHEIM, E. 2001. *Necessary But Not Sufficient: A Theory of Constraints Business Novel*. First Edition. Gower Publication Company.

GOUSSARD, RJ. 2001. Evaluation of Product Design and Manufacturing Support offered by Three Different Software Applications. MEng thesis. University of Stellenbosch. Stellenbosch

GREER, M. 1999. *The Manager's Pocket Guide<sup>TM</sup> to Project Management*. HRD Press. : Massachusetts.

KENDALL, J & KENDALL, K. 1999. *System Design and Analysis*. Fourth Edition. Prentice Hall. : New Jersey.

KERZNER, H. 1998. *Project Management Workbook*. Sixth Edition. John Wiley & Sons Inc. : New York.

KERZNER, H. 1995. *Project Management – A Systems Approach to Planning, Scheduling, and Controlling*. Fifth edition. Van Nostrand Reinhold Company. : New York.

LIN, F-R, YANG, M-C & PAI, Y-H. 2002. A Generic Structure for Business Process Modelling. *Business Process Management Journal*. Volume 8. No. 1. pp. 19-41. MCB UP Limited.

MEREDITH, JR & MANTEL, SJ. 1995. *Project Management: A Managerial Approach*. Third Edition. John Wiley & Sons Inc. : New York.

OLIVIER, MK. 1998. Investigation of the Application of Integrated Project Management Software and Enterprise Modelling in a Project-driven Enterprise. MEng thesis. University of Stellenbosch. Stellenbosch

PROJECT MANAGEMENT INSTITUTE (PMI). 1996. *Project Management Body of Knowledge (PMBOK)*. 1996 Edition. Automated Graphic Systems. : Maryland.

PROJECT MANAGEMENT INSTITUTE (PMI). [www.pmi.org](http://www.pmi.org).

QMUZIK. [www.qmuzik.com](http://www.qmuzik.com).

SALVENDY, G. 1992. *Handbook of Industrial Engineering*. Second Edition. John Wiley & Sons Inc. : New York.

SAP. [www.sap.com](http://www.sap.com).

SHTUB, A. 1999. *Enterprise Resource Planning (ERP): The Dynamics of Operations Management*. Kluwer Academic Publishers. USA.

SOUTH AFRICAN DEPARTMENT OF TRADE AND INDUSTRY. 1995. *National Strategy for the Development and Promotion of Small Business in South Africa*.  
[www.polity.org.za/govdocs/white\\_papers/smallbiz.html](http://www.polity.org.za/govdocs/white_papers/smallbiz.html).

SOUTH AFRICAN INSTITUTE OF CHARTERED ACCOUNTANTS.  
*General Accepted Accounting Principles (GAAP)*. [www.saica.co.za](http://www.saica.co.za).

TAM, ASM, CHU, LK & SCULLI, D. 2001. Business Process Modelling in Small- to Medium-sized Enterprises. *Industrial Management & Data Systems*. 101/4. pp. 144-152. MCB University Press.

TURBAN, E, MCLEAN, E & WETHERBE, J. 1996. *Information Technology for Management: Improving Quality and Productivity*. John Wiley & Sons Inc. : New York.

TURNER, JR. 1999. *The Handbook of Project-Based Management*. Second Edition. McGraw-Hill. : London.

UNIVERSITY SYNERGY PROGRAM. [www.university-synergy.net/](http://www.university-synergy.net/).

WATSON, HJ, HOUDSHEL, G & RAINER, RK. 1997. *Building Executive Information Systems and other Decision Support Applications*. John Wiley & Sons Inc. : New York.

WHITTEN, JL & BENTLEY LD. 1998. *Systems Analysis and Design Methods*. Fourth Edition. McGraw-Hill. : Singapore.

ZWASS, V. 1992. *Management Information Systems*. Wm. C. Brown Publishers. Dubuque. : USA.

**APPENDICES**

- A. *Business Process Modelling in ERP Implementation***
- B. *PM Models***
- C. *AS-IS Reports***
- D. *TO-BE Reports***
- E. *TO-BE Report Examples***

# APPENDIX A – BUSINESS PROCESS MODELLING IN ERP IMPLEMENTATION

## 1 *Introduction*

ERP implementation is a process where an existing information system is implemented in a business. Business process modelling is the stage in this process where the mapping between the business processes embedded within the existing ERP system and the processes as executed within the company are done. The aim is to provide a best-fit match, if a perfect match is not possible, between these two existing business processes.

A business process modelling exercise is done in order to ultimately provide customers with better business solutions.

## 2 *Stages in Business Process Modelling*

A typical business modelling exercise consists of a number of phases, being:

- AS-IS design
- AS-IS analysis
- TO-BE analysis
- TO-BE design

It may not always be necessary to do all four stages. In some instances, AS-IS design and analysis will not be applicable because it is a new organisation. In another instance, for example, TO-BE design will merely be a different view of the TO-BE analysis.

### 2.1 *The AS-IS Design Phase*

The aim of the AS-IS design phase is to understand the customers' business. In other words, *how* they perform their everyday tasks in the workplace, including all controls and decision-making processes.

This phase can be modelled with pictures, photos, slide shows, videos or any other visual and/or verbal method.

## **2.2 *The AS-IS Analysis Phase***

The aim of the AS-IS analysis phase is to understand the customer's core business as it operates at present. In other words, *what* they are doing to make the organisation profitable. Here all the 'design' or implementation layers are filtered out – controls, non-core events, system events and strategic events. The *core business* with the necessary dependant activities, which support this core business, is modelled.

## **2.3 *The TO-BE Analysis Phase***

The aim of the TO-BE analysis phase is to understand the customers' core business as it is going to operate in future. In other words, *what* they are going to be doing to make the organisation more profitable. Here the *new core business* with the necessary dependant activities, which support this core business, was modelled.

## **2.4 *THE TO-BE Design Phase***

The aim of the TO-BE design phase is to understand the customer's business, as they want to implement it. In other words, *how* they are going to perform their everyday tasks in the new workplace, including the design and implementation aspects of these processes.

This phase can also be modelled with pictures, photos, slide shows, videos or any other visual and/or verbal method. It is, however, most commonly modelled in the same fashion as the TO-BE analysis; presentation layers of these models can then be created for better relation to the day-to-day business.

### **3 Business Process Modelling Procedures**

A typical modelling exercise based on this methodology incorporates the following activities in all four stages (detailed or overview – depending on the customer's needs):

- Event list
- Data flow diagrams (context overview, context event, functional primitive)
- Data dictionary
- Entity relationship diagrams
- Specifications
- GAP analysis (only in TO-BE design)

Each activity is expanded on below.

#### **3.1 Event List**

As part of the business modelling, an event list must be compiled. These events assist the business modeller in creating the business models, by focussing on the core events, and not being hindered by the non-core events. The events are divided into the following categories:

##### *Strategic Events*

These are the events that change the business. It hence changes the business model as opposed to stimulating it into life. Strategic events typically originate at an organisation's competition or at the major governing body of the organisation.

##### *Business Events*

A business event is an external incident originating at the organisation's customer that places a demand to which the organisation has to respond in order to accomplish its strategic mission. These events are directly associated with revenue generation and under the discretion of outside customers.



### *Dependant Events*

Dependant events depend on at least one business event; therefore, the organisation has some measure of control over them.

### *Regulatory Events*

A regulatory event is an external incident originating at a governing body that places a demand on the organisation to which it responds in order to comply with legal requirements.

### *System Events*

A system event is an internal incident created during the design of the organisation's structure and systems in order to satisfy some aspect of technology (human or computer). A new design aspect can always change or eliminate these events.

In modelling the business, all *strategic* and *system* events are filtered out and only the core business is modelled – which are the *business*, *dependant* and *regulatory* events. Strategic events will change the way of doing business anyway, thus changing the models; in other words the activity of 'changing an existing model' is not modelled. System events contain all those controls and '*things that are so very important in our day-to-day lives*' – but have actually nothing to do with the core business of the organisation (e.g. Inventory cycle counts).

## **3.2 Data Flow Diagrams (DFD's)**

A data flow diagram (DFD) shows the flow of data through a process. It is not a step-by-step flowchart but rather a continuous flow of data in the system.

### Legends

The legend that is used to build these data flow diagrams is the choice of the customer/organisation. A few data flow diagram legend examples are shown in Table D-1.









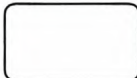
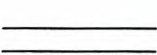
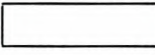


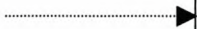




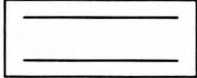
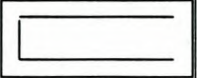




Type	DeMarco Style	Gane/Sarson Style	Customised Style
External Interface			
Data Flow			
Process			
Internal File			
Control Flow			
External Interface			
External File			
Stimulus Flow			

Table D-1 Examples of Data Flow Diagram Legends

This diagram shows three styles, the DeMarco, Gane/Sarson and the customised styles. The first two are well known and widely used

styles. Readers that are familiar with these styles should note that the customised style is the one used in this document.

### *Types of DFD's*

The first DFD that should give a *summarised* view of the organisation's core business is an *overview context level DFD* (Level 0). This diagram should show all the business events and their interaction by means of data flow.

The second DFD is a *context event level DFD* (Level 1), which will show each event as *only one process* with data flowing in and out of this process.

The context event level DFD's are broken down into *functional primitives* or detailed diagrams. This is the *lowest process level*, which can be described.

### **3.3 Data Dictionary**

The data dictionary defines the data in the business models, decomposed to the lowest level of data.

### **3.4 Entity Relationship Diagrams**

The entity relationship diagrams specify entities or objects, their attributes and their relationships to each other. This is normally used when designing a database and is optional if an organisation only wants to model business processes and not entity relationships.

### **3.5 Specifications**

The specifications in a business modelling exercise can vary from high-level descriptive meanings to detailed drawings and explanations, depending on the organisation's needs.

These are the different specifications to be done:

- Process specifications

- Data specifications
- Entity specifications
- Relationship specifications

No further detail on any of the specifications will be provided here, as it is outside the scope of this report.

### **3.6 GAP Analysis**

The GAP analysis is a process where the AS-IS models and the TO-BE models will be compared to see what the effect on the different business activities will be. This analysis will only be done in the TO-BE design stage. A GAP analysis document will then lead to compiling an action plan, which will specify what needs to be done to get from current state to future state.

The GAP analysis is a direct result from the AS-IS and TO-BE models. Although the GAP analysis results from business process modelling, it is not primarily part of this modelling exercise.

## **4 Conclusion**

Business modelling, in ERP implementation, is done on a set of techniques that are clearly divided into analysis and design blocks. These techniques were discussed in this appendix and enable event driven business modelling (*stimulus and response*) rather than flowchart driven modelling. Every event is either a stimulus for another event, or a response of a previous event.

Event driven business modelling also forces the modelling of only the core business layer of the organisation (not all the controls and policies).

## **5 Reference**

DE KOCK, D J. 2000. *Business Modelling: Statement of Work*. Enterprise Systems Implementation (ESi) White Paper. : Pretoria

## APPENDIX B – PROJECT MANAGEMENT MODELS

### 1. INTRODUCTION

Here follows the PM business models as developed for the quick ERP implementation blueprint. The business processes that are indicated as Qmuzik activities are described in a table, which are also the descriptions presented to the user on the Qmuzik *business model* function. The description assists the user in completing the business process. Underlined Italic text indicates a Qmuzik function that can or should be used to fulfil the required process. The level 0-, 1- and 2- models have little or no Qmuzik activities, and therefore little or no description is provided in the accompanying tables.

The template used in the models is shown in Figure B-1.

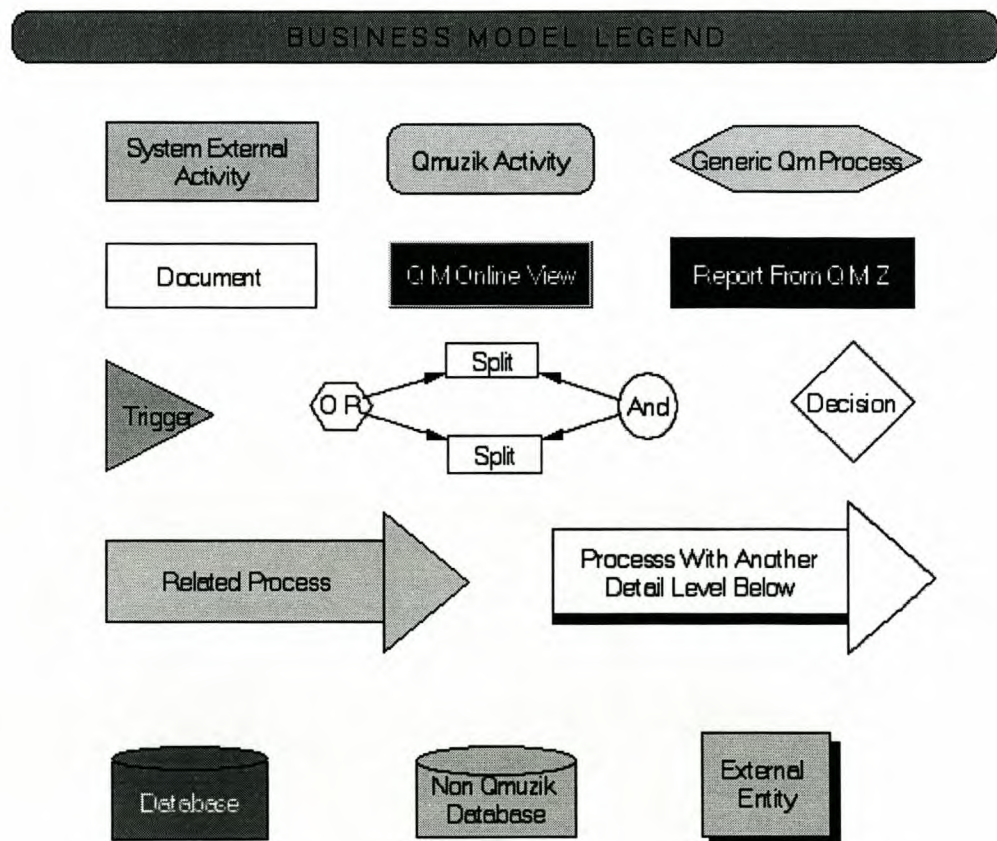


Figure B-1: The Business Model Legend Used

Subject	Notes
System External Activity	This represents a non-Qmuzik function that the user must fulfil in the business process.
Qmuzik Activity	This represents a Qmuzik function that the user must fulfil in the business process.
Generic Qmuzik Process	This represents a process, e.g. cycle counting in Qmuzik, which is a generic, automatic function in Qmuzik.
Document	An external document that acts as an input to or output of a business process.
Q M Online View	Data can be viewed on Qmuzik front-end to use as input for, or output of a business process.
Report from Q M Z	A physical report that is generated from a Qmuzik business process, and act as output of this business process, or input to another business process
Trigger	A business model entity that starts a business model process flow. The entity is labelled to be from either a periodical interval or another business model.
OR/AND Split	This entity provide for multiple options and connections in the business processes.
Decision	This entity provides the decision-making in the business process.
Related Process	This indicates another process that is triggered by the end of this process through a relation, e.g. a requisition from Project Management triggers a process in Materials Management.
Process with another Detail level below	This entity is used in the higher-level business models, and indicates that a lower level business process is lying below it.
Database	This entity represents the Qmuzik database and is labelled with the table name where data is stored during the related business process.
Non Qmuzik Database	This entity caters for data requirements in the business model not met by the Qmuzik database. The data is necessary for business model processes additional to Qmuzik functions.
External Entity	This is an entity external to the company, e.g. a customer.

Firstly the level 0 model is shown in Figure B-2. This model indicates the seven functional business areas that were decided on for the generic project management business model.

