Chapter 3: Corporate Project Life Cycle Management

3.1 History of Project Management

The PMBOK® Guide (2000) defines a project as *"a temporary endeavour undertaken to create a unique product or service"*. In the business environment a project can be better defined as a finite piece of work directed at achieving a stated business benefit within certain defined cost and time constraints (Buttrick, 2000). A project normally consists of a series of activities and tasks, which consume human and non-human resources and which are multifunctional.

In recent years projects have become strategic management tools and are frequently used as "vehicles" of change. In response to this the field of project management is no longer the preserve of specialists and a company's project management skills are fast becoming a core competence (Buttrick, 2000).

"Project Management, once considered nice to have, is now recognized as a necessity for survival" (Kerzner, 2001: xix).

The PMBOK® Guide (2000) also defines project management as *"the application of knowledge, skills, tools and techniques to project activities to meet project requirements"* while Meredith & Mantel (1995) defines it as *"the means, techniques and concepts used to run a project and achieve its objectives"*.

The growth of project management in the late 1980's and early 1990's was not only due to the recession of that time, but also to the development of new processes that supported project management (Kerzner, 2001). It has primarily been supported by the following concepts or philosophies that has been introduced or re-discovered since 1985:

- 1985: Total Quality Management
- 1990: Concurrent Engineering
- 1991-1992: Empowerment and Self Directed Teams
- 1993: Reengineering
- 1994: Life Cycle Costing
- 1995: Scope Change Control
- 1996: Risk Management
- 1997-1998: Project Offices and CEO's
- 1999: Co-Located Teams
- 2000: Multi-National Teams

Kerzner (2001) defines five life cycle phases that an organization goes through in order to implement project management as a core competency. The phases as well as some characteristics are shown in Table 3.1.

Embryonic Stage	Executive Management Acceptance Stage	Line Management Acceptance Stage	Growth Stage	Maturity Stage
• Recognize need • Recognize benefits • Recognize applications • Recognize what must be done	• Visible Executive Support • Executive understanding of project management • Project Sponsorship • Willingness to change way of doing business	• Line Management Support • Line Management commitment • Line Management education • Willingness to release employees for project management training	• Use of life-cycle phases • Development of a project management methodology • Commitment to planning • Minimizing of "creeping scope" • Selection of a project tracking system.	• Development of a management cost/schedule control system • Integrating cost and schedule control • Developing an educational program to enhance project management skills.

Table 3.1: Life-Cycle Phases for Project Management Maturity

Source: Kerzner, 2001

Companies are increasingly compiling procedural manuals to guide and train personnel in project management as they strive to enter the maturity stage. A well-defined project management methodology is, however, a prerequisite for the maturity stage. A benchmarking study conducted by Robert Buttrick concluded that companies, which are successful in project management, all use a company-specific, simple and well-defined project management framework. It defines a staged approach for all projects under all circumstances (Buttrick, 2001:17).

The influence of concurrent engineering on project management has further resulted in a "*checklist with periodic review points*" methodology. This type of methodology relies on checklists, addressing the same evaluation criteria but progressing in detail, for evaluating the project at different review points over the life cycle. The result is a more informal project management atmosphere in which the phases of a project can and often do overlap (Kerzner, 2001).

Projects, as well as project management, have an impact in a sphere broader than that of the project itself. Viewed against the background of sustainable development as discussed in Chapter 1, companies are increasingly accountable for the impacts resulting from a project as

well as the effects of the project on the people, environment as well as economy, even long after the project has been completed (PMBOK® Guide, 2000:27).

In order for projects to support sustainable development, the concepts thereof must be integrated into the planning and management of a project over the whole life cycle. An analysis of the project life cycle management framework is therefore required in order to establish how these impacts and effects are currently dealt with in project management.

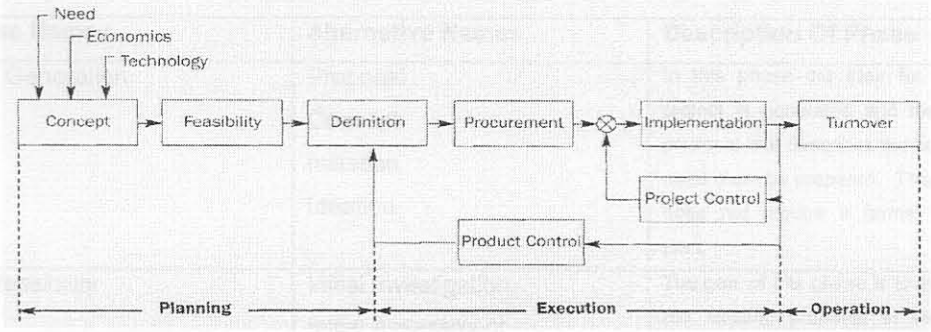
3.2 Project Life Cycle Management

3.2.1 Project Life Cycle

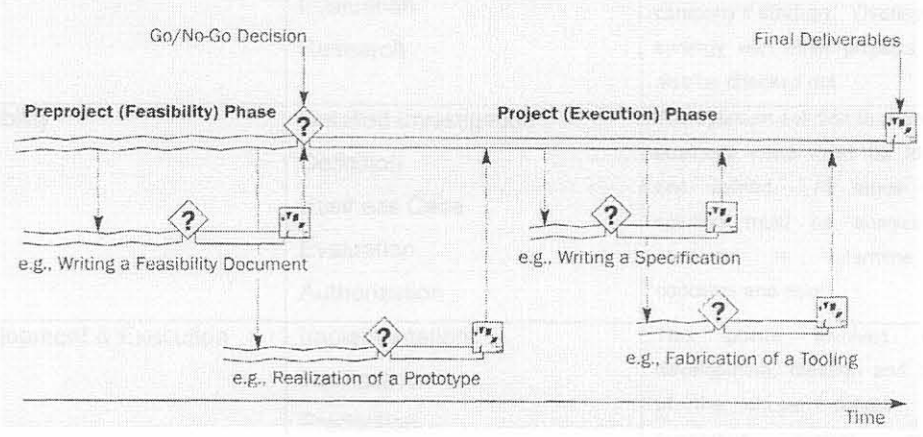
Projects consist of various stages also referred to as phases of development. Buttrick (2000), defines a project phase as a period during which certain work on the project takes place by collecting the correct information and creating specified outputs. The outputs or deliverables of a phase is normally used as a functional input to the next. Collectively the project phases are referred to as the project life cycle.

