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AN OPTIMISED PORTFOLIO MANAGEMENT MODEL, INCORPORATING BEST PRACTICES

By

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Abstract

Driving sustainability, optimising return on investments and cultivating a competitive market advantage, are imperative for organisational success and growth. In order to achieve the business objectives and value proposition, effective management strategies must be efficiently implemented, monitored and controlled. Failure to do so ultimately result in; financial loss due to increased capital and operational expenditure, schedule slippages, substandard delivery on quality and depreciation of market share. This research paper investigates and discusses management strategies with the focus on integration of effective portfolio management, efficient system development life cycles and optimal project control to ultimately drive organisational sustainability and growth. With the aid of this research, optimal decisions on project/organisational venture selection can be made. Furthermore, integrating portfolio management strategies with system development life cycles and optimal project control strategies, will optimise an organisational portfolio and enhance the probability of project and organisational success.



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Contents

1. Introduction	1
1.1. Introduction and Context.....	1
1.2. Defining Research Problem.....	3
1.3. Research Question	5
1.4. Research Objectives.....	6
1.5. Brief Overview and Concepts.....	7
1.5.1. Portfolio Management.....	7
1.5.2. System Development Life Cycles	8
1.5.3. Project Controls Strategies	9
1.6. Research Process Strategy	10
1.6.1. Define the Research Problem/Question	11
1.6.2. Write the Research Proposal	11
1.6.3. Develop the Research Design	11
1.6.4. Collect Data	11
1.6.5. Select Procedure and Analyse Data	12
1.6.6. Research Reporting.....	12
1.6.7. Organisational Strategic Decisions.....	12
1.7. Research Overview	12
1.8. Conclusion.....	14
2. Portfolio Management.....	15
2.1. Introduction to Portfolio Management	15
2.2. Goals and Benefits of Effective Portfolio Management	17
2.2.1. Maximise Value.....	17
2.2.2. Create Balance	17
2.2.3. Strategic Direction	18
2.2.4. Right Number of Projects.....	18
2.3. The Portfolio Management Process.....	20
2.3.1. Step 1: Identification.....	24
2.3.2. Step 2: Categorization.....	24
2.3.3. Step 3: Evaluation	24

2.3.4.	Step 4: Selection.....	25
2.3.5.	Step 5: Prioritization	25
2.3.6.	Step 6: Portfolio Balancing.....	25
2.3.7.	Step 7: Authorisation	25
2.3.8.	Step 8: Portfolio Reporting and Review.....	25
2.3.9.	Step 9: Strategic Change	26
2.3.10.	Step 10: Component Execution and Reporting.....	26
2.4.	Portfolio Management Models.....	28
2.4.1.	Financial Methods.....	29
2.4.1.1.	Net Present Value	29
2.4.1.2.	Discounted Payback.....	30
2.4.1.3.	Expected Commercial Value	30
2.4.1.4.	Productivity Index (PI).....	32
2.4.1.5.	Benefit / Cost Analysis and Profitability Index.....	32
2.4.2.	Scoring Models.....	33
2.4.3.	Bubble Diagrams	34
2.4.4.	Strategic Buckets.....	38
2.4.5.	Checklists and Resource Capacity Analysis	39
2.5.	Popularity of Portfolio Optimisation Models.....	40
2.6.	Challenges in Portfolio Management	41
2.7.	Conclusion.....	42
3.	System Development Life Cycles (SDLC) and Projects Controls	44
3.1.	Introduction to System Development Life Cycles and Projects Controls	44
3.2.	Goals and Benefits of SDLC's and Effective Project Controls.....	46
3.3.	System Development Life Cycles	47
3.3.1.	Waterfall Method	47
3.3.2.	Spiral Method.....	48
3.3.3.	Incremental Design Method	49
3.3.4.	Rapid Application Development (RAD).....	50
3.3.5.	Evolutionary Design Method	51
3.3.6.	Agile Design Method.....	52
3.4.	System Development Life Cycle Selection Criteria	53