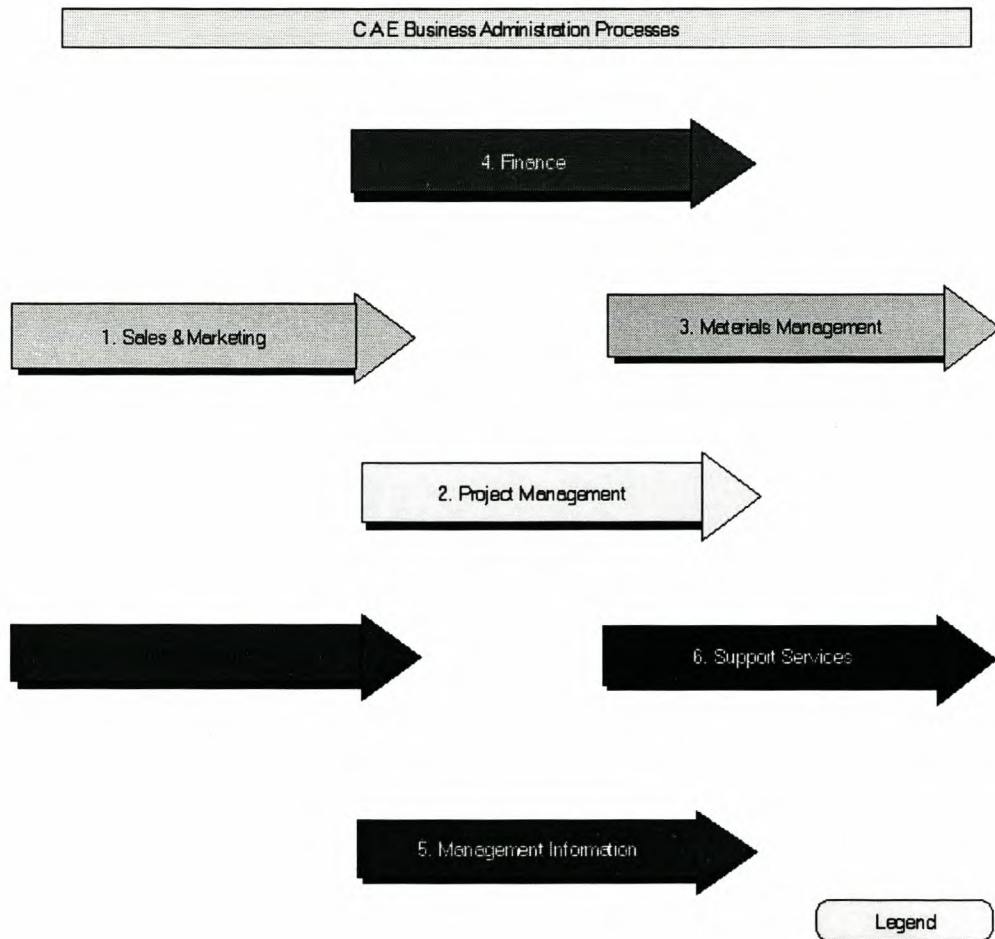


Figure B-2: Level 0 Functional Area Business Model

The only functional area that will be discussed in this appendix is project management. The model was developed in three levels, which will be shown and the key processes shortly described. . Level 1 and 2 were already briefly explained in Chapter 3.3.

The models can be used by a project driven company to perform their projects based on the advised and recognised PMBOK processes.

## 2. PROJECT MANAGEMENT

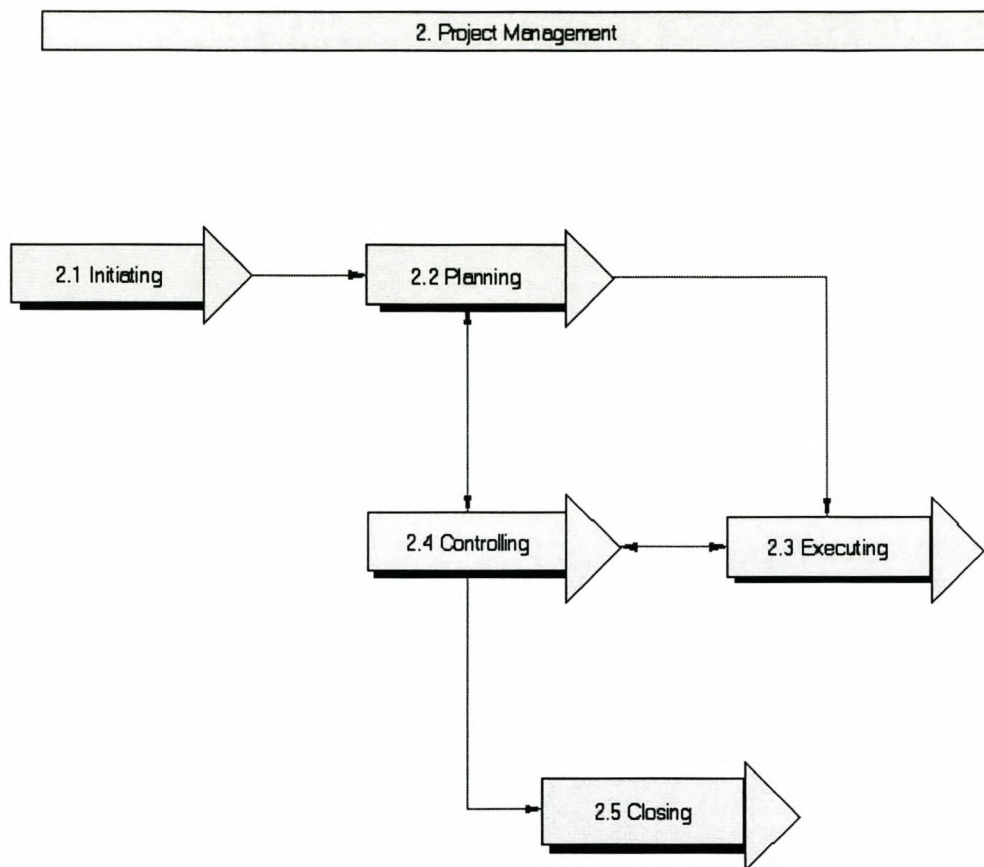


Figure B-3: Level 1 Project Management Business Model

Subject	Notes
	<i>Description already in Chapter 3.3</i>



### 2.1. Initiation

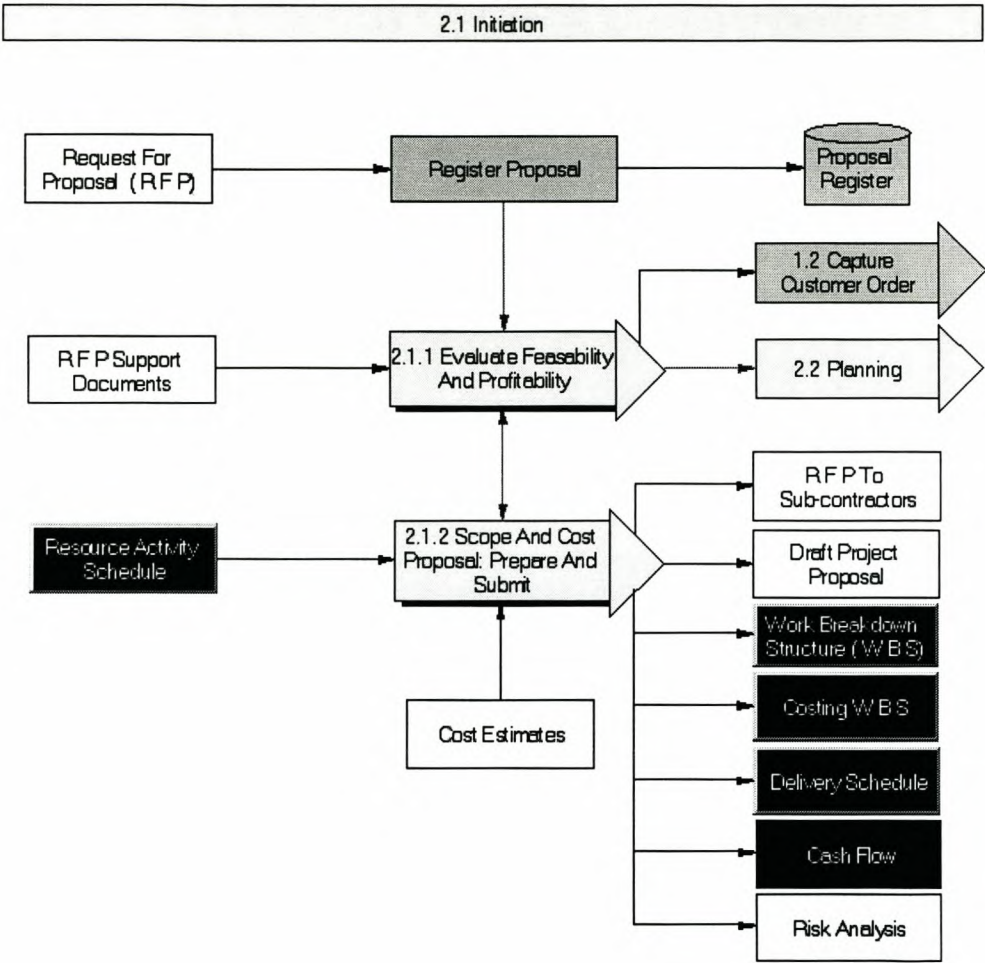


Figure B-4: Level 2 PM Business Model: Initiation

Subject	Notes
	<i>Description already in Chapter 3.3</i>

2.1.1. Evaluate Feasibility and Profitability

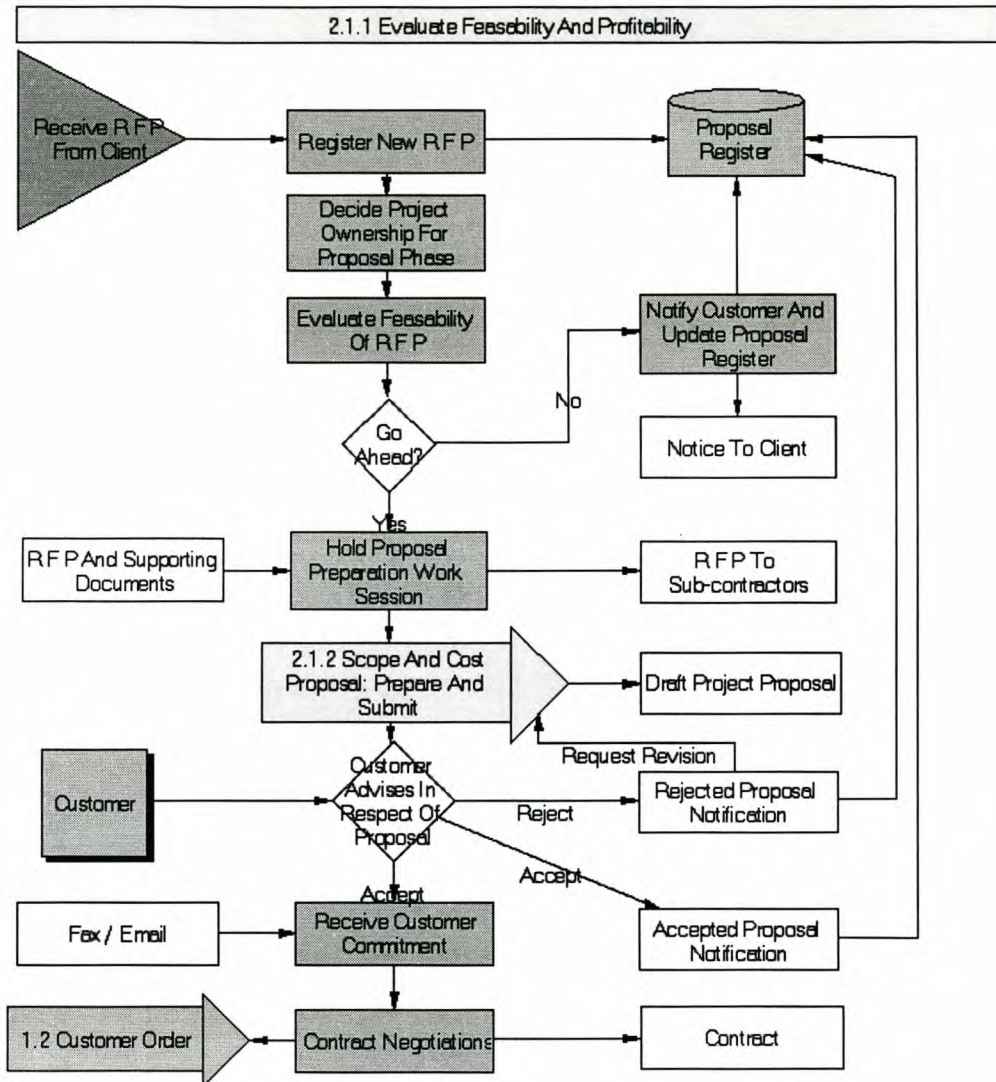


Figure B-5: Level 3 PM Business Model:  
2.1.1 Evaluate Feasibility and Profitability

Subject	Notes
	<p><i>No Qmuzik activities</i></p> <p>This diagram is for the purpose of receiving a requirement from a customer. The requirement is analysed. If the request seems viable, a proposal is compiled and submitted. The customer can either accept or reject the proposal. The company revises the proposal or enter a customer order and continue to the next step.</p>

2.1.2. Scope and Cost Proposal: Prepare and Submit

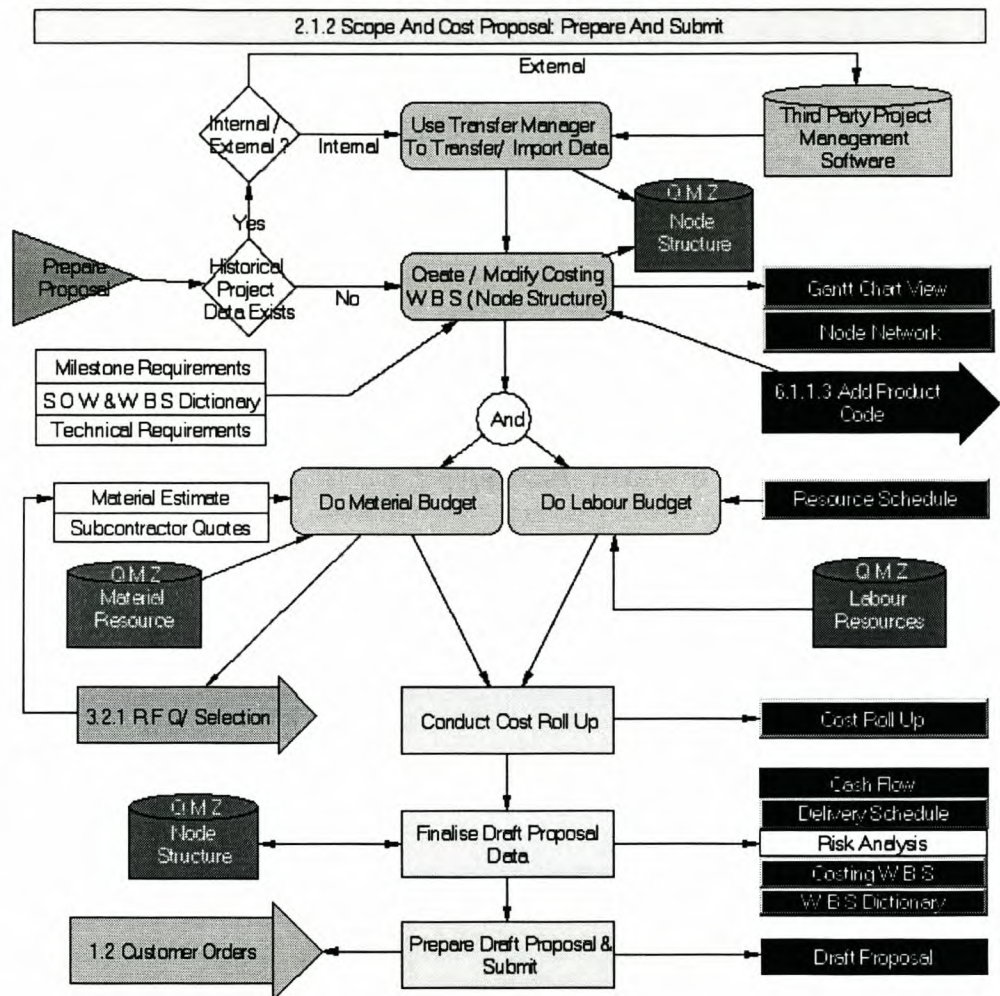


Figure B-6: Level 3 PM Business Model:

2.1.2 Scope and Cost Proposal: Prepare and Submit

Subject	Notes
	<p><i>No Qmuzik Activities</i></p> <p>In this step the company prepares a proposal to submit to the customer. A WBS is generated. Material and labour budgets are compiled. The cost is calculated and the final proposal documents submitted.</p>

## 2.2. Planning

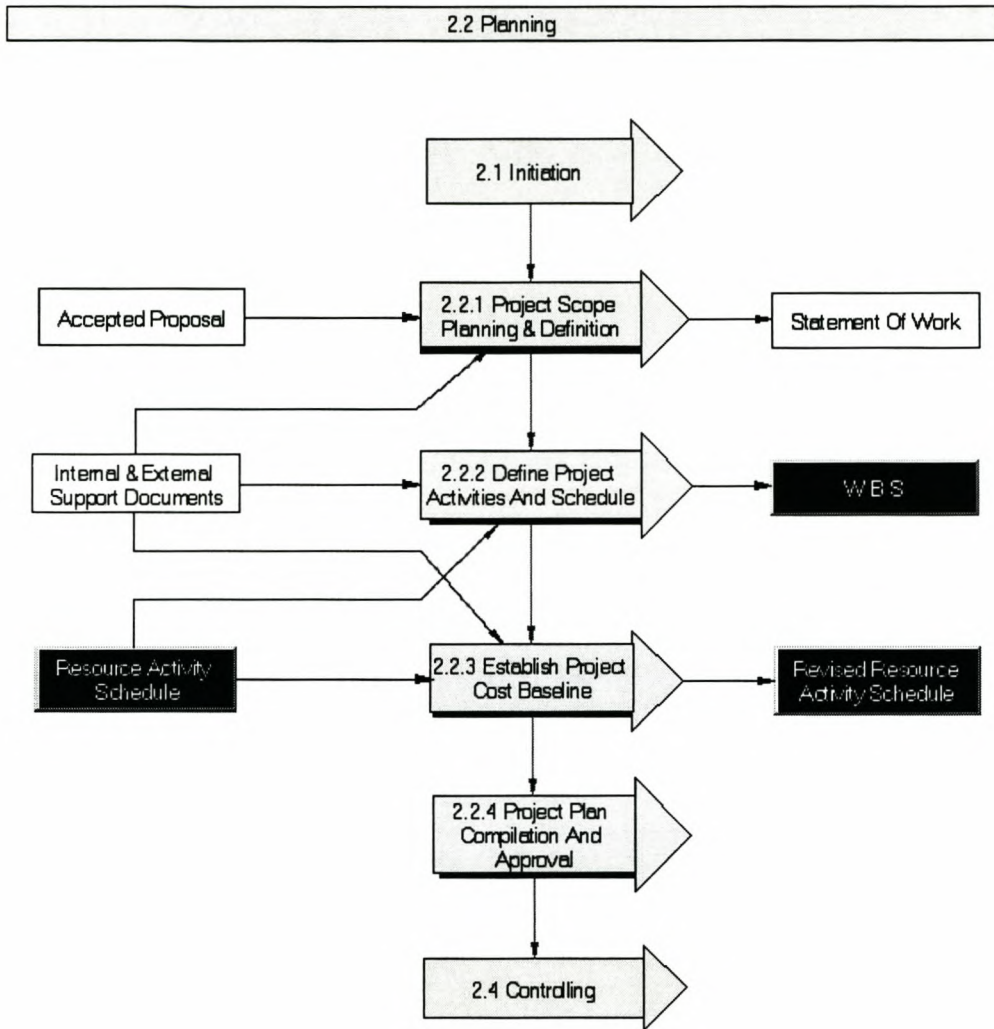


Figure B-7: Level 2 PM Business Model: Planning

Subject	Notes
	<i>Description already in Chapter 3.3</i>

### 2.2.1. Project Scope Planning and Definition

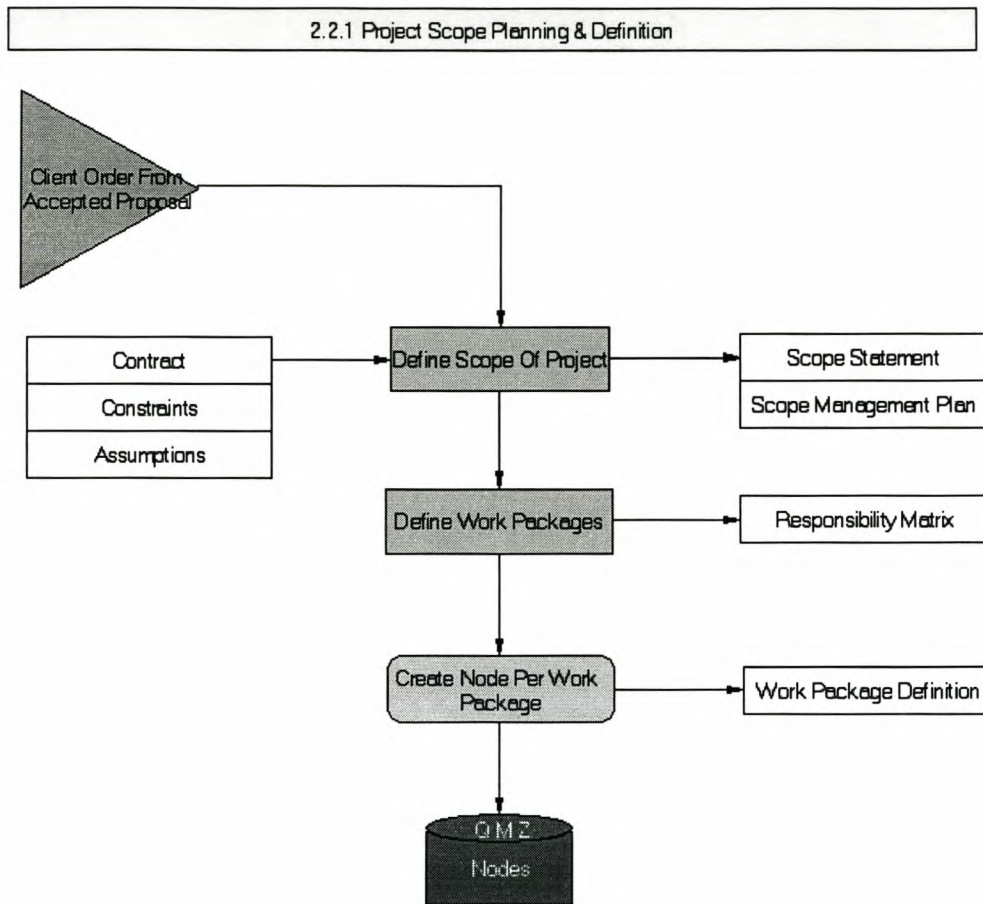


Figure B-8: Level 3 PM Business Model:  
2.2.1 Project Scope Planning and Definition

Subject	Notes
Create Node Per Work Package	Use the <u>Node</u> function to create a node in a node structure for every project activity in the WBS.

## 2.2.2. Define Project Activities and Schedule

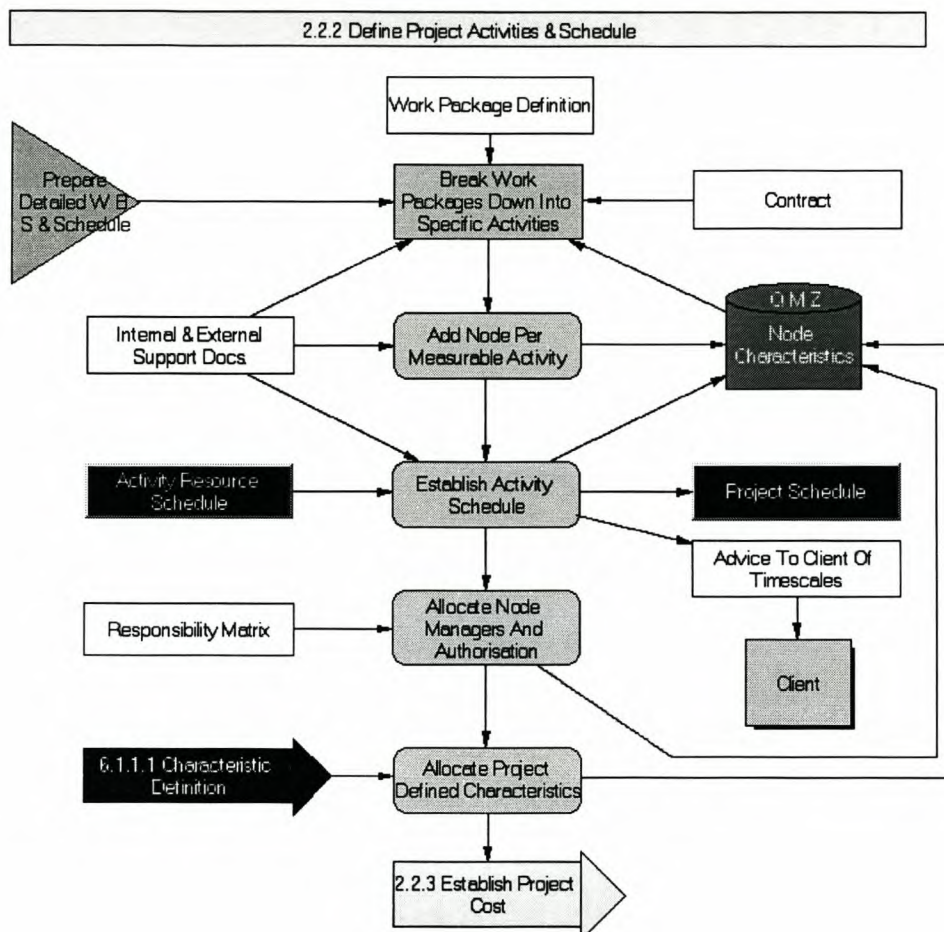


Figure B-9: Level 3 PM Business Model:  
2.2.2 Define Project Activities and Schedule

Subject	Notes
Add Node Per Measurable Activity	Use the <b><u>Node</u></b> function to add the nodes per measurable activity.
Establish Activity Schedule	Use the <b><u>Node</u></b> function to add start and end dates per defined node.
Allocate Node Managers And Authorisation	Use the <b><u>Node</u></b> function to allocate the nodes to the responsible employee(s). Adjust the financial authorisation levels per project manager.
Allocate Project Defined Characteristics	Use the <b><u>Node</u></b> function to add company specific characteristics to nodes

2.2.3. Establish Project Cost Baseline

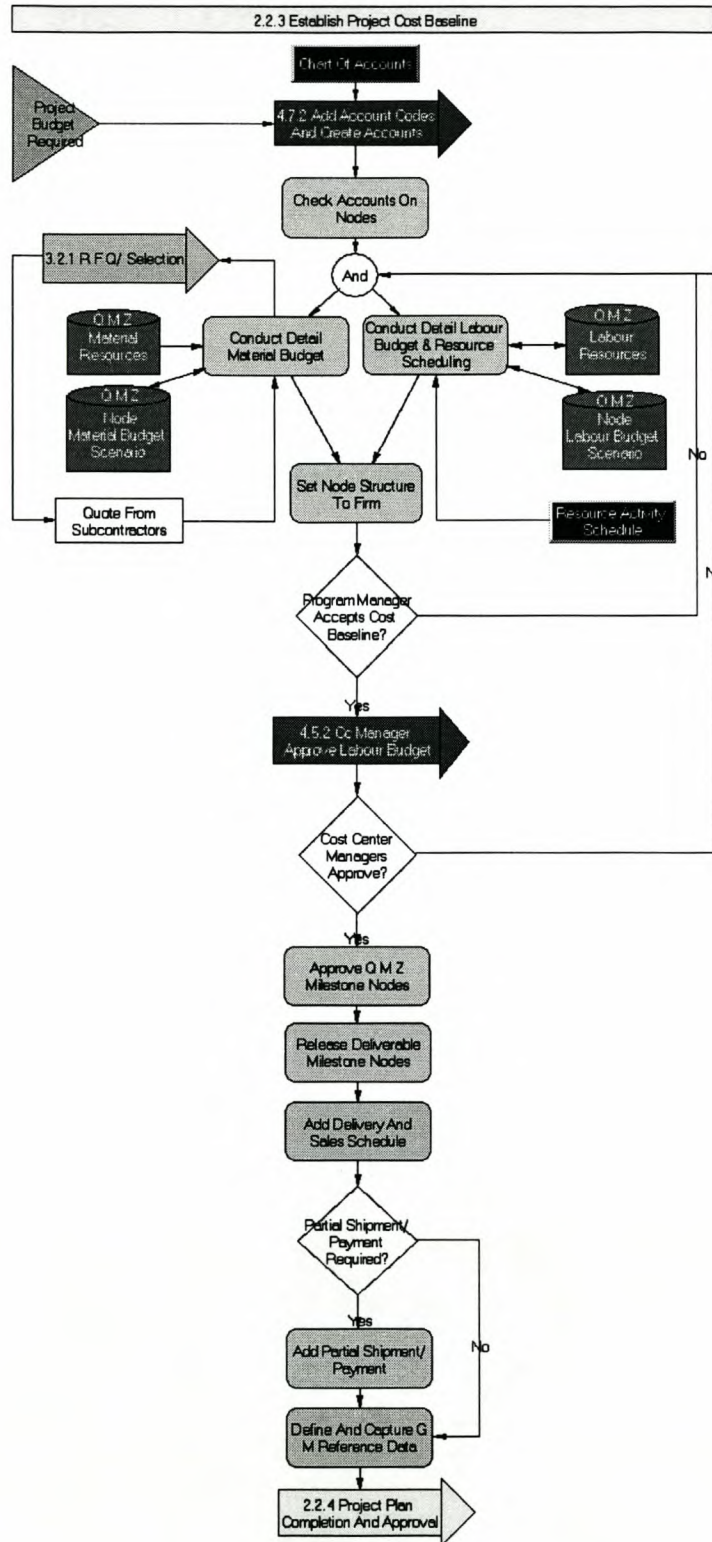


Figure B-10: Level 3 PM Business Model:  
2.2.3 Establish Project Cost Baseline

Subject	Notes
Check Accounts On Nodes	Use the <b><u>Node</u></b> function to add the accounts on every node
Conduct Detail Material Budget	Use the <b><u>Material Budget</u></b> function to calculate the material requirement for the project.
Conduct Detail Labour Budget & Resource Scheduling	Use the <b><u>Labour Budget</u></b> function to calculate the labour requirement for the project. Use the existing resource schedule to plan this project's resource schedule.
Set Node Structure to Firm	Use the <b><u>Node</u></b> function and change the node status to "Firm". This indicates to the cost centre managers that the node budget for material and labour is finished.
Approve Q M Z Milestone Node	Use the <b><u>Node</u></b> function and change the node status to "Approved". This indicates that the project planning phase are complete, and project work can commence.
Release Deliverable Milestone Nodes	Use the <b><u>Node</u></b> function and change the node status of deliverable milestone nodes to "Released". Each milestone node manager can now continue with the activities underneath their milestone.