Various project life cycle approaches exist in literature, e.g. control-oriented model, quality-oriented model, risk-oriented model, a fractal approach to the project life cycle, as well as some company specific project life cycles (Bonnal, Gourc & Lacoste, 2002). These life cycle approaches are shown in Figure 3.1.The number of phases within each of these approaches differs as well as the names used to describe the phases. According to Kerzner (2001:76) "*there is no agreement among industries or even companies within the same industry, about the life-cycle phases of a project*" due to the complex nature and diversity of projects.

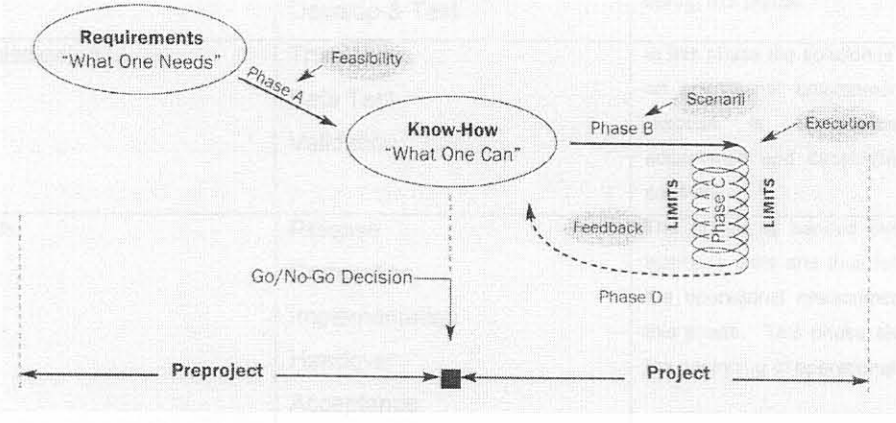
Various authors hence define various life cycle phases for a project. According to Buttrick (2000) it is possible to distinguish between seven life cycle phases. The generic phases together with a basic description as well as alternative phase names are summarized in Table 3.2.



Control Oriented Project Life Cycle Model (Kelley, 1982 as cited in Bonnal, Gourc and Lacoste,2002)



Fractal Approach to Project Life Cycles



Risk Oriented Project Life Cycle Model (Lacoste, 1999 as cited in Bonnal, Gourc and Lacoste,2002

Figure 3.1: Project Life Cycle Models

Source: Bonnal, Gourc & Lacoste, 2002

Phase Names	Alternative Names	Description Of Phase
Idea Generation	Proposal Concept Initiation Ideation	In this phase the idea for a new project is generated and the initial proposal that describes the business need must be prepared. This phase does not require a formal project plan.
Pre-feasibility	Initial Investigation Initial Assessment Preliminary Investigation Evaluation Research	The goal of this phase is to evaluate the existing proposal in terms of financial, operational and technical viability as well as against the company's strategy. Overlapping or synergy with other projects should also be checked out.
Feasibility	Detailed Investigation Definition Business Case Evaluation Authorization	The optimum solution to address the business need must be identified and defined. All areas of this solution must be analyzed and assessed to determine killer concerns and risks.
Development & Execution	Implementation Realization Production Construction Build Develop & Test	This phase involves design, development, creation and building of the chosen solution. The supporting system, manuals, business processes and training for the solution must also be developed during this phase.
Commissioning	Trial Beta Test Validation	In this phase the solution is tested in an operational environment. The purpose is to validate the acceptance and capabilities of the solution.
Launch	Release Completion Implementation Handover Acceptance	The project is handed over to the business units and thus released to the operational environment during this phase. This phase also marks the beginning of operational support.
Post Implementation Review (PIR)	Business Review Project audit Post Project Review	After sufficient time (9 –15 months) the project should be assessed to determine if the benefits were delivered and what the impact of the project was on the business. Lessons learned should be captured for future reference.

Table 3.2: Phases in the Project Life Cycle

Source: Adapted from Buttrick, 2000

Although specific projects may require a separately defined project life cycle methodology, the frameworks can be typically matched with the Buttrick generic project life cycle as illustrated in Table 3.3.

Projects Types	Buttrick's generic project life cycle				
	Pre-feasibility	**Feasibility**	**Development & Execution**	**Commissioning**	**Launch**
Product Development	Concept	Alternatives & feasibility	Develop and test	Market validation	Launch
Product withdrawal	Initial Investigation	Detailed Investigation	Develop and test	Pilot withdrawal	Close operations
Information systems	Analysis	Logical and outline physical design	Detailed design, build and test	Pilot	Cutover
Bid or tender	Receive request and evaluate	Prepare detailed tender	Develop, build internal test	Commissioning trails	Handover
Construction	Inception study	Feasibility study, tender design	Detailed design and construction	Commissioning trails	Handover
IT	Requirements review	Analysis and design	Build	Beta test	Cutover

Table 3.3: Alignment of individual project life cycles with generic project life cycle

Source: Buttrick, 2000.

The generic project life cycle can be tailored to suit the requirements of individual projects and it does happen that phases are combined, e.g. the development and execution phase is often combined with the commissioning phase. Some literature does not regard the idea generation and post-implementation review as phases of the project life cycle while other sources, such as Kerzner (2001), states that the theoretical system life cycle phases should be applied to a project. These phases are: Conceptual, Planning, Testing, Implementation and Closure.

In the South African context there is no agreement on a generic project life cycle model. The life-cycle has, nevertheless, been adapted for the South African process industry to address identified specific needs of the industry sector (Labuschagne, 2002). The generic life cycle proposed by Buttrick (2000) is taken as a basis due to its adaptability and comprehensiveness. The preferred project life cycle for the remainder of this document is shown in Figure 3.2.

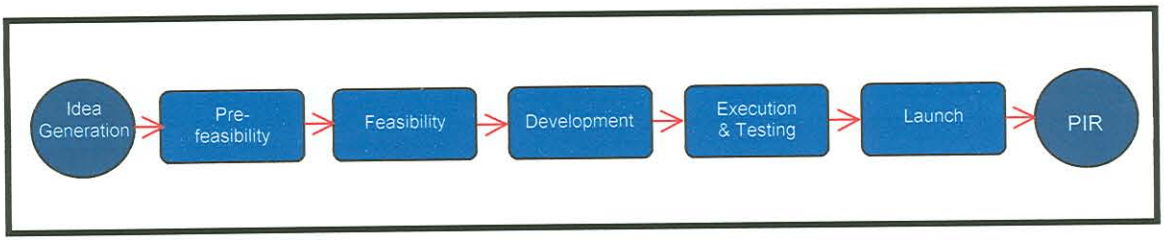
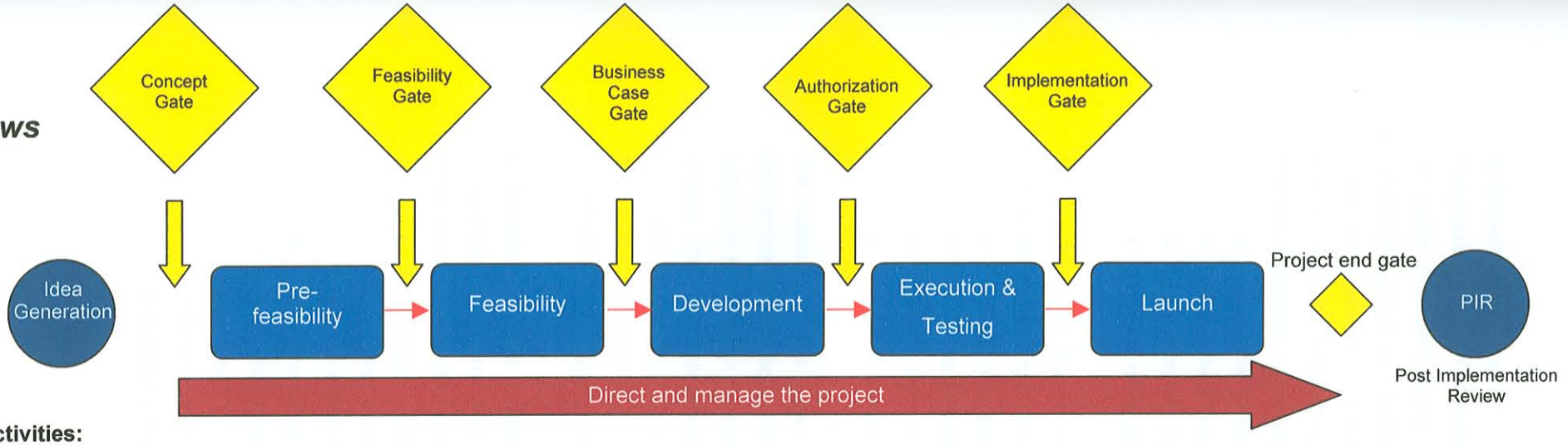


Figure 3.2: Project Life Cycle

3.2.2 Project Life Cycle Management Framework

A staged project management framework that relies on the "*checklist for end-of-phase review*" methodology is chosen as basis for sustainable project life cycle management (Figure 3.3). The decision is motivated by the fact that in recent years it was proven that the use of project life cycle phases improve management control and provide links for the ongoing operations, as most of the processes within project management are iterative in nature. Another advantage of the framework is the fact that the "*checklist for end-of-phase review*" methodology results in less documentation (Kerzner, 2001). The benchmarking study performed by Buttrick (2000) as discussed in Section 3.1, supports the choice of the framework. The framework can be adapted with ease for various project life cycle models.



Major activities:

• Identify opportunity • Assess fit with strategy and other product portfolios • Identify stakeholders	• Evaluate, in outline, operational, technical and commercial viability • Assess impact on organization • Check any legal, regulatory or patent issues • Identify options • Undertake initial investment appraisal • Preliminary assessment of risks and uncertainties • Plan the next stage of the project	• Define technical and operational requirements • Assess possible solutions • Design solutions in outline • Obtain quotes from suppliers • Undertake feasibility review • Define the chosen solution • Technology selection • Do investment appraisal • Re-check legal, regulatory and patent issues • Reduce uncertainties • Plan remainder of project	• Develop the solutions • Develop training • Finalize supplier arrangements • Obtain legal, patent and regulatory permissions • Optimal integration of all issues into the final business plan • Check and refine plans for remainder of project	• Train users • Manage the quality of deliverables • Provide assets and deliverables according to final business plan • Test solutions • Conduct trials in operational environment and refine solution	• Launch/release capability or service • Carry out remaining training • Handover solutions for on-going management • End-of-job documentation • Carry out closure review	• Assess the effectiveness of project in meeting the business objectives • Check that operational aspects are working effectively • Start business support • Capture Best Practices/Learnings

Deliverables:

• Proposal	• Initial Business Case • Preliminary Plan of execution • Preliminary engineering proposal	• Output definition • Conceptual engineering proposal • Feasibility report • Plan of execution • Detailed Business Plan	• Plan of Execution • Final Business Plan • Complete Engineering Proposal	• Trial results • Ready to service review report	• Project Closure report	• Post Implementation Review (PIR) Report • Certified Performance Report

Figure 3.3: Staged Project Life Cycle Management Framework

a) End-of-Phase Review

The phase-end or end-of-phase reviews are often called phase exits, stage decision gates or kill points (PMBOK® Guide, 2000). It serves the purpose of reviewing both the key deliverables and project performance at the end of each phase in order to ensure proper project management. The question whether these decision gates serves as end points to ensure that the full scope of a phase has been covered or as entry points to the next phase, is debated in literature. According to Buttrick (2000) the decision gates serve as points to:

- Ensure that the project is still required and that the risks are acceptable.
- Confirm the priority of the project relative to other projects.
- Decide whether the project should be continued.
- Agree on the project plan for the remainder of the project.

Kerzner (2001:559), emphasises that some companies have identified four possible decisions that can be taken during these end-of-phase review meetings:

- Proceed to the next phase based on an approved funding level.
- Proceed to the next phase **but** with a new or modified set of objectives.
- Postpone decision to proceed based on a need for additional information.
- Terminate the project.

The reasoning is that unless specific criteria have been met, as evidenced by approved deliverables, the subsequent phase should not be started. These criteria can however be met before the full scope of a phase is finished. Therefore, although the gates are entry points to phases, phases can consequently overlap, thereby reducing the timescale without increasing associated risks. This is a very powerful characteristic of the staged framework and emphasizes the principle that gates are compulsory but phases not. This is supported by concurrent engineering principles as stated in section 3.1.

b) Aspects addressed at Decision Gates:

Three distinct questions need to be answered at each decision gate to ensure that gates serve their purpose as discussed. The three questions are:

- *Is the project viable?*
  The question address the acceptability of risks, the business sense behind the project as well as how the project fit into overall company strategy.
- *What is the priority of the project relative to other projects?*
  The question concerns the project in its context and compares its priority with all other projects.
- *Is there funding available to undertake the project?*
  The question addresses the availability of working capital to finance the project.

In order to answer these questions a project must be evaluated against certain criteria at the different gates. It is important to address all aspects of the project in parallel and to take into consideration that gate criteria are often repeated in consecutive gates. This ensures that certain issues are addressed throughout the project life cycle (Buttrick, 2000).

In conclusion, the criteria that are most often used for the evaluation of projects can be divided into three main categories:

- Criteria concerned with the overall business strategy and business management of the project. The aim of these criteria is to integrate the project decisions with the overall business strategies and operational activities.
- Criteria concerned with Technical Management.
- Criteria concerned with Project Management.