### 2.2.4. Project Compilation & Approval

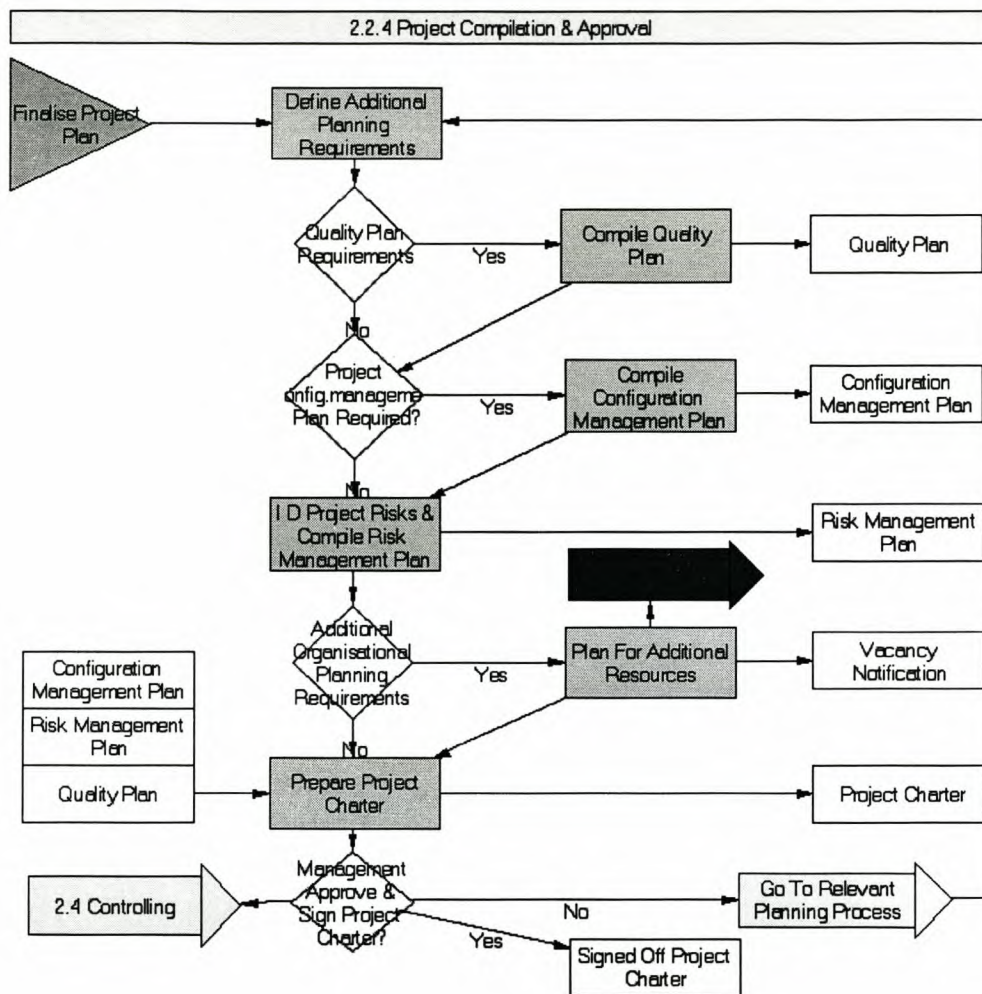


Figure B-11: Level 3 PM Business Model:  
2.2.4 Project Compilation & Approval

Subject	Notes
	<p><i>No Qmuzik activities</i></p> <p>In this step additional project planning requirements are included. The following are defined where necessary: Quality Plan, Configuration Management Plan, Risk Management Plan and Resource Plan. Finally the project charter is compiled, approved and signed off by management.</p>

### 2.3. Executing

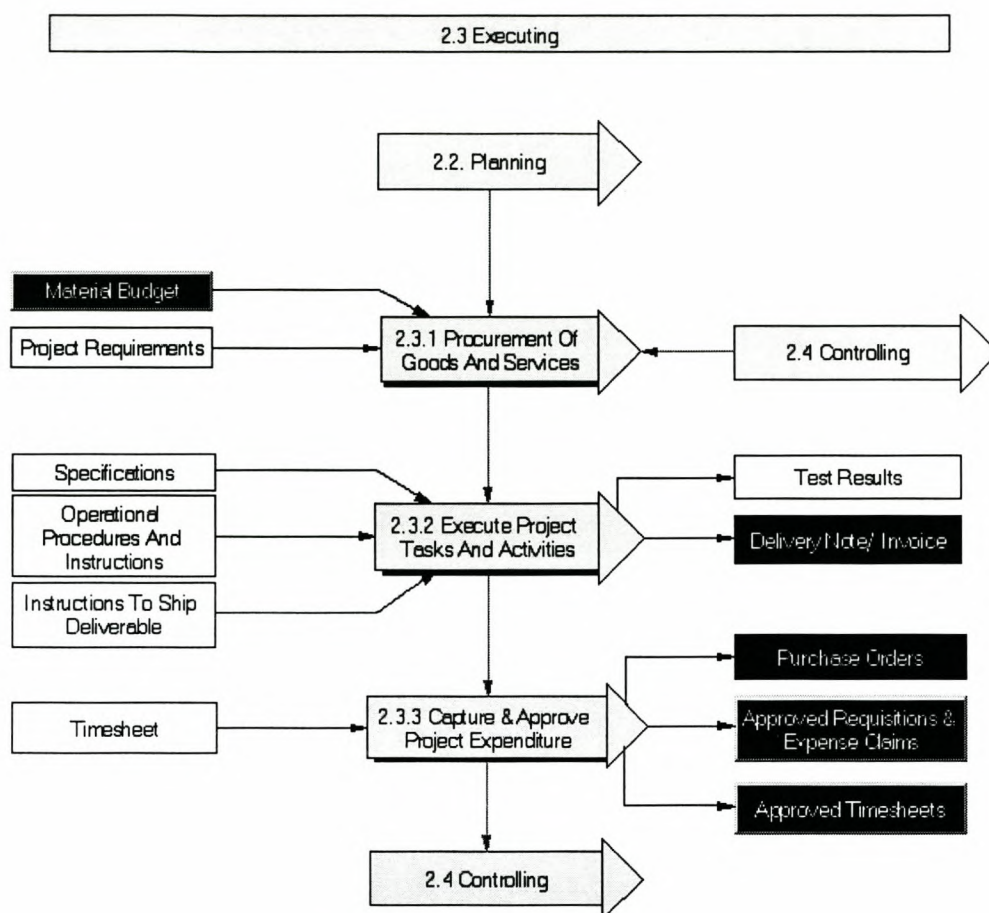


Figure B-12: Level 2 PM Business Model: Executing

Subject	Notes
	<i>Description already in Chapter 3.3</i>

### 2.3.1. Procurement of Goods

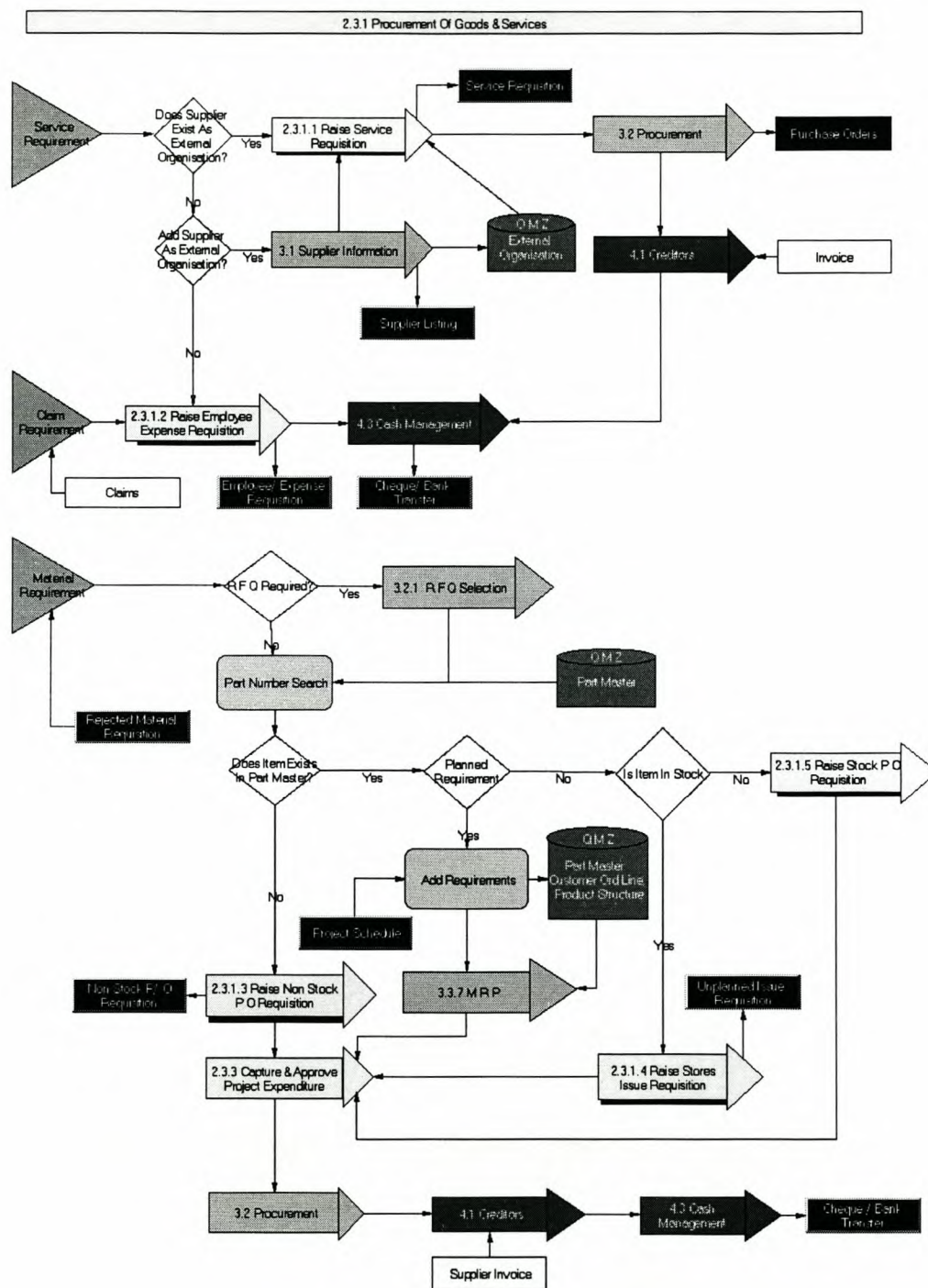


Figure B-13: Level 3 PM Business Model:  
2.3.1 Procurement of Goods

Subject	Notes
Part Number Search	<p>Use <u>Part Number</u> search to find the correct part number. At least three criteria must be selected on the first tab.</p> <p>Descriptions or part thereof and or characteristics (if linked) can be used as additional search criteria.</p>
Add Requirements	<p>Use the <u>Customer order</u> function to add a customer order line for the delivery of hardware.</p> <p>Line type must be " Customer Special ".</p> <p>Specify the relevant node.</p> <p>Enter a sales price of zero ("Sales" is handled through the " Non Stock Customer Line " of the milestone node).</p> <p>Enter bill of material parent part number and select explode "Yes".</p> <p>If bill of material does not exist go to the " Requirements " tab and add the requirements manually.</p>

### 2.3.2. Execute Project Tasks & Activities

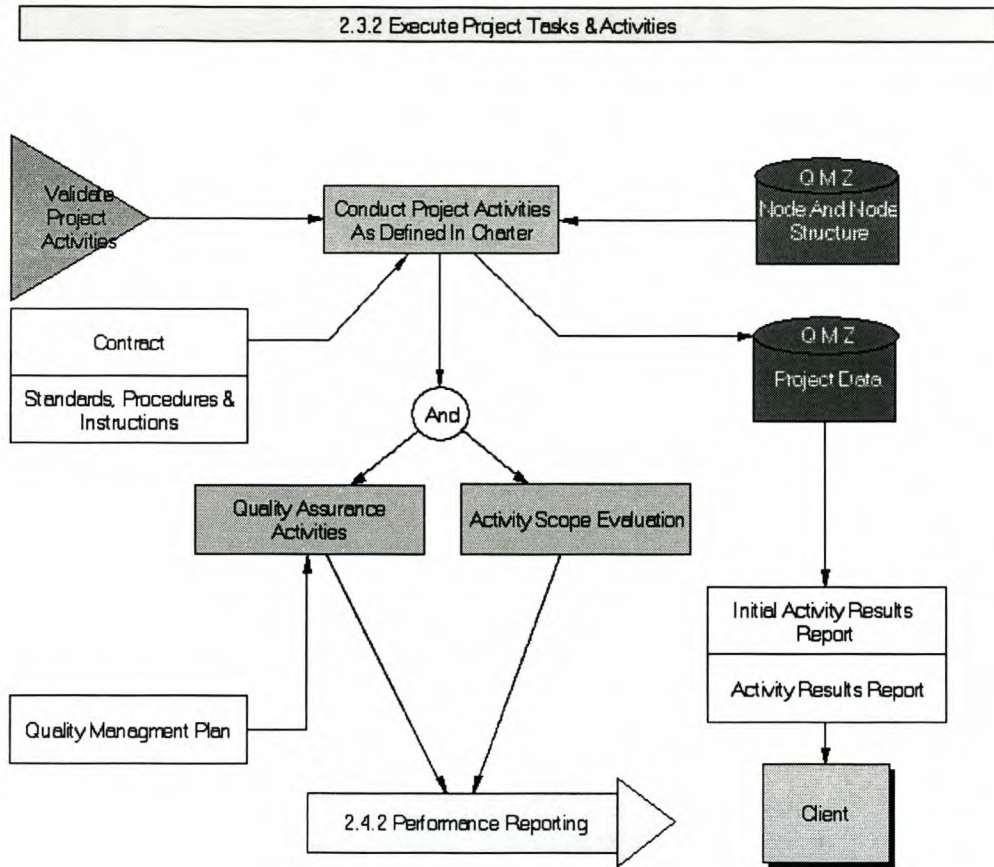


Figure B-14: Level 3 PM Business Model:  
2.3.2 Execute Project Tasks & Activities

Subject	Notes
Conduct Project Activities As Defined In Charter.	Project manager and project team are responsible for coordination of activities (technical and organizational) that will result in the creation of the intended product.
Quality Assurance Activities	These activities should be performed throughout the project, and are systematic in assuring that project satisfies the relevant quality standards.  Primary concern is for correctness of work done.
Activity Scope Evaluation	Scope evaluation ensures that the activities were completed correctly and satisfactorily. It is the process of formalizing the scope by all stakeholders.  Primary concern is for acceptance of work done.

### 2.3.3. Capture and Approve Project Expenditure

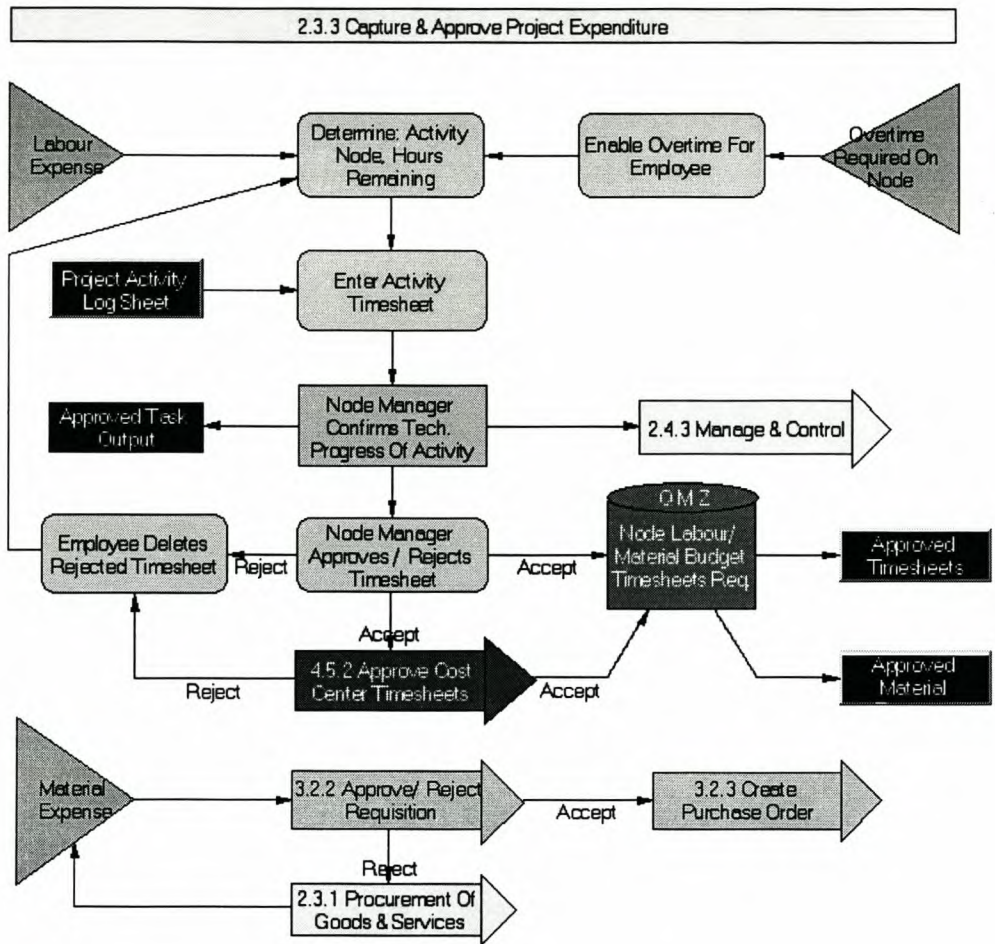


Figure B-15: Level 3 PM Business Model:  
2.3.3 Capture and Approve Project Expenditure

Subject	Notes
Determine Activity Node & Hours Remaining	User can inquire on activities available to log against and number of 'Log-Able' hours remaining using <i>Timesheet</i> function.