Typical criteria for each one of the main categories that can be used at the different gates are listed in Figure 3.4. The criteria are listed in the form of questions, but the most common practice is to translate the criteria into financial requirements and to take decisions based on the financial values.

Gate Reviews: Typical Questions

	Business Strategy	Technical Management	Project Management
Idea Generation			
Concept Gate	• Is it clear which business units or function the proposal support? • Does the proposal fit the strategy? • Is the opportunity attractive relative to alternative proposals? • Is the proposal likely to be acceptable to the customers and shareholders? • Do any competitors have capabilities similar to this? • Will the proposal provide the business with an competitive advantage? • Has a project sponsor been identified for at least the next phase/stage of the project?	• Can resources be committed to do the pre-feasibility study? • Is the business likely to be able to develop or acquire the required capabilities to support the proposal? • Is the proposal technically feasible with current technology? • Has the organization operational capability to support the proposal?	• Has a project manager been identified for the pre-feasibility phase/stage?
Pre-feasibility			
Feasibility Gate	• Is it clear which business units or function the project support? • Does the project fit the strategy? • Is the business opportunity attractive? • Are the risks acceptable? • Is the initial business case and investment appraisal acceptable? • Have all the relevant business units and functions been involved in creating and reviewing the deliverables? • Has a project sponsor been identified for the project?	• Can resources be committed to perform the feasibility study? • On current knowledge is it technically feasible with current technology, or it there a possible technical development path to provide the capability or service? • Does the business currently possess the operational capability to support the project? If not is it likely that this can be put in place within the current/proposed process architecture?	• Has a project manager been identified for the project? • Is there a detailed schedule, resource and cost plan for the Feasibility Phase/Stage? • Is there an outline schedule, resource and cost plan for the full project?
Feasibility			
Business Case Gate	• Is it clear which business units or function the project support? • Does the project still fit the strategy? • Have the development concepts e.g. marketing been researched and tested on target segments and the need reaffirmed? • Is the detailed business plan acceptable and compelling? • Have the key sensitivities and scenarios for the recommended option been checked and confirmed as acceptable? • Is the output definition clear? • Is the business case ready to be build into the overall business plan?	• Is it technically feasible with current technology? • Does the organization have the operational capability to support the project? • Are there resources to undertake the Development and Execution phase/stage? • Have formal commitments been made by the relevant line managers? • Have all relevant environmental permits been obtained?	• Are the project plans full and complete? • Is there a detailed schedule, resource and cost plan for the Development and Execution Phase/Stage? • Is there an outline schedule, resource and cost plan for the full project? • Are there sufficient review points in the plan? • Has the project been designed to eliminate known high risks?

Development	Business Strategy	Technical Management	Project Management
Authorization Gate	• Is the project still a good business proposition? • Is the project still correctly reflected in the overall business plan of the business? • Have all the high risks been eliminated?	• Is this the most suitable technical solution? • **Has the EIA study been completed and environmental approval been obtained?** • Have all the alternatives been evaluated?	• Is the project plan up to date, full and complete? • Is there a detailed schedule, resource and cost plan for the Execution and Testing Phase/Stage? • Is there an outline plan for the remainder of the project? • Are sufficient resources allocated to conduct the execution and testing?
Execution & Testing			
Implementation Gate	• Is the project still a good business proposition? • Have all the high and medium risks been eliminated from the project? • Have the costs and benefits been reforecast against the business plan?	• Have the tests been finalized and the results accepted? • Have process design across the business been accepted and is all training completed? • Are benefits/results monitoring systems in place?	• Is the project plan updated, full and complete? • Is there a detailed schedule, resource and cost plan for the Launch Phase/Stage? • Are sufficient resources allocated to undertake the launch?
Launch			
Project end gate	• Has the business forecast been updated to take into account the benefits arising from the project? • Has someone agreed to be accountable for monitoring the benefits? • Have review points and metrics for measuring the benefits been defined? • Has the project account been closed so that no more costs can be incurred? • Have all relevant stakeholders been informed of the project closure? • Have all issues been resolved?	• Have all issues been resolved? • Has ownership of each outstanding risk and issue been accepted by a NAMED person in the line or in another project?	• Have the timing, accountability and terms of reference for the Post Implementation Review been agreed on? • Have team appraisals relating to the project team been completed? • Have all lessons learned been recorded and communicated to the relevant process and documentation owners?
PIR			
Post Implementation Review			

3.2.3 Evaluation of the project life cycle management framework

Surveys conducted by Hellings & Pike in Britain confirmed that project appraisal through the life cycle concentrates only on the assessment of the financial and technical feasibility of a project (Lopes & Flavell, 1998). The appraisal in the generic project management framework proposed by Buttrick, focuses strongly on technical and financial feasibility as well as resource availability for project execution.

In the South African context the content of certain deliverables, e.g. business case and plan and engineering proposals (see Figure 3.3), were studied more closely in order to identify any environmental activities or aspects that are addressed. Figure 3.5 summarizes the main activities and appraisal issues concerned with environmental aspects over a project's life cycle in South Africa.

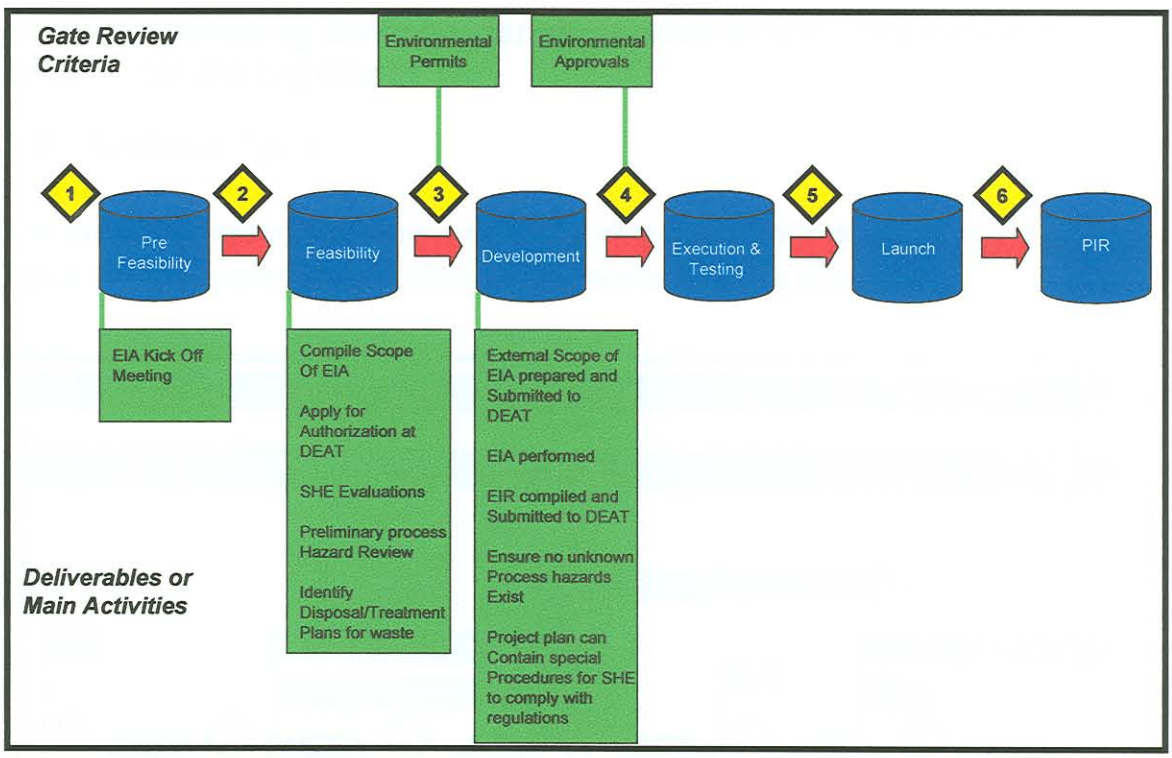


Figure 3.5: Extent of current environmental considerations during project management in South Africa

The figure indicates that social factors are currently not included in the normal project appraisal process, while environmental factors are only addressed by means of one question at the business case and authorization gates. It is consequently concluded that in South African context the emphasis is on financial feasibility during project appraisal. Economic objectives of business sustainability are thus efficiently addressed. The deliverables at gates do not include specific mentioning of social aspects, although it can form part of the

environmental impact assessment (EIA) (see chapter 2.5.3 c). Environmental impacts are mostly addressed on a deliverable level by following the formal guidelines of the national Department of Environmental Affairs and Tourism (DEAT) for conducting Environmental Impact Assessments (EIAs) (see Figure 3.5 and Appendix B).

Environmental factors are consequently addressed in a reactive way and environmental liabilities and risks are not considered at a strategic management level. It can hence be concluded that sustainable development factors are not efficiently addressed in the project management framework since the three objectives are not addressed similarly. A mechanism is therefore required to ensure that social and environmental considerations receive the same attention as economic factors at the project decision gates. The aim of this dissertation is to incorporate environmental sustainability in the project life cycle management framework.

3.3 Incorporating Environmental Sustainability into Project Life Cycle Management

3.3.1 Available Tools

The available environmental management tools were discussed in detail in Chapter 2. In Figure 3.6 the relevant tools were applied to the generic project life cycle.

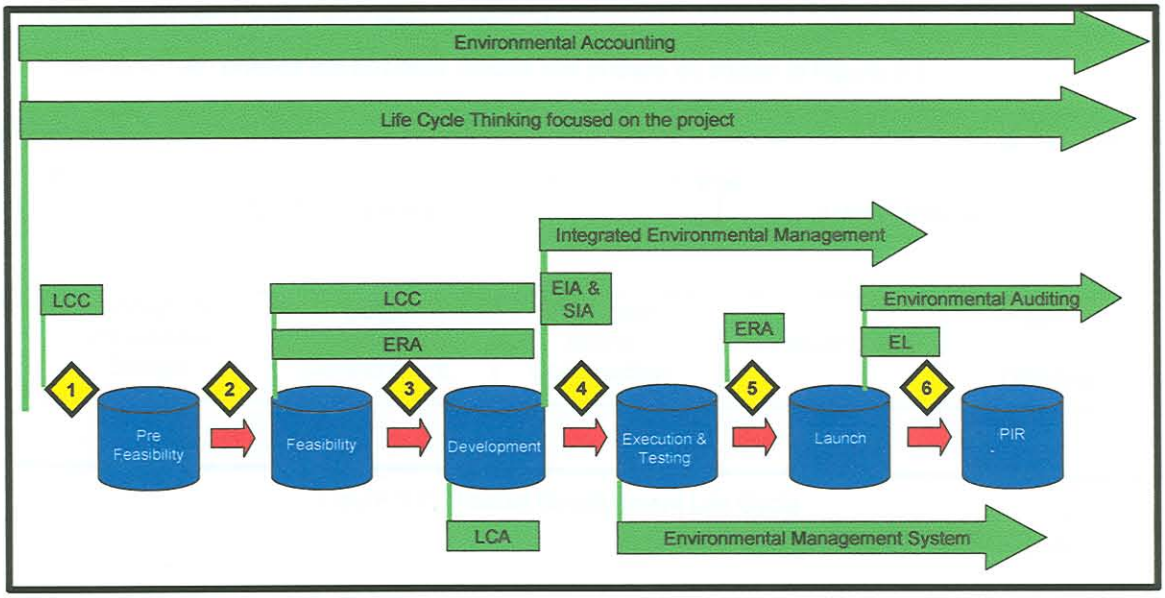


Figure 3.6: Environmental Management Tools applied over a generic project life cycle

A comparison of Figure 3.5 and 3.6 shows that all the available environmental management tools are not effectively utilized for project management purposes as only EIA and ERA are officially documented as part of the management process. There is thus room for improvement in incorporating environmental concerns into the project life cycle management

framework. It can be concluded form Figure 3.6 that concepts such as Life Cycle Thinking must be integrated into the business culture as it can be applied at all levels and should guide the paradigm of decision-makers. The importance of considering the "product/service" of the project is emphasized by the applicability of tools such as Environmental Labelling. In the process industry the "product" of a project is usually either a new or improved process that produces consumable products. The interactions between the three life cycles (product, process and project) must thus be analysed.

3.3.2 Life Cycle Interaction

The American Heritage® Dictionary of the English Language defines a life cycle as *"a progression through series of different stages of development"*. The life cycle of a product or process can accordingly be defined as the various development phases through which the project, process and/or system passes from its initialization until the final phase-out. The project life cycle is discussed in detail in Section 3.2.1.

a) Product Life Cycle

Various Product Life Cycles exist in literature. As with the project life cycle there is no general consensus among industries. It is possible to distinguish between a product development and a product manufacturing life cycle. Blanchard and Fabrycky's definition of life cycles supports a systems engineering approach and is a good example of a product development life cycle. Blanchard and Fabrycky (1998) believes that the product life cycle starts with the identification of a need and then consist of two main phases: Acquisition and Utilization. These two main phases are however divided into phases as shown in Figure 3.7.