Subject	Notes
Enter Activity Timesheet	<p>Using the <u>Timesheet</u> function hours can be booked against a node, cost centre, resource (not equal to the specific employee) and a specific employee for a specific financial period between the node start and end dates within the node's cost limit. If a resource was selected the default labour rate on the resource will determine the rate applicable that includes the cost centre, employee and labour resource.</p> <p>A minimum of at least the labour rate has to exist</p>
Node Manager Confirms Technical Progress Of Activity	<p>These are value-adding activities established as measurable in the original project plan.</p>
Node Manager Approves / Rejects Timesheet	<p>The node manager (and/or acting employees) is prompted by mail, that employees have entered timesheets, and that they have been approved or auto approved by the cost centre manager and require node manager approval.</p> <p>The node manager uses the <u>Timesheet Approval</u> function to view and analyse such timesheets, taking note of any comments made regarding the progress of the project, and approves or rejects the timesheets accordingly.</p>
Employee Deletes Rejected Timesheet	<p>Use the <u>Timesheet</u> function to delete the rejected timesheet and re-capture the time to the correct activities.</p>
Node Manager Approve / Reject Requisition	<p>The node manager will be notified via Qmuzik mail that indicates approval required on a requisition.</p> <p>Access is either directly from the mail screen using the 'Go To' button, or else by way of the <u>Requisition</u> function.</p>

## 2.4. Controlling

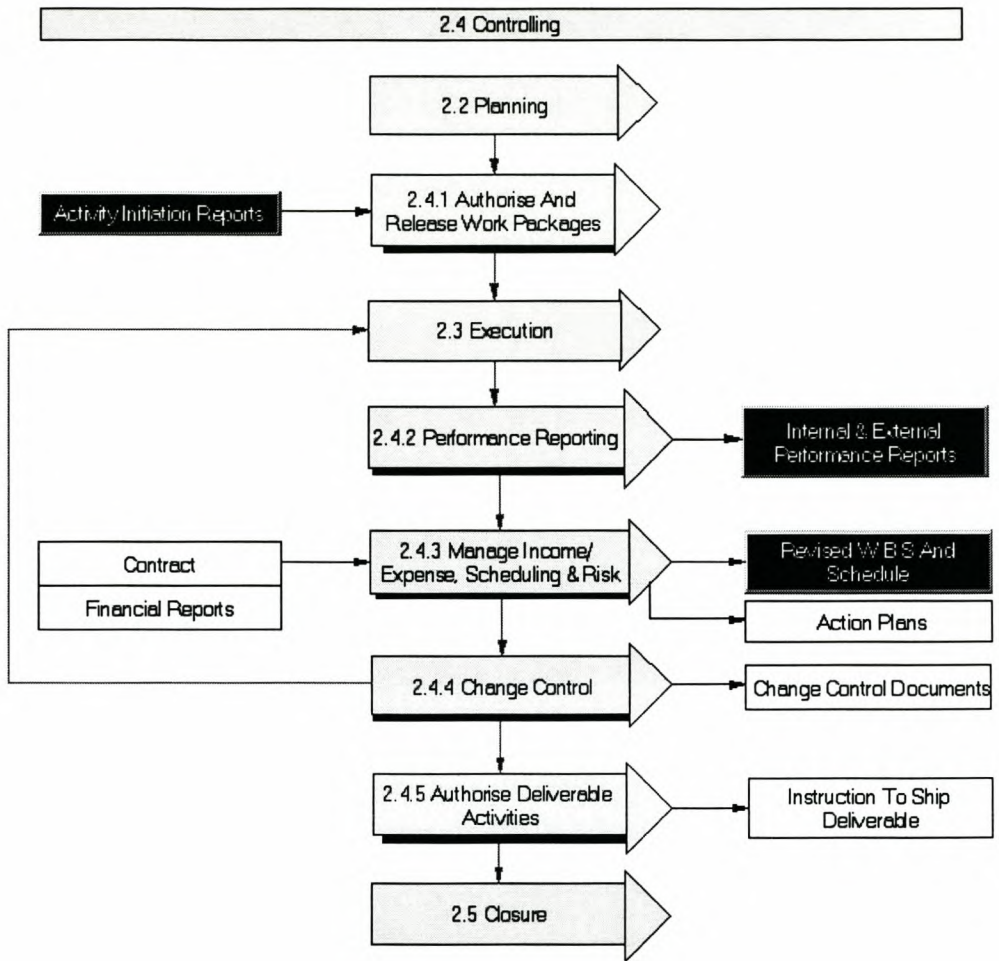


Figure B-16: Level 2 PM Business Model: Controlling

Subject	Notes
	<i>Description already in Chapter 3.3</i>



### 2.4.1. Authorise and Release Work Packages

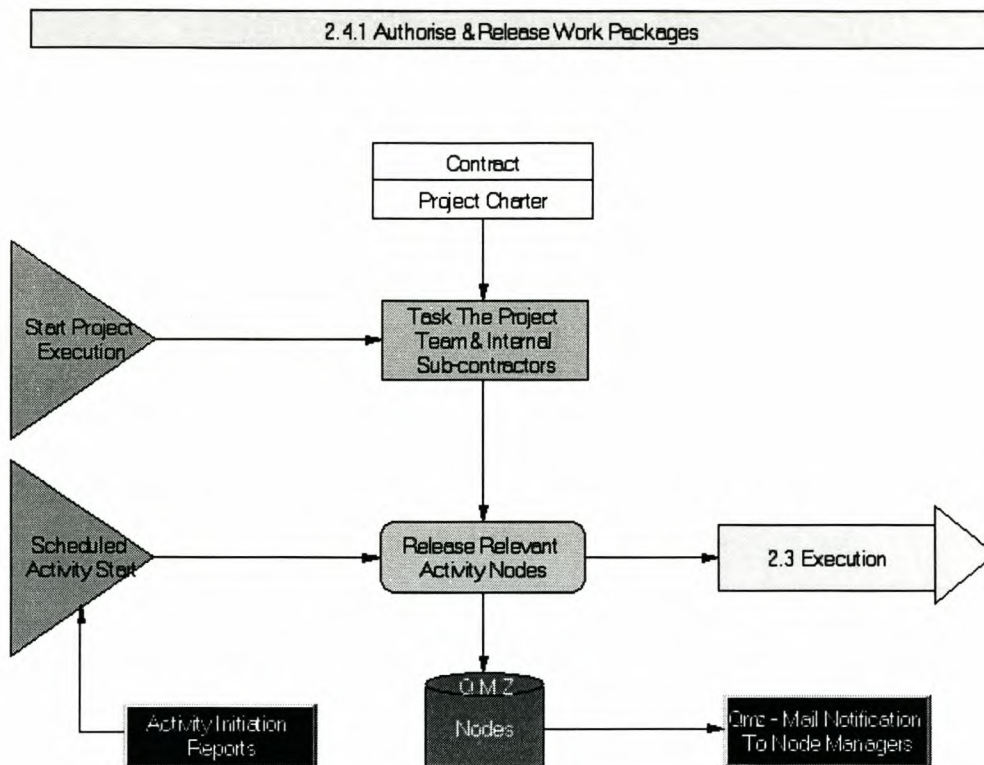


Figure B-17: Level 3 PM Business Model:  
2.4.1 Authorise and Release Work Packages

Subject	Notes
Task The Project Team And Internal Sub-Contractors	This should be a formal procedure whereby project work is sanctioned to ensure that it is done at the right time and in the right sequence.
Release Relevant Activity Nodes	The milestone node's node manager or first node manager with authority in the structure may set the milestone node's status to Released "R".  When setting a node's status to Released "R", then that node's milestone node must also be Released "R" or In-process "I".

2.4.2. Performance Reporting

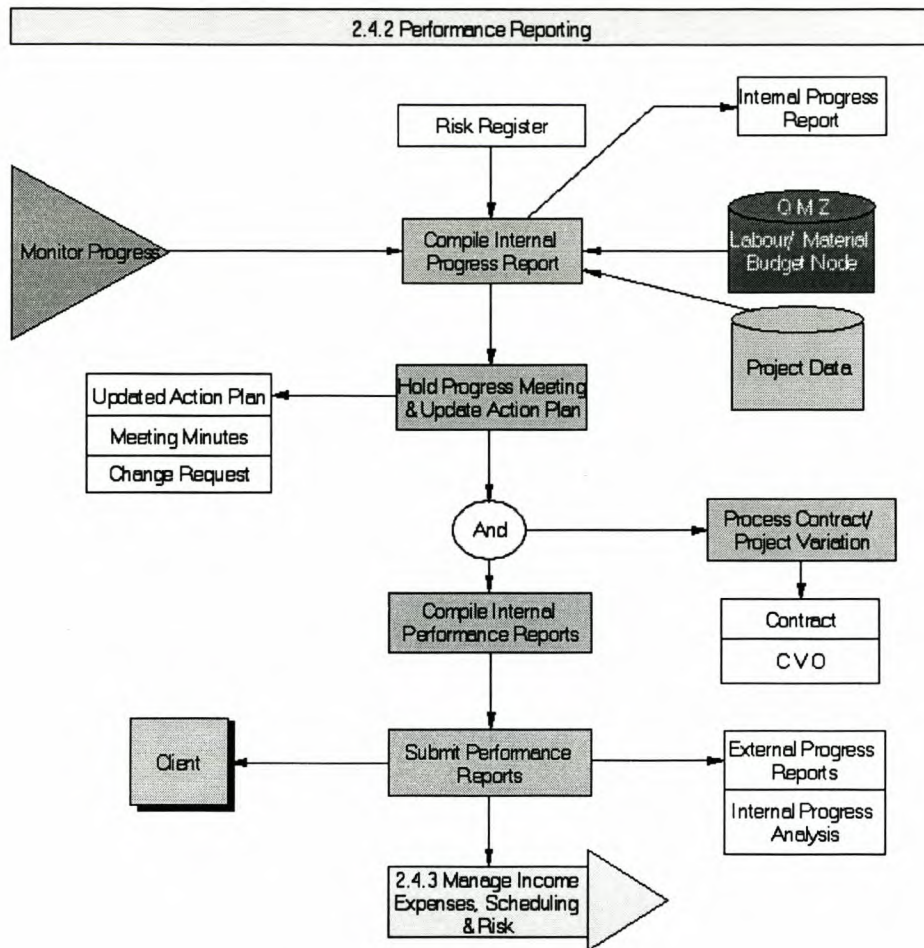


Figure B-18: Level 3 PM Business Model:  
2.4.2 Performance Reporting

Subject	Notes
Compile Internal Progress Report	This must include information on project scope, schedule, cost and quality. In addition risk and procurement analysis should also be included where available.
Hold Progress Meeting & Update Action Plan	Assess project progress and status. An analysis is made of project trends, variances and value added.
Compile Performance Reports	These reports organise and summarize the information gathered during progress compilation and the progress meeting.

### 2.4.3. Manage Income/Expenses, Scheduling and Risk

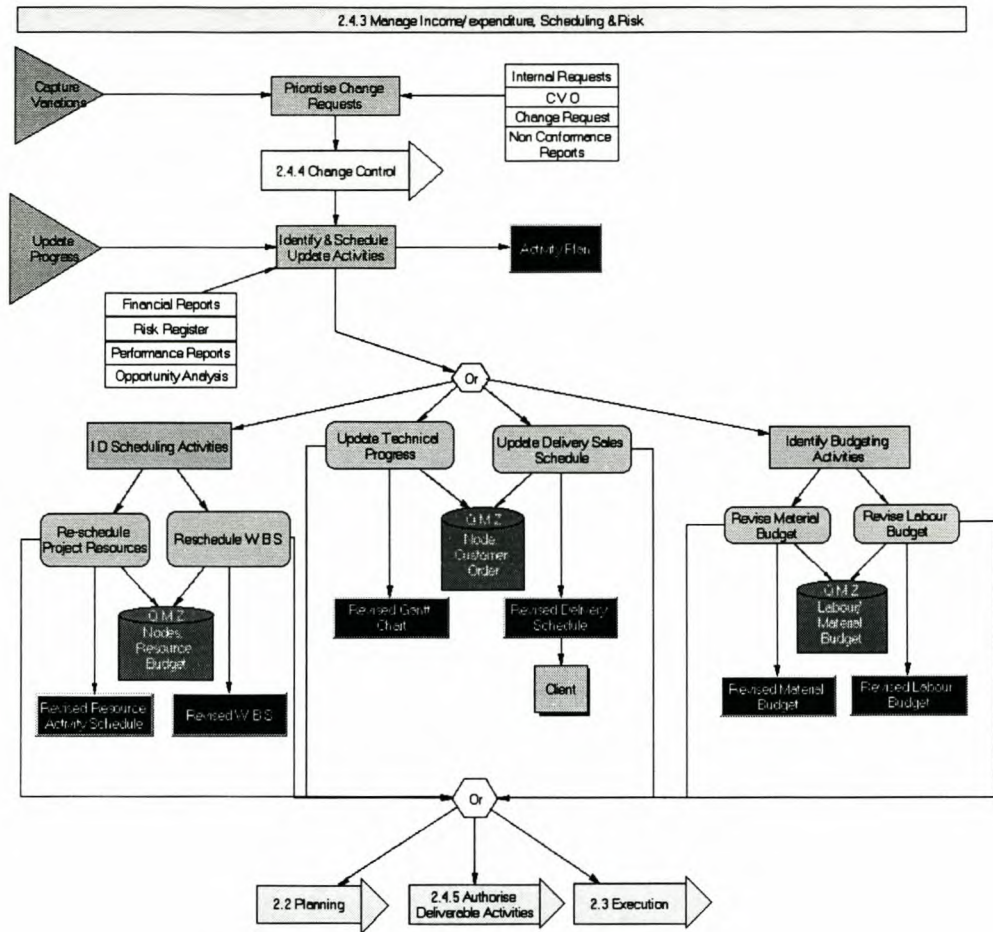


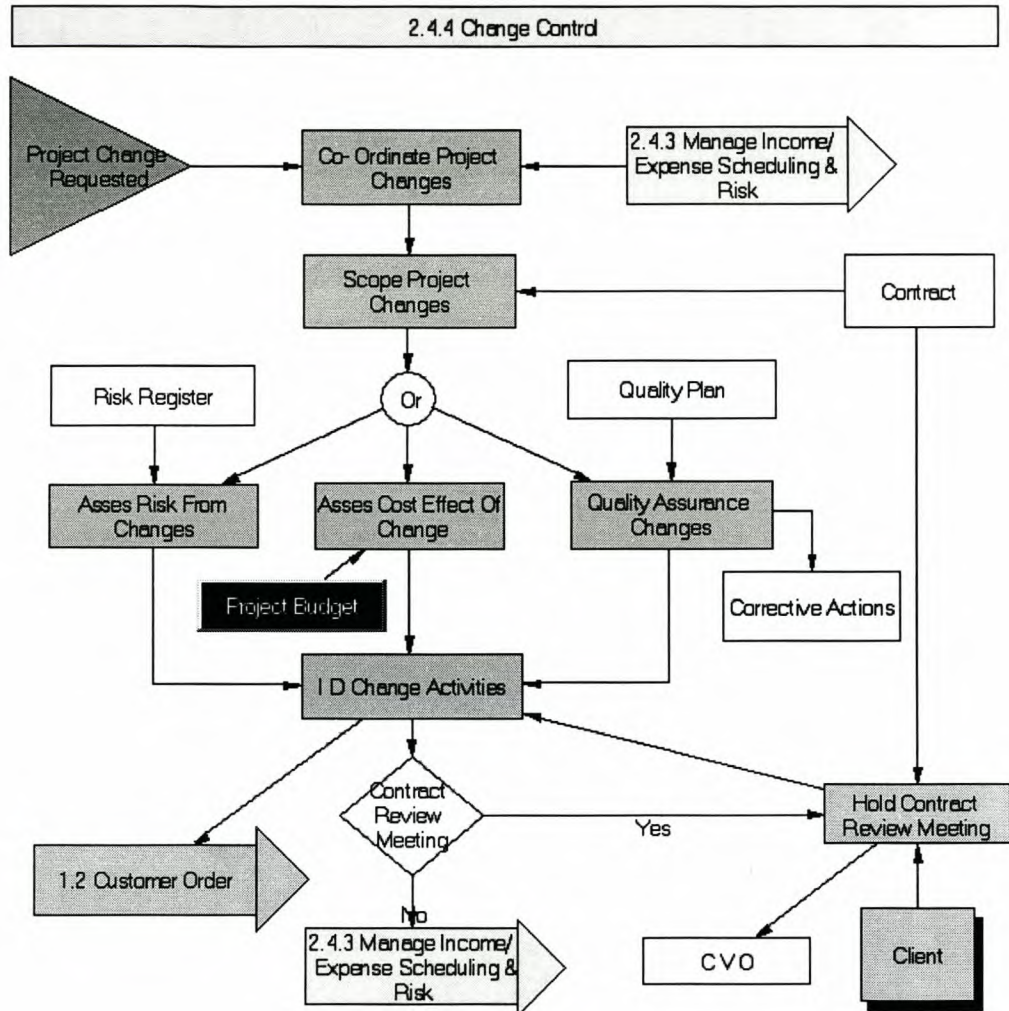
Figure B-19: Level 3 PM Business Model:

#### 2.4.3 Manage Income/Expenses, Scheduling and Risk

Subject	Notes
Prioritise Change Requests	Evaluate change requests to ensure they are beneficial and/or essential. This relates to scheduling, costing, contractual issues etc.
Identify And Schedule Update Activities	These must be carried out with the correct approval levels and necessary authorizations.
Re-Schedule Project Resources	Use the <b>Node</b> function and <b>Labour budget</b> to modify relevant labour budgets.