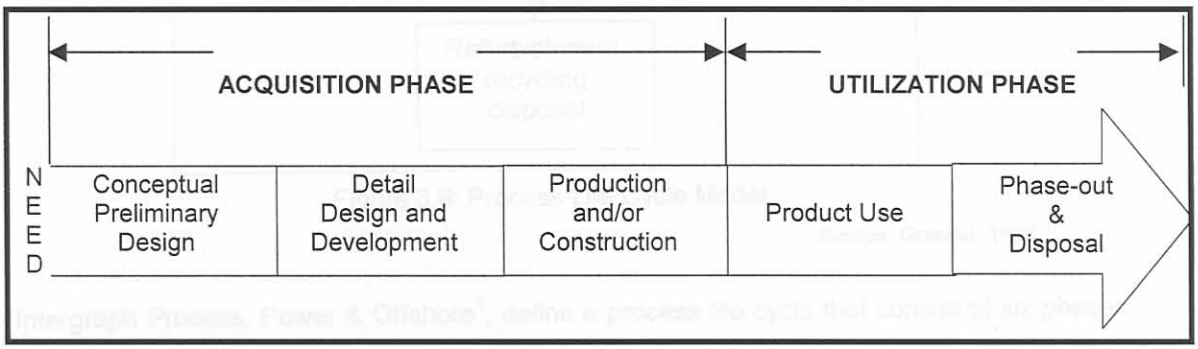


Figure 3.7: Product Development Life Cycle

Source: Blanchard & Fabrycky (1998)

An example of a product manufacturing life cycle that supports supply chain principles is shown in Figure 3.8.

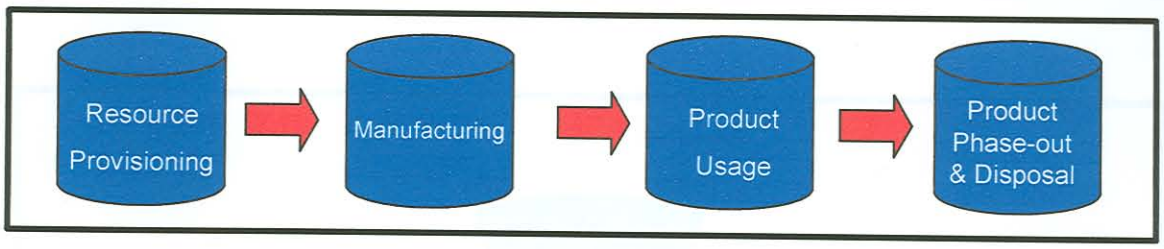


Figure 3.8: Product Manufacturing Life Cycle

b) Process Life Cycle

Various process life cycles are described in literature and it is evident that the type of process defines the characteristic life cycle stages. Graedel (1998) believes that the life cycle of industrial processes consist of five phases, but only three epochs as graphically shown in Figure 3.9.

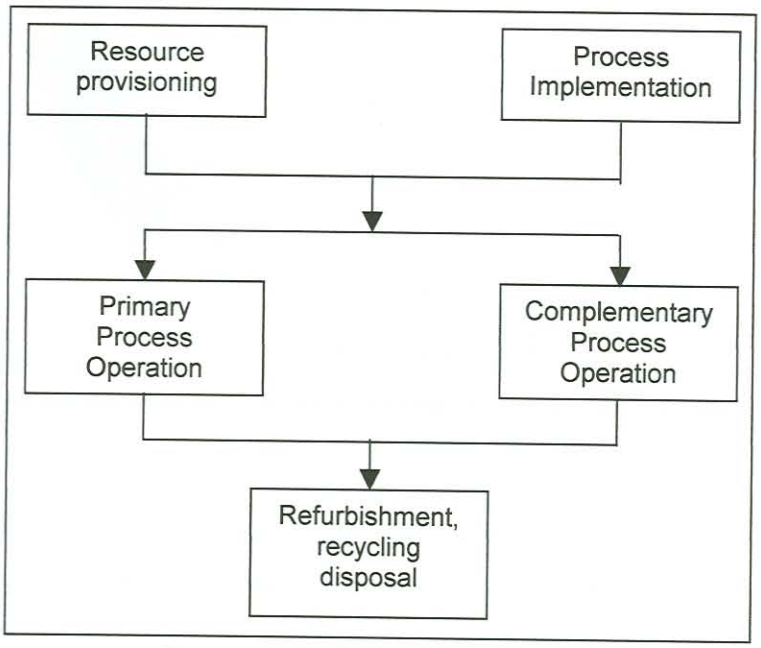


Figure 3.9: Process Life Cycle Model

Source: Graedel, 1998.

Intergraph Process, Power & Offshore[1], define a process life cycle that consist of six phases as shown in Figure 3.10.

[1] A company with 23 years experience in providing value to customers engaged in the design, construction and operation of plants by delivering software, services and solutions to achieve breakthroughs in efficiency.

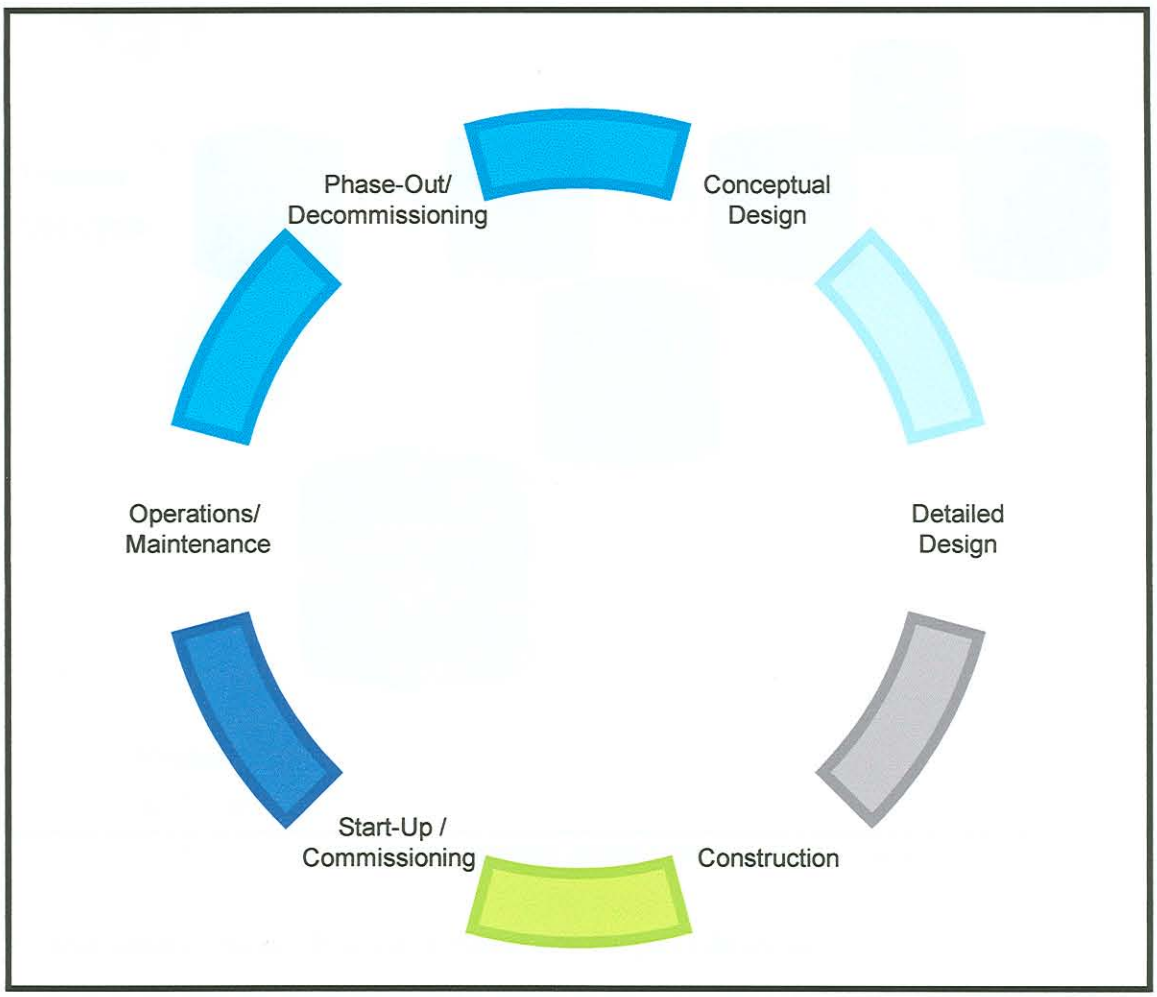


Figure 3.10: Process Life Cycle

The process life cycle of Graedel (1998) and the Integraph life cycle are combined and simplified into the four-phase process life cycle, shown in Figure 3.11.

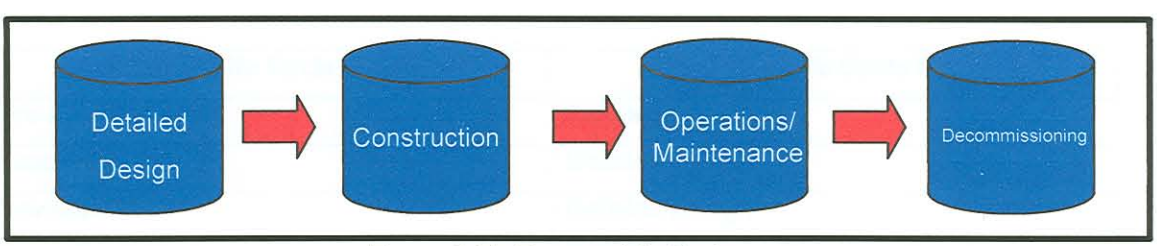


Figure 3.11: Process Life Cycle

c) Interaction between Product and Process Life Cycle

A process is defined as *"a series of actions, changes, or functions bringing about a result or a series of operations performed in the making or treatment of a product"* (The American Heritage® Dictionary of the English Language). The "result" is a product of some kind. The operation phase of the process is thus the manufacturing or production phase of the product. The relationship is depicted in Figure 3.12.

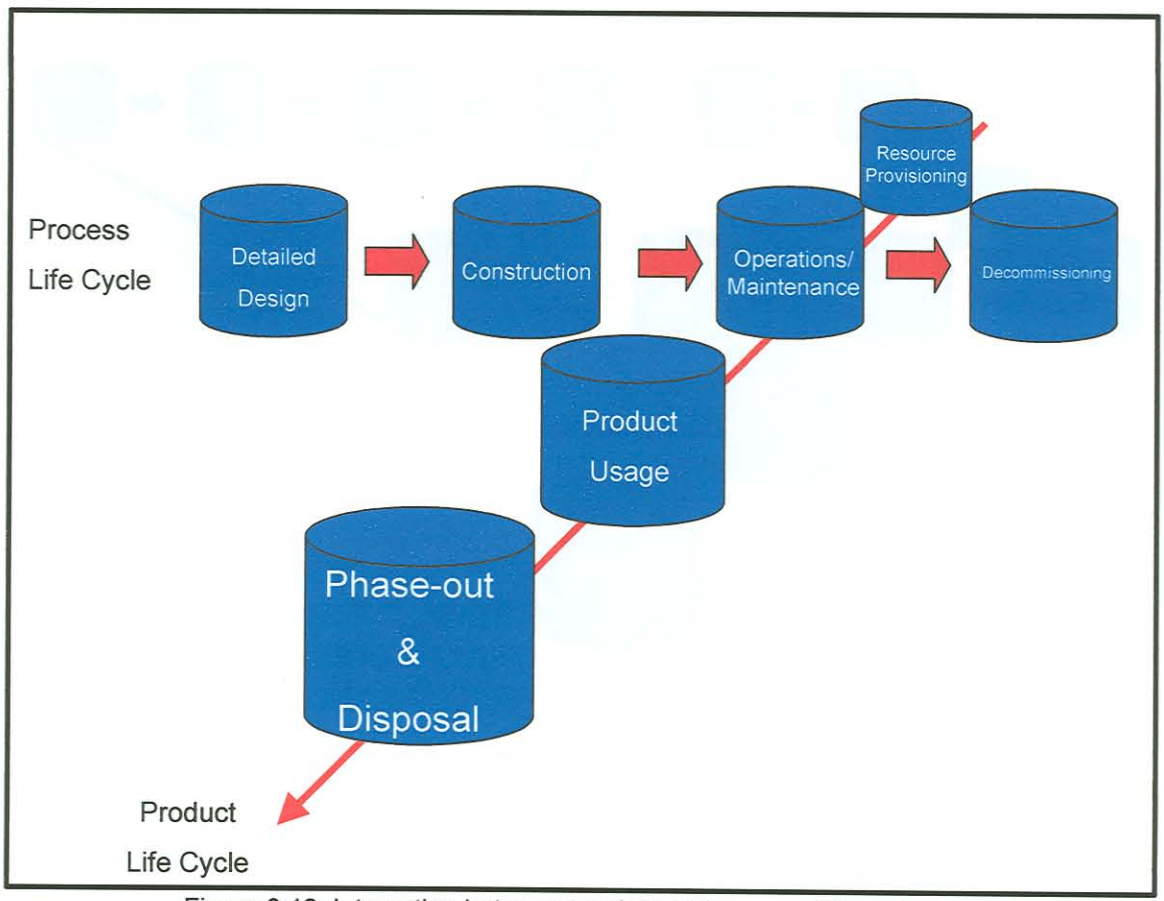


Figure 3.12: Interaction between product and process life cycles

d) Interaction between Process, Product and Project Life Cycle

Since projects that are undertaken in the South African process industry usually deliver a new or improved process that can produce products to fulfill the market's demand, the interaction between the project life cycle and the product and process life cycles must also be analysed. The process and the project and process life cycles are mapped in Table 3.4 and the interaction between the project, process and product life cycles is shown in Figure 3.13.