Subject	Notes
Reschedule The WBS	Reschedule the WBS using: <ol style="list-style-type: none"> <li>1. Third party software (MS Project, PS8 Etc.) and then <b><u>Node</u></b> function and/or node structure overview.</li> <li>2. Directly in <b><u>Node</u></b> function and/or <b><u>Node Structure Overview</u></b>.</li> </ol>
Revise Labour Budget	Use <b><u>Labour Budget</u></b> function to revise the labour budget.
Revise Material Budget	Use <b><u>Material Budget</u></b> function to revise the material budget.
Update Technical Progress	Update the percentage complete field on the <b><u>Node</u></b> function to indicate technical progress.
Update Delivery Sales Schedule	Use the <b><u>Customer Orders</u></b> function to modify customer order line according to the revised delivery schedule.

**2.4.4. Change Control**



**Figure B-20: Level 3 PM Business Model:  
2.4.4 Change Control**

Subject	Notes
Co-Ordinate Project Changes	Schedule and allocate changes to the relevant responsible and approval authorities.
Scope The Project Changes	Responsible persons to analyse and evaluate inputs and activities required producing the required output. Document them accordingly.
Assess & Assure	Ensure risks are evaluated, cost limits maintained and quality not jeopardized.

### 2.4.5. Authorise Deliverable Activities

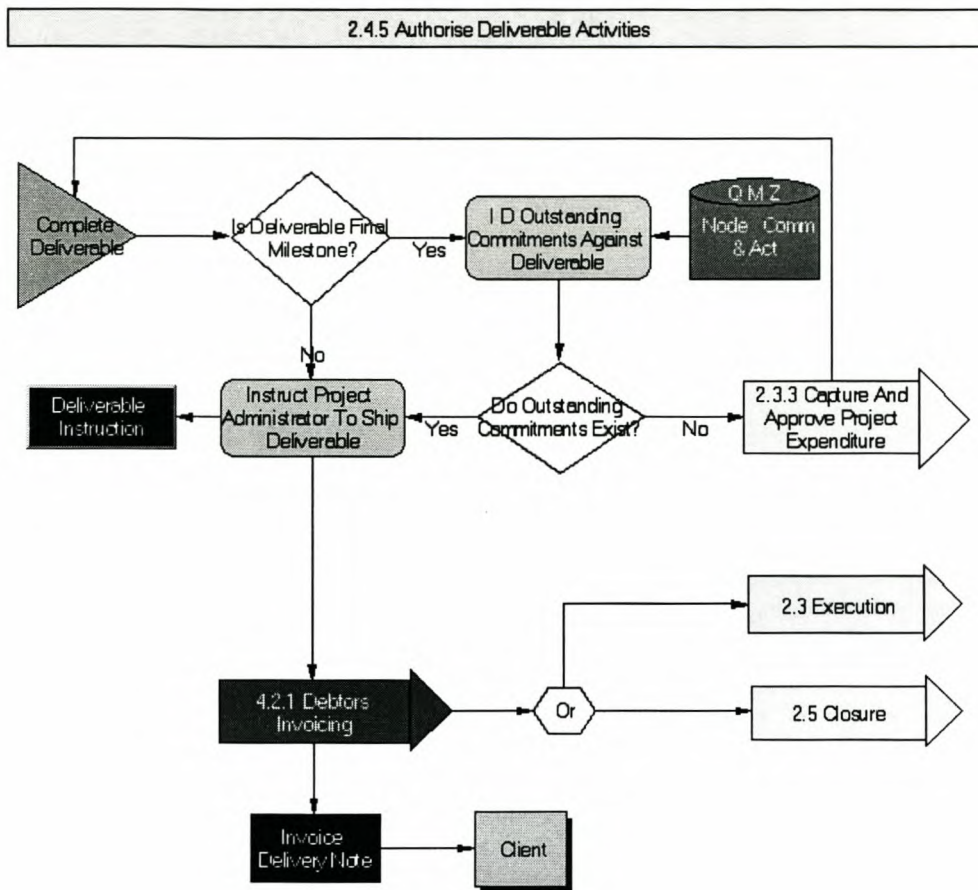


Figure B-21: Level 3 PM Business Model:  
2.4.5 Authorise Deliverable Activities

Subject	Notes
I D Outstanding Commitments Against Deliverable	Use the <b><i>Node Budget Commitments And Actual Expenditure</i></b> function to ensure that there are no outstanding commitments against the relevant deliverable.  Select commitments option only.
Instruct Project Administrator To Ship Deliverable	Using the <b><i>Mail</i></b> function, send notification to the project administrator to ship the deliverable to the client.

## 2.5. Closing

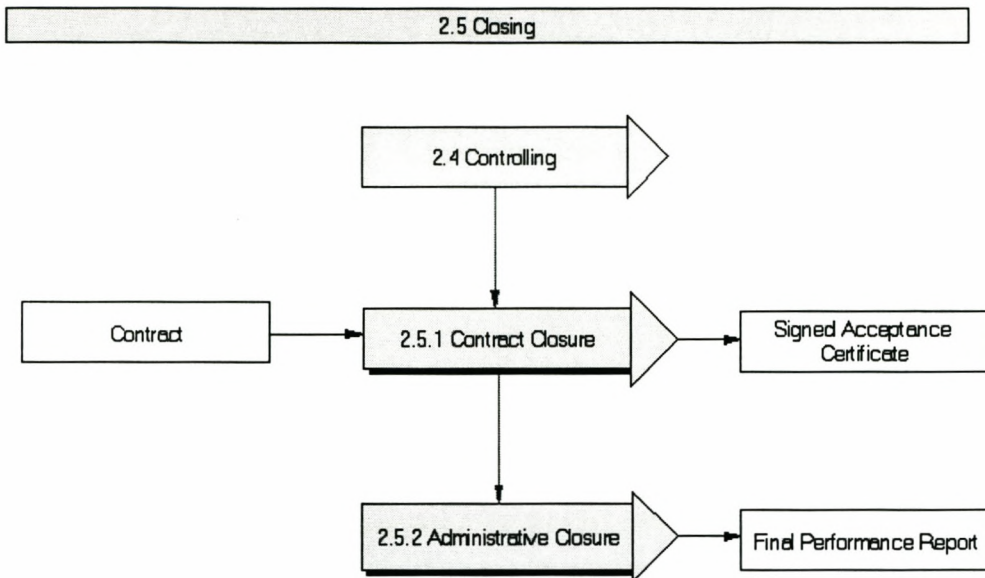


Figure B-22: Level 2 PM Business Model: Closing

Subject	Notes
	<i>Description already in Chapter 3.3</i>

**2.5.1. Contract Closure**

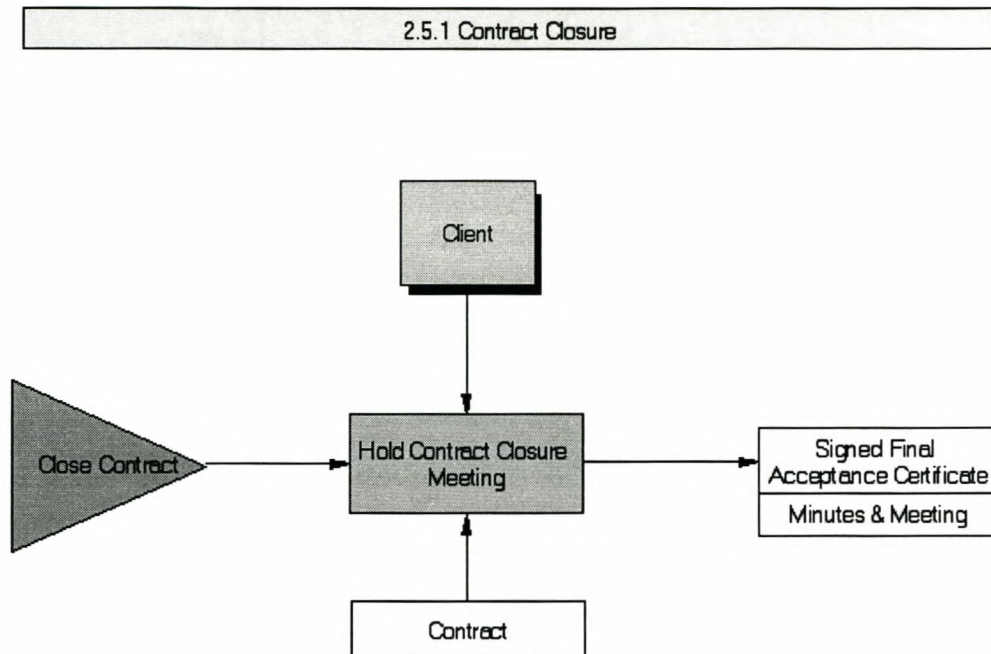


Figure B-23: Level 3 PM Business Model:  
2.5.1 Contract Closure

Subject	Notes
Hold Project Closure Meeting	Ensure all records relating to the project are collected and that they reflect the final specifications. Analyse the project success and effectiveness and ensure that all relevant information is archived for future use.



## 2.5.2. Administrative Closure

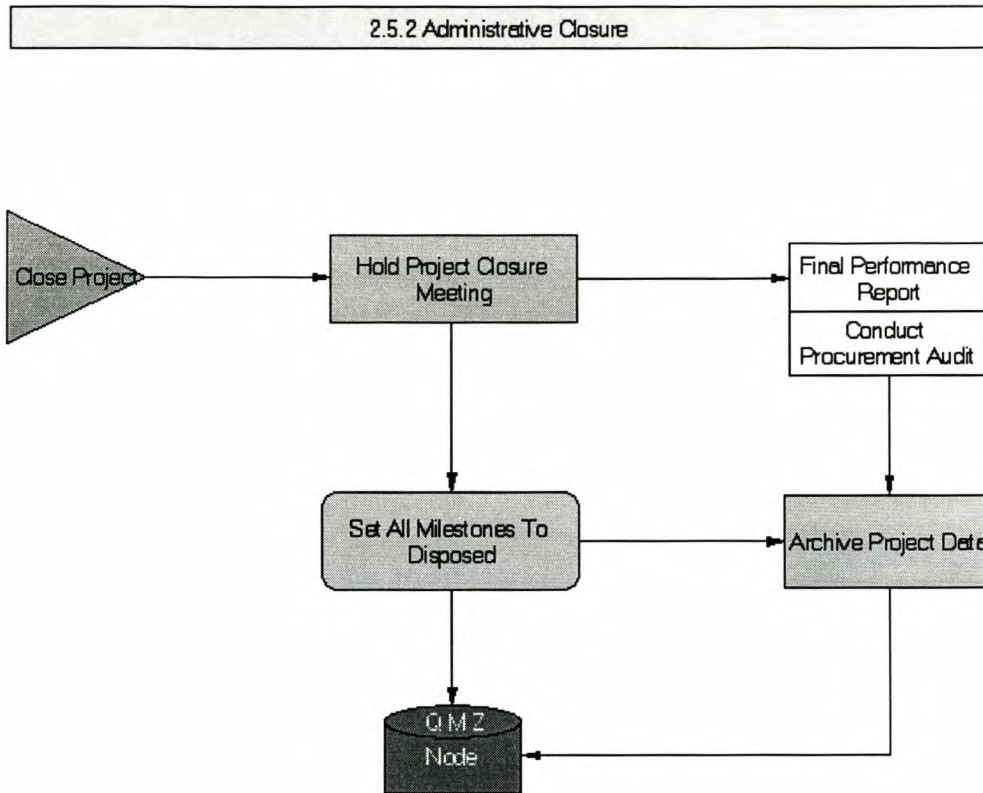


Figure B-24: Level 3 PM Business Model:  
2.5.2 Administrative Closure

Subject	Notes
Hold Project Closure Meeting	Ensure all records relating to the project are collected and that they reflect the final specifications. Analyse the project success and effectiveness and ensure that all relevant information is archived for future use.
Set All Milestone Nodes To Disposed	Use the <u>Node</u> function to set all milestone nodes to 100% complete and then ship the customer non-stocked order line using the <u>Node Shipment</u> function.

## APPENDIX C – CAE AS-IS REPORTS

Here follows the AS-IS list of reports found in the business processes of CAE at the start the blueprinting phase during the ERP (Qmuzik) implementation

REF. #	AS-IS REPORT	DEPT	FREQ.
F01	Invoice	Finance	As Required
F06	Summary of DG Enterprises	Finance	As Required
F07	Expenses	Finance	As Required
G01	Meeting Minutes	General	Weekly
G02	Project Plan	PM	As Required
G04	CAE Personnel contact Details	HR	As Required
HR02	Time log sheet from VW	HR	Monthly
HR08	Summary Log Sheet	HR	Weekly
HR09	Log Sheet Check	HR	Weekly
IT02	User Accounts Report	IT	As Required
L02	Inventory Sheet	Logistics	As Required
PM01	Project Status List	PM	Monthly / Weekly
PM02	Proposal	PM	As Required
PM03	Quotation	PM	As Required
PM04	Project Report	PM	As Required

## **APPENDIX D – TO-BE REPORTS**

The TO-BE reports list is a list of all reports from all seven business areas, and a short description that provides a basis for the development team to develop the business reports from. Some of the reports were customised from previous reports used by other Qmuzik clients. Because of the new release used for CAE, these reports had to be re-developed, but the specifications did not need to be done from scratch.

The reports list includes management reports and process reports. Although most of them fall outside the scope of this document, the reports for all the functional business areas are also included for completeness. Some of these reports were shown in the business models for project management in Chapter 3.3 and Appendix B.

The reader might feel that the reports presented for project management is lacking some information required to successfully managing the project company. This list provides the reader with a complete list of reports developed for the bigger project and ensures that no lack of reported information exists. Either the management information system- or the financial reports will address these gaps.

A list of all the reports developed for CAE during the project, follows:

Type Legend	Source Legend	Priority Legend	Status Legend
<b>Access</b> – Microsoft Access <b>EIS</b> – Qmuzik Executive Information System Task <b>Excel</b> – Excel spreadsheet with Pivot Table <b>QQ</b> – Qmuzik Quick Query	<b>ESi</b> – Internally developed by ESI <b>Qmz</b> – Shipped by Qmuzik as standard for new release <b>JCI/ADS/LIW</b> – originally developed at other client <b>New</b> – to be created	<b>1 to 19</b> - Most urgent reports in order of importance <b>20</b> - Important reports to be created <b>50</b> - Required but not very important <b>100</b> - Listed but may not be required	<b>Open</b> – to be speced <b>Spec</b> – Specification received to be started <b>In Process</b> – In process of being developed <b>Completed</b> – development completed, being tested <b>Repaired</b> – After completion changes is required <b>Accepted</b> – signed off by key user / team member <b>Close</b> – Will not be needed anymore

## D.1 SALES AND MARKETING

No.	Report Name	Description	Source name	Type	Source	Priority	Status
19.1	Sales by Customer and Product	Details and Summary of all customer orders per Customer. <ul style="list-style-type: none"> <li>• Include all types of released customer orders.</li> <li>• Order value is split in four, Order Value / Value Invoiced / Value Paid / Value to be Paid</li> <li>• Orders excluded are those invoiced and paid in full (closed)</li> <li>• Select all or specific customer</li> <li>• Select all or specific product family</li> <li>• Sort per customer or per product family</li> </ul>	Sales Analysis	Access	ESi	20	Open
19.2	Quotation Orders	List all current quotation orders per customer Include: order no, sales person, line no, line description, value, quotation expiry date, perc certainty	Sales Analysis	Access	ESi	20	Open
19.3	Customer Order Payment Details	<ul style="list-style-type: none"> <li>• List the expected payments for orders as per the sales order payment function (non stock lines) and customer order function.</li> <li>• Selectable from financial period</li> <li>• fixed width 18 months</li> <li>• Graph?</li> </ul>	Sales Analysis	Access	New	20	Open
19.4	Outstanding Customer Product Orders	Lists outstanding orders for Customer Product Sales	Sales Analysis	Access	New	50	Open
19.5	Sales Part Price History	View exists	Sales Analysis	Access	New	100	Open
19.6	Invoiced Sales per Account	Printed Debtor Invoices for a selected Account for a selected Financial Period(s)	Sales Analysis	Access	New	10	Open
30	Confirmed Sales		Confirmed Sales	EIS	Qmz	20	Completed
31	Invoiced Sales		Invoiced Sales	EIS	Qmz	20	Completed
32	Outstanding Sales		Outstanding Sales	EIS	Qmz	20	Completed
37	Sales Quotations		Sales Quotations	EIS	Qmz	50	Completed

No.	Report Name	Description	Source name	Type	Source	Priority	Status
38	Sales		Sales	EIS	Qmz	50	Completed
53	External Organisation Sales Person		External Organisation Sales Person	QQ		20	Completed

## D.2 PROJECT MANAGEMENT

No.	Report Name	Description	Source name	Type	Source	Priority	Status
8.1	Actual Labour Usage	List actual labour usage against BCWS and LCWS	Manhour Control	Access	JCI	12	Open
8.2	Timesheet Reports	Hours booked by employees on projects.	Manhour Control	Access	JCI	13	Open
8.3	Timesheet Complete Report	Indication of uncompleted timesheets <ul style="list-style-type: none"> <li>Sorts per Cost Centre Manager and then per cost centre</li> <li>Employees linked to direct cost centres with zero timesheets</li> <li>Employees with timesheets that is captured for a week that is not indicated as complete</li> <li>Selection per week or per month</li> </ul>	Manhour Control	Access	New	9	Open
8.4	Timesheet Approved Report	Indication of unapproved timesheets <ul style="list-style-type: none"> <li>Sorts per Approval Node Manager and then per Node</li> <li>Employees linked to direct cost centres with zero timesheets</li> <li>Employees with timesheets that is captured for a week that is not approved</li> <li>Selection per week or per month</li> </ul>	Manhour Control	Access	New	10	Open
8.5	Overtime Report	Lists all time captured against overtime resources (2) minus time captured against hours remaining for overtime time off resource Sort and include Cost Centre and Employee	Manhour Control	Access	New	20	Open
8.6	Unapproved Labour Budget	Lists all labour budgets waiting for approval by Cost Centre Managers	Manhour Control	Access	JCI	50	Open
20.1	Resource Activity Schedule	Lists employees linked to nodes and resources (new table) Includes and must be able to sort primarily per <ul style="list-style-type: none"> <li>Employee</li> <li>Start Time</li> <li>End Time</li> </ul> Utilisation factor to be given in all instances Make provision for comments to be included in next Service Pack	Manhour Forecast	Access	New	20	Open
20.2	Resource Loading by Schedule	List resource loading per week / month for a view period of 18 weeks / months <ul style="list-style-type: none"> <li>Weekly loading = days of week * 9 hours * % assignment</li> <li>Monthly loading = days of month * 9 hours * % assignment</li> </ul>	Manhour Forecast	Access	New	50	Open
20.3	Resource Loading by Budget	List resource loading per month for a view period of 18 months	Manhour Forecast	Access	JCI	50	Open

No.	Report Name	Description	Source name	Type	Source	Priority	Status
		<ul style="list-style-type: none"> <li>Per Cost Centre</li> <li>Per Employee</li> <li>Per Node</li> </ul>					
24	Overtime Tracker		Overtime Tracker	Access	New	50	Open
33	Node Budgeted Hours	Shows the budgets against a node for a selected node and period	Node Budgeted Hours	EIS	QMZ	20	Completed
34	Node Timesheet Hours	Shows the hours booked on timesheets against a node	Node Timesheet Hours	EIS	QMZ	20	Completed
35	Nodes	List of all nodes and their Cost Limits	Nodes	EIS	QMZ	20	Completed
54	Budget per Employee	Shows the budget per employee for a selected employee, period or node	Budget per Employee	QQ	QMZ	20	Completed
55	Program Nodes	Lists all program nodes	Program Nodes	QQ	QMZ	20	Completed
56	Requisitions per Node	List all requisitions linked to a specific node	Requisitions per Node	QQ	QMZ	20	Completed

### D.3 MATERIALS MANAGEMENT

No.	Report Name	Description	Source name	Type	Source	Priority	Status
16	Finished Goods	Inventory list of all manufactured items	Inventory	Access	Swrtklip	19	Open
21.1	Released Non Stock Requisitions	List all Released Non Stock Purchase Requisitions Selectable to display requisitions per External Organisation or Buyer View to use exists	Purchasing	Access		20	Open
21.2	Raw Materials	Inventory list of all purchased and subcontracted parts, quantities and values	Purchasing	Access		20	Open
21.3	Supplier Performance	Listing of delivery dates vs required dates	Purchasing	Access		50	Open
22.1	Open Requisition	Display Requisitions selectable per status and per type	Requisitions	Access	ADS	20	In Process
22.2	Requisition Inquiry	Prints the detail of a specific requisition for all types Order Issue Non Stock PO Service Employee Expense Grouping Transport	Requisitions	Access	ADS	20	Completed
22.3	Overdue Requisitions	List all Overdue Requisitions View exists	Requisitions	Access	ADS	20	Open
22.4	Transport Requirement Detail	Transport Requirement Report (Application for Travel) Sort per vehicle per Financial Period	Requisitions	Access	Views	50	Open

No.	Report Name	Description	Source name	Type	Source	Priority	Status
22.5	Analyse Open Service and Expense Requisitions	Print all the Service and Employee Expense Requisitions	Requisitions	Access			Completed
22.6	Print Expense Requisitions	Print Employee Expense Requisitions	Requisitions	Access			Completed
39	Outstanding Purchase Orders		Outstanding Purchase Orders	EIS	QMZ	50	Completed
40	Overdue Purchase Orders		Overdue Purchase Orders	EIS	QMZ	50	Completed
41	Purchases Beyond Lead Time		Purchases Beyond Lead Time	EIS	QMZ	50	Completed
42	Requisition Days		Requisition Days	EIS	QMZ	50	Completed
43	Requisitions to implement		Requisitions	EIS	QMZ	50	Completed
44	Stock at Suppliers		Stock at Suppliers	EIS	QMZ	50	Completed
45	Stock Value		Stock Value	EIS	QMZ	50	Completed
46	Supplier Performance		Supplier Performance	EIS	QMZ	50	Completed
47	Released Non Stock Requisition	List Released Non Stock Requisitions requiring action from Buyer	Released Non Stock Requisitions	QQ	New	14	Completed
57	Outstanding Purchase Orders	List of Purchase Orders not complete	Outstanding Purchase Orders	QQ	Qmz	20	Completed
58	Overdue Purchase Orders	List In-Process or Released Purchased Orders that is overdue	Overdue Purchase Orders	QQ	QMZ	20	Completed

## D.4 FINANCE

No.	Report Name	Description	Source name	Type	Source	Priority	Status
6.1	Open Payable	List all linked invoices payable per organisation and payment date	Creditors	Access	ESi	5	Completed
6.2	Invoice Register	List all creditors payed and unpaid	Creditors	Access	ESi	20	Completed
6.3	Creditors Payments	List all creditors payments	Creditors	Access	ESi	20	Open
6.4	Creditors Payments – Cheques	List all cheque payments	Creditors	Access	ESi	20	Completed
6.5	Creditors Payments – Bank Transactions	List all bank transaction payments	Creditors	Access	ESi	20	Open
6.6	Creditors Suspense	Creditors Suspense account details	Creditors	Access	ESi	5	Completed
6.7	Creditor(s) List	List of all active creditors	Creditors	Access	ESi	50	Completed
6.8	Invoice Line Linked	Listin of all paid and payable lines per organisation	Creditors	Access			Completed

No.	Report Name	Description	Source name	Type	Source	Priority	Status
7.1	Summary Debtor Age Analysis	Summary Age Analysis for all debtors	Debtors	Access	ESi	6	Completed
7.2	Invoices Printed	Invoices Printed	Debtors	Access	ESi	6	Completed
7.3	Debtor Statement	Debtor statement for each debtor	Debtors	Access	ESi	6	Completed
7.4	Debtors Listing	Debtors Listing	Debtors	Access	ESi	50	Completed
7.5	Invoices Not Printed	Invoices Not Printed	Debtors	Access	ESi	6	Completed
7.6	Unapplied Cash	Unapplied Cash	Debtors	Access	ESi	6	Completed
7.7	Debtor Suspense, Revaluation, Control		Debtors	Access	ESi	50	Completed
7.8	Debtor Credit Notes		Debtors	Access	ESi	50	Completed
7.9	Invoice Register		Debtors	Access	ESi	50	Completed
9.1	Asset Register Summary	List all Assets, Opening Values, Depreciation, Adjustment, Disposal and Closing Values	Assets	Access	JCI	11	Open
9.2	Asset Register Details	Details of the above per financial period	Assets	Access	JCI	11	Open
9.3	Asset Disposal	Listing and values for all scrapped and sold assets for the selected period with all applicable details	Assets	Access	JCI	11	Open
9.4	Asset Tax Depreciation	List the values depreciated for tax purposes where	Assets	Access	JCI	100	Open
9.5	Asset Variance	List Asset Book values per group and the nett amount of the @cost value and the book value. The report must show that the assets "balance" against the TB.	Assets	Access	JCI	20	Open
23	Journal Analyser	No changes required – only add three new journal types	Journal Analyser	Access	ESi	50	Open
26.4	Summary Trail Balance	Trail Balance per Account Code	Financial	Access	JCI	1	Open
26.5	Detail Trail Balance	Trail Balance per Account	Financial	Access	JCI	2	Completed
26.6	Chart of Accounts	A list of all Non-posting Entity Mapping	Financial	Access	JCI	20	Open
26.7	NPE Structure	List all NPEs and structures	Financial	Access	JCI	50	Open
26.8	General Ledger Transactions	Listing of all transactions for the following selections <ul style="list-style-type: none"> <li>Financial Period</li> <li>Cost Centre</li> <li>Division</li> </ul>	Financial	Access	New	3	Completed
26.9	General Ledger Transaction Details	Details of each journal entry per journal type NB – three new types in 6.1. Give all info for external journals	Financial	Access	New	15	Completed
26.10	Cash Book	CashBook	Financial	Access	New	4	In Process
26.11	Bank Recon	Bank Recon Taking new accounts in 6.1 into consideration. Recon to balance to TB and Bank Transaction Inquiry	Financial	Access	New	4	In Process



No.	Report Name	Description	Source name	Type	Source	Priority	Status
26.12	Cheque Report	Cheque Report (Might be more than one)	Financial	Access	New	4	In Process
26.13	Transfer Report	Transfer Report	Financial	Access	New	4	In Process
26.14	VAT Input Details	Details of all VAT on payments made during a period / periods selected per Tax Code	Financial	Access	New	16	Open
26.15	VAT Output Details	Details	Financial	Access	New	16	Open
26.16	VAT Payable Report	Summary of VAT payable and re-imbursable per period(s) per Tax Code all on one sheet	Financial	Access	New	16	Open
48	Journal	Journal	Journal	QQ	Qmz	20	Completed
49	Cheques Printed	Cheques Printed	Cheques Printed	QQ	Qmz	20	Completed
50	Unreconciled Cashbook Transactions	Unreconciled Cashbook Transactions	Unreconciled Cashbook Transactions	QQ	Qmz	20	Completed
51	Trail Balance	Trail Balance per Account	Trail Balance	QQ	Qmz	20	Completed
59	Trial Balance	Trial Balance	Trial Balance			20	Completed
60	Sales Tax List	Listing of all Sales Tax Codes Used	Sales Tax List	QQ	ESI	50	Completed

## D.5 MANAGEMENT INFORMATION SYSTEMS

No.	Report Name	Description	Source name	Type	Source	Priority	Status
4.1	CRS Report	Summary CRS Reports	CRS	Access	ADS	4	Completed
4.2	Sales	Summary CRS Reports	CRS	Access	ADS	4	Completed
4.3	Debtors	Summary CRS Reports	CRS	Access	ADS	4	Completed
4.4	Cost Cumulative	Summary CRS Reports	CRS	Access	ADS	4	Completed
5.1	Program Actuals and Committed Costs	Detail CRS Reports	Programs	Access	ADS	4	Completed
5.2	Program Purchase Orders	Detail CRS Reports	Programs	Access	ADS	4	Completed
5.3	Program Sales	Detail CRS Reports	Programs	Access	ADS	4	Completed

No.	Report Name	Description	Source name	Type	Source	Priority	Status
5.4	Outstanding Debtors per Department	Detail CRS Reports	Programs	Access	ADS	4	Completed
5.5	Program Resource Utilisation Summary	Detail CRS Reports	Programs	Access	ADS	4	Completed
5.6	Program Invoiced Actual	Detail CRS Reports	Programs	Access	ADS	4	Completed
10.1	*Program Summary Report	Summary	Node Structure Enquiry	Access	JCI	12	Spec
10.2	*Detailed Project Expenditure	Detail	Node Structure Enquiry	Access	JCI	13	Spec
11.1	*Program Summary Report	Summary	Node Actual and Cash Flow	Access	JCI	12	Spec
11.2	*Detailed Project Expenditure	Detail	Node Actual and Cash Flow	Access	JCI	13	Spec
12.1	*Program Summary Report	Summary	Node Expenditure	Access	JCI	12	Spec
12.2	*Detailed Project Expenditure	Detail	Node Expenditure	Access	JCI	13	Spec
15	Cost Centre Management Report	List Recovery of costs per employee per cost centre for selected periods	Cost Center Management	Access	JCI / ADS	17	Spec
19.6	Cost of Sales Analysis	Report Analysing the COS associated with a division per project	Sales Analysis	Access	New	50	Open
25.1	Sales Forecast (Graphs)	Sales Forecast	Sales Forecast	Access	-	100	Open
26.1	Liquidity Report	Liquidity Report	Financial	Access	-	100	Completed
26.2	Cash Flow Analysis Summary	List current Bank Balance, Total Payments Due, Total Invoices receivable per Month	Financial	Access	New	15	Open
26.3	Cash Flow Analysis Detail	List current Bank Balance, Total Payments Due, Total Invoices receivable per Day	Financial	Access	New	15	Open
27.1	Summary Income Statement	Summary Income Statement	Income Statement	Excel	ESi	7	Open
27.2	Detail Income Income Statement	Detail Income Income Statement as per spec supplied	Income Statement	Excel	ESi	7	Spec
27.3	Income Statement per Project and Cost Centre	Income Statement per Project and Cost Centre	Income Statement	Excel	ESi	50	Open
28.1	Balance Sheet	Balance Sheet as per Spec supplied	Balance Sheet	Excel	ESi	8	Spec
29.1	Summary Labour Expenditure	Summary and Detail Labour Not per Project	Labour Cost	Excel	New	50	Open
29.2	Detail Labour Expenditure	Summary and Detail Labour Not per Project	Labour Cost	Excel	New	50	Open
36	Load per Cost Centre	Budgeted hours per Cost Center	Load per Cost Centre			20	Completed