Project Life Cycle Phase	Process Life Cycle Phase
Pre-Feasibility	Detailed Design
Feasibility	Detailed Design
Development	Detailed Design
Execution & Testing	Detailed Design – Testing of Pilot Plant
Launch	Construction

Table 3.4: Mapping of the Project and Process Life Cycles

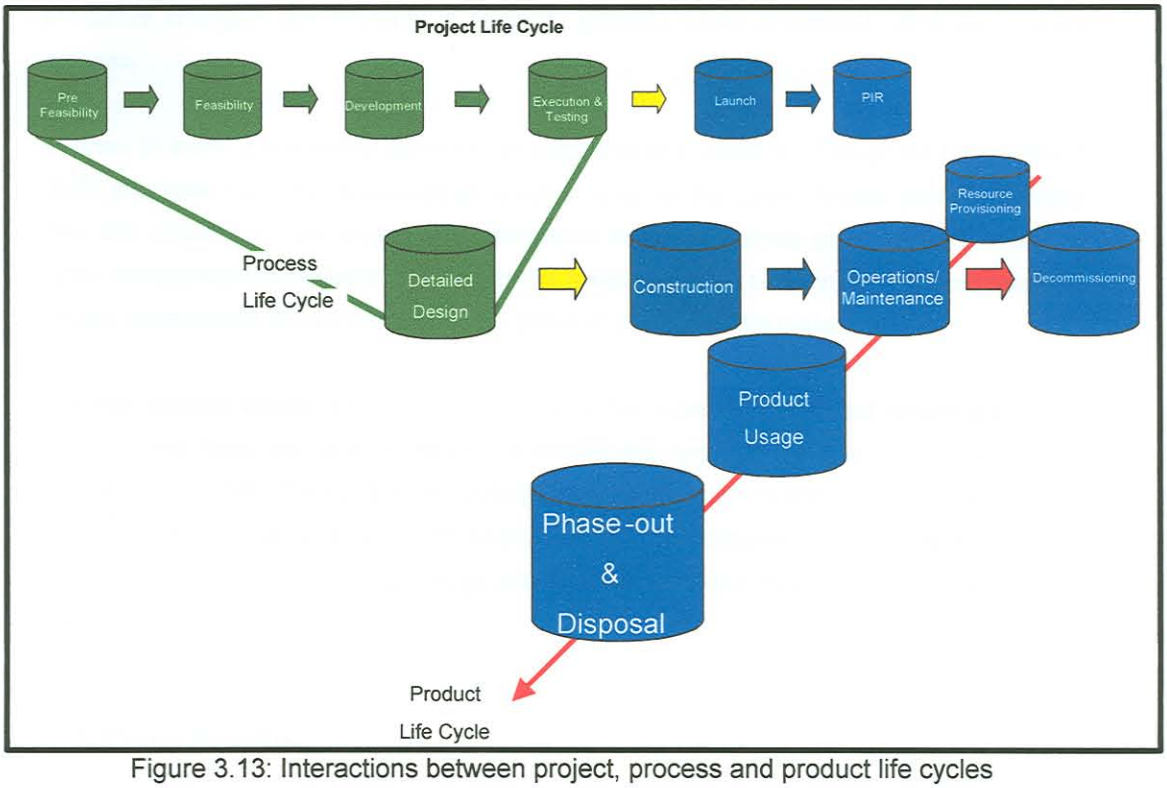


Figure 3.13: Interactions between project, process and product life cycles

A staged project life cycle management framework focuses on the project life cycle, but all environmental studies conducted during a project life cycle focus on possible environmental impacts resulting from the process or product life cycle. The remainder of this dissertation will therefore focus on all three life cycles and especially the interaction between the three, although changes are proposed to the project life cycle management framework only.

3.3.3 Proposed Changes to the Project Life Cycle Management Framework

a) Project Appraisal:

Environmental criteria will only receive the same attention as economic criteria if specific questions are developed to address environmental factors at the decision gates. Figure 3.4 clearly indicates that this is not currently the case. A whole new set of criteria dealing specifically with environmental factors must thus be developed for each gate of the project life cycle management framework.

b) Project Life Cycle Phase Activities and Deliverables:

Environmental criteria cannot only be addressed during project appraisal. Additional environmental related activities and deliverables must be added to the various project life cycle phases. Most projects in the process industry involve the development and implementation of a new or improved process. The design phase of a new process influences a significant portion of the total overall cost and it is also the only phase in which

pro-active changes can be made to minimize possible future environmental impacts of the process.

In order to follow a pro-active approach an additional tool based on "Design for Environment" (DfE) principles must be developed at strategic level for the South African process industry. This tool should be used to generate information for the first three gates of the process life cycle management framework. Applied in this manner the tool can support the Environmental Impact Assessment conducted in the third phase of the project life cycle.

It is the process resulting from the project, and the subsequent product resulting from the process, that have the largest possible environmental impacts associated with the project. The strategic tool should assess possible environmental impacts of the Construction, Operations/Maintenance and Decommissioning life cycle phases of the process. Possible environmental impacts of product usage and product phase-out must be considered as part of the Operations/Maintenance phase.

3.4 Conclusion

Hobbs and Miller, 1998 stated that projects could no longer be treated as static undertakings due to the fact that a project is subjected to uncertainty, risks and both internal and external pressures through its life cycle and dynamic change is hence expected (as cited in Jaafari, 2000). The project management philosophy and – framework must therefore be adapted to ensure maximum flexibility and innovation throughout the life of a project.

In order to achieve sustainable project life cycle management it will be necessary to address all three pillars of sustainable development i.e. economic, environment and social during all aspects of project life cycle management. Current business management frameworks typically do not support this approach and must thus be altered to incorporate all sustainability criteria.

Changes have been suggested to the project life cycle management framework to ensure that environmental criteria are effectively considered. This involves an additional set of project appraisal criteria, the development of a strategic tool to bridge the gap between decision makers and designers, and the promotion of other environmental management tools within the project life cycle management framework.