No.	Report Name	Description	Source name	Type	Source	Priority	Status
	Labour Recovery Report	List Recovery of costs per employee per cost centre for selected periods	Cost Center Management	JCI/ADS		18	Closed

*\* Requirement will be reassessed after the CRS is received / reviewed*

## D.6 SUPPORT SERVICES

No.	Report Name	Description	Source name	Type	Source	Priority	Status
17.1	Requests & Failures		Help Desk	Access	-	20	Open
61	Characteristics listing		-	QQ	-	100	Completed
62	External Object listing		-	QQ	-	100	Completed
52	Security Profiles		Security Profiles	QQ	New	20	Completed
63	Password Reset Report		-	QQ	-	100	Completed
	Engineering Change Control Report	Routing and Outstanding: Summaries and Details	-		-	100	Closed
	Transaction History Report		-	-	-	100	Closed
	Movement Details Report		-	-	-	100	Closed

## D.7 HUMAN RESOURCES

No.	Report Name	Description	Source name	Type	Source	Priority	Status
17.2	Security Employees Access		Help Desk	Access	-	100	Open
17.3	Employee Ownership and Profile Report		Help Desk	Access	-	20	Open
18.1	Headcount Report		Human Resources	Access	-	100	Open
18.2	Nominal Role		Human Resources	Access		20	Open
18.3	Employee Information Report		Human Resources	Access	-	100	Open
64	Employees		Employees	QQ	Qmz	100	Completed

## **APPENDIX E – TO-BE REPORT EXAMPLES**

In Chapter 4 the reports are described. This appendix provides one sample page of every one of the nine reports described:

- Six program reports,
- Two labour control reports, and
- The contract review sheet

Sensitive data has been greyed out.

The report framework examples developed for CAE follows:

## E.1 PROGRAM REPORT – ACTUALS AND COMMITTED COSTS

**CAE R/A STELLENBOSCH AUTOMOTIVE ENGINEERING (PTY) LTD**

**PROGRAM ACTUAL AND COMMITTED COSTS**

Milestone Node Description

Product Code

Milestone Node

Customer Order

Financial Period

Actual Cost Between 2001-07 And 2003-06



AAA066 VW BORA CAD/ CAM DEVELOPMENT [IN-PROCESS]						
LABOUR						
EMPLOYEE ID	COST CENTRE	EMPLOYEE NAME	RESOURCE	RESOURCE RATE	HOURS	ACTUAL COST
FINANCIAL PERIOD--> 2001-10						
Total For Financial Period - 2001-10						

FINANCIAL PERIOD--> 2002-04						
Total For Financial Period - 2002-04						

MATERIAL						
REQ NUMBER	DESCRIPTION	RESOURCE	UNIT COST	UNITS	ACTUAL COST	
FINANCIAL PERIOD--> 2001-10						
Total For Financial Period - 2001-10						
Node Total For - AAA066						

AAA187 VWBORA MARKETING [IN-PROCESS]						
LABOUR						
EMPLOYEE ID	COST CENTRE	EMPLOYEE NAME	RESOURCE	RESOURCE RATE	HOURS	ACTUAL COST
FINANCIAL PERIOD--> 2002-03						
Total For Financial Period - 2002-03						

MATERIAL						
REQ NUMBER	DESCRIPTION	RESOURCE	UNIT COST	UNITS	ACTUAL COST	
FINANCIAL PERIOD--> 2002-02						
Total For Financial Period - 2002-02						

FINANCIAL PERIOD--> 2002-03

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Program Commitment Actuals\_R

MOB : PROGRAM REPORTS.MOB

DATABASE : CAE Production

SERVER : ATLAB

## E.2 PROGRAM REPORT – PURCHASE ORDERS

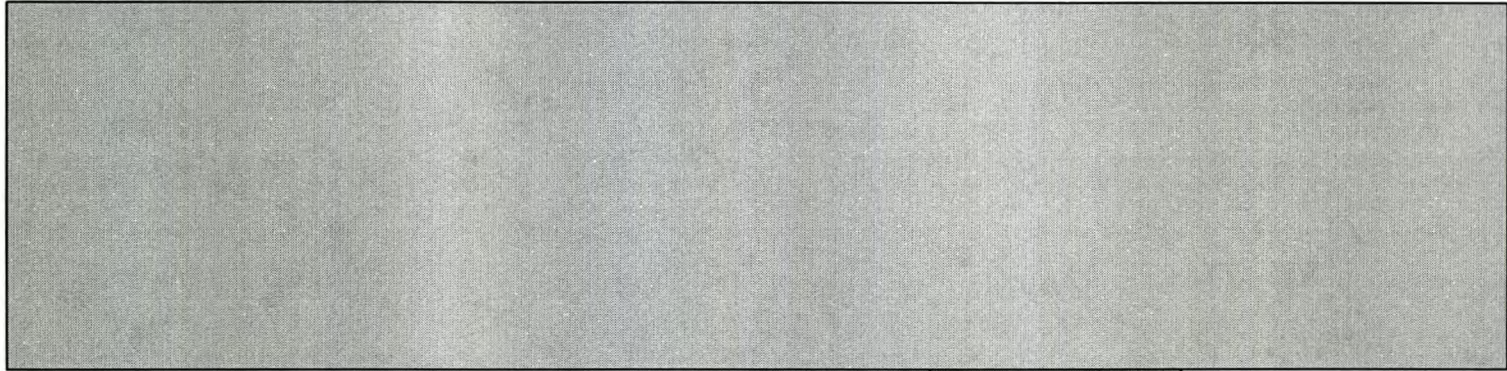
**CAE R/A STELLENBOSCH AUTOMOTIVE ENGINEERING (PTY) LTD  
PROGRAM PURCHASE ORDER(S) - ALL PURCHASE ORDERS**

Milestone Node Description  
Product Code  
Milestone Node  
Customer Order



NO.	PURCHASE ORDER No.	LINE	DESCRIPTION	SUPPLIER	QTY ORDERED	QTY RECEIVED	QTY QTY	UNIT COST	TOTAL COST	COMPLETED COST	QTY COST	DATE CAPTURED	CUSTOMER DELIVERY	DATE OF COMPLETION
-----	--------------------	------	-------------	----------	-------------	--------------	---------	-----------	------------	----------------	----------	---------------	-------------------	--------------------

VBE-003 - -> VW BORA ENDURANCE TESTING



Total For VBE-003  
Total For Programme

### E.3 PROGRAM REPORT – SALES

CAE R/A STELLENBOSCH AUTOMOTIVE ENGINEERING (PTY) LTD

**PROGRAM SALES**

Milestone Node Description  
 Product Code  
 Milestone Node  
 Customer Order  
 Actual Sales To Financial Period  
 Report Between Financial Periods



CU BY O/LINE	FORECAST END DATE	SALES ITEM DESCRIPTION	MODE	ITEM No.	INVOICE No.	LINE No.	INVOICE DATE	FORECAST	ACTUAL	EBC	OTHER	TOTAL
-----------------	----------------------	---------------------------	------	----------	-------------	----------	--------------	----------	--------	-----	-------	-------

**WWSA - VOLKSWAGEN OF SOUTH AFRICA (PTY) LTD**

2001-07

[Redacted Data]												
										Total For 2001-07		

2001-09

[Redacted Data]												
										Total For 2001-09		
										Total For WWSA - VOLKSWAGEN OF SOUTH AFRICA (PTY) LTD		
Programme Total												

## E.4 PROGRAM REPORT – OUTSTANDING DEBTORS

**CAE R/A STELLENBOSCH AUTOMOTIVE ENGINEERING (PTY) LTD**  
 OUTSTANDING DEBTORS PER DEPARTMENT  
 FINANCIAL PERIOD : 2002-05

INVOICE No.	LINE No.	NODE DESCRIPTION	ITEM No.	ORDER DESCRIPTION	DATE	CURRENT	30 DAYS	60 DAYS	90 DAYS
-------------	----------	------------------	----------	-------------------	------	---------	---------	---------	---------

CUSTOMER ORDER (CO-0081); PRODUCT CODE (102); PROGRAMME DESCRIPTION (M102)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0079); PRODUCT CODE (ATE); PROGRAMME DESCRIPTION (ADHOK TESTING PRODUCT EVALUATION)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0024); PRODUCT CODE (CCR); PROGRAMME DESCRIPTION (CAE PART SALES)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0034); PRODUCT CODE (CCR); PROGRAMME DESCRIPTION (CAE PART SALES)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0044); PRODUCT CODE (CCR); PROGRAMME DESCRIPTION (CAE PART SALES)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0106); PRODUCT CODE (CCR); PROGRAMME DESCRIPTION (CAE PART SALES)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0111); PRODUCT CODE (CCR); PROGRAMME DESCRIPTION (CAE PART SALES)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0126); PRODUCT CODE (CCR); PROGRAMME DESCRIPTION (CAE PART SALES)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (HDM01); PRODUCT CODE (CCR); PROGRAMME DESCRIPTION (CAE PART SALES)

--	--	--	--	--	--	--	--	--	--

Total

CUSTOMER ORDER (CO-0032); PRODUCT CODE (CJV); PROGRAMME DESCRIPTION (JOINT VENTURE SALES)

--	--	--	--	--	--	--	--	--	--



## E.5 PROGRAM REPORT – RESOURCE UTILISATION SUMMARY

**CAE R/A STELLENBOSCH AUTOMOTIVE ENGINEERING (PTY) LTD**

**PROGRAM RESOURCE UTILIZATION SUMMARY**

Milestone Node Description  
 Product Code  
 Milestone Node  
 Customer Order  
 Financial Year  
 Actuals To Financial Period



REPOURCE	TOTAL PRO YEAR	2001-07	2001-08	2001-09	2001-10	2001-11	2001-12	2002-01	2002-02	2002-03	2002-04	2002-05	2002-06	2002-07	ACTUAL TO DATE	PERCENTAGE AT COMPLETION
----------	----------------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	----------------	--------------------------

**LABOUR**

OVER TIME - OTHER	
DESIGNER	
ENGINEER	
BUSINESS UNIT MANAGER	
OVER TIME - AS PER	
TECHNICIAN	
TECHNOLOGIST	
OPERATOR	
DRIVER	
OTHER	

**MATERIAL**

REPAIRS AND MAINTENANCE	
PROCUREMENT OF MATERIALS	
PROCUREMENT OF SERVICES	
TRAVEL - OVERSEAS	
SERVICES	
MATERIALS	
MANUFACTURING	
FOOD AND BEVERAGE	
TRAVEL - LOCAL	
CONSUMABLES	
POSTAGE AND COMMUNICATIONS	
RENTALS	
UTILITIES	
OTHER	
TOTAL	

## E.6 PROGRAM REPORT – INVOICED ACTUAL

**CAE R/A STELLENBOSCH AUTOMOTIVE ENGINEERING (PTY) LTD**

PROGRAM INVOICING FOR FINANCIAL PERIOD(S)

Milestone Node Description

Product Code

Milestone Node

Customer Order

Actual Invoicing To Financial Period

Report Between Financial Periods



INVOICE No.	SALES ORDER LINE	COMPLETION DATE	SALES ITEM DESCRIPTION	NODE	ITEM No.	INVOICE DATE	CONTRACTUAL END DATE	FORECAST	ACTUAL	ESC	OTHER	TOTAL
-------------	------------------	-----------------	------------------------	------	----------	--------------	----------------------	----------	--------	-----	-------	-------

**VWSA - VOLKSWAGEN OF SOUTH AFRICA (PTY) LTD**



*Total For VWSA - VOLKSWAGEN OF SOUTH AFRICA (PTY) LTD*

PROGRAM TOTAL



## E.7 LABOUR CONTROL – SCHEDULE

**CAE R/A STELLENBOSCH AUTOMOTIVE ENGINEERING (PTY) LTD**  
**LABOUR SCHEDULE DETAIL FOR FINANCIAL PERIOD FROM 2001-07 - 2002-06**

RESOURCE & EMPLOYEE NAME	TYPE	2001-07	2001-08	2001-09	2001-10	2001-11	2001-12	2002-01	2002-02	2002-03	2002-04	2002-05	2002-06	TOTAL
--------------------------	------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	-------

PARENT NODE : VBE-001

VBE-003

HAINES R (HAINES)	BCWB	
	LCWB	
	ACWP	
	LCF	
VINCENT B (BAV)	BCWB	
	LCWB	
	ACWP	
	LCF	
BELL AJ (BELL)	BCWB	
	LCWB	
	ACWP	
	LCF	
BUSINESS UNIT MAN	BCWB	
	LCWB	
	ACWP	
	LCF	
DAVIDSON C (C DAVIDSON)	BCWB	
	LCWB	
	ACWP	
	LCF	
MASHALABA G (MASHAL)	BCWB	
	LCWB	
	ACWP	
	LCF	
DESIGNER	BCWB	
	LCWB	
	ACWP	
	LCF	



## E.9 CONTRACT REVIEW SHEET

Status as At 30 Apr 2000

Order Number Programme Mgr Costing Date	
---	--

Program Program # Division Client	
--	--

Contractual Start Date Contractual End Date Anticipated End Date	
--	--

Contract Price	Sales to Date	Remaining to be Invoiced	Total Sales (excl VAT)						Future Years				
			Cumulative Prior 01 Jan 2000	Year to Date			Full Year		2001	2002	2003	2003 +	
				Actual	Budgeted	Variance	Budget	Forecast					
5,534	3,170	2,355	Original	2,100	1,070	812	467	2,000	2,032	502	0	0	0
0	0	0	plus variations	0	0	0	0	0	0	0	0	0	0
4,455	2,100	2,355	Prev Month Original	2,100	0	429	-429	2,699	1,853	502	0	0	0
0	0	0	plus variations	0	0	0	0	0	0	0	0	0	0
5,534	3,170	2,355	<b>Total</b>	2,100	1,070	812	467	2,000	2,032	502	0	0	0
4,455	2,100	2,355	Prev Month Total	2,100	0	429	-429	2,699	1,853	502	0	0	0

Cash In (excl VAT)			Payments (excl VAT)						Future Years				
Total	To Date	Future	Cumulative Prior 01 Jan 2000	Year to Date			Full Year		2001	2002	2003	2003 +	
				Actual	Budgeted	Variance	Budget	Forecast					
5,537	2,800	2,737	Total Cash Fbw	1,927	872	801	71	815	2,042	1,508	0	0	0

Total Price incl VAT			Debtors Schedule (incl VAT)				
Debtors	Overdue	Current	0-30 day				0
			0-30 day	30-60 day	60-90 day	>90 days	
433	100	200	Debtors incl VAT	50	110	0	0

Original Costing			Industrial Analysis						Risks and Opportunities (CPE)				
			CPA - CPE		Cost Cumulative to end of Program						RISKS Max	RISKS Weighted	Weighted Opportunities
CPA	CPE	Included Provisions	CPA	CPE	Provisions incl in PPS	CPR	PPS	Actual Variance of CPA - CPE	from CPA	from CPE			
3,189	3,189	100	Situation at Begin Yr	4,080	3,992	120	1,213	3,268	0	170	119	826	0
			Prev. Month Situation	4,080	4,440	120	1,847	2,722	-467	170	119	826	0
			This Month Situation	4,080	4,588	120	2,089	2,499	-396	170	119	826	0