3.5.	Project Controls	55
3.5.1.	Scope Definition and Control	56
3.5.2.	Schedule Control	57
3.5.3.	Cost Control	58
3.5.4.	Quality Control	60
3.5.5.	Risk Control	61
3.5.6.	Contracts Control	61
3.6.	Conclusion.....	63
4.	Research Process Overview	65
4.1.	Introduction	65
4.2.	Selection of Research Methodology	66
4.3.	Case Study Research	67
4.4.	Case Study Research Process.....	67
4.4.1.	Designing the Case Study	68
4.4.1.1.	Study's Questions.....	68
4.4.1.2.	Proposition	69
4.4.1.3.	Unit of Analysis	69
4.4.1.4.	Linking Data to the Proposition	69
4.4.2.	Preparing and Collection of Data	69
4.4.2.1.	Case Study Selection	70
4.4.2.2.	Data Collection Protocol	70
4.4.3.	Analysing Case Study Evidence	71
4.4.4.	Reporting the Results.....	71
4.5.	Conclusion.....	72
5.	Findings and Integration Analysis	73
5.1.	Introduction	73
5.2.	Key Findings for Portfolio Management, SDLC's and Project Controls:	75
5.2.1.	Portfolio Management.....	75
5.2.2.	System Development Life Cycles	77
5.2.3.	Project Controls	78
5.3.	Case Studies, Analysis and Reporting	79
5.3.1.	Case Study 1: Paper Company X and Cable Company Y	79

5.3.1.1.	Introduction	79
5.3.1.2.	Brief Background on Companies.....	79
5.3.1.3.	The Case	80
5.3.1.4.	Analysis of Case Study and Findings	81
5.3.1.5.	Patterns within Case Study 1	83
5.3.2.	Case Study 2: Petrochemical Company Z.....	83
5.3.2.1.	Introduction	83
5.3.2.2.	Brief Background on Company	83
5.3.2.3.	The Case	83
5.3.2.4.	Analysis of Case Study and Findings	85
5.3.2.5.	Patterns within Case Study 2	86
5.3.2.6.	Common Patterns in Case Study 1 and 2.....	87
5.4.	Proposed Model for Portfolio Management Process	88
5.4.1.	Step 0: Key Stakeholders.....	90
5.4.2.	Step 1: Current Strategic Plan	90
5.4.3.	Step 2: Identification.....	90
5.4.4.	Step 3: Clear Scope Definition.....	90
5.4.5.	Step 4: Categorization.....	91
5.4.6.	Step 5: SDLC Selection and Project Control Points Prioritization	91
5.4.7.	Step 6: Evaluation	91
5.4.8.	Step 7: Selection.....	92
5.4.9.	Step 8: Prioritization	92
5.4.10.	Step 9: Portfolio Balancing.....	93
5.4.11.	Step 10: Authorisation	93
5.4.12.	Step 11: Portfolio Reporting and Review	93
5.4.13.	Step 12: Strategic Change	93
5.4.14.	Step 13: Component Execution and Reporting.....	94
5.5.	Conclusion.....	95
6.	Conclusion and Recommendations.....	98
6.1.	Introduction	98
6.2.	Restatement of the Research Problem.....	101
6.3.	Answers to Research Question	103

6.4.	Restatement and Achievement of the Research Objectives	107
6.5.	Recommendations	109
6.5.1.	Recommendation 1: Test the proposed portfolio management process.....	109
6.5.2.	Recommendation 2: Build on best practices and methods.....	109
6.5.3.	Recommendation 3: Investigate the viability of a fully integrated portfolio and project management system.....	109
6.6.	Conclusion.....	110
	Bibliography	113



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List of Figures

Figure 1: Research Objectives Flow Diagram.....	6
Figure 2: Portfolio Management Process (Project Management Institute 2006)	7
Figure 3: Water Fall Project Life Cycle Model (Bhunu 2007)	8
Figure 4: Typical Project Controls System (Erickson 2013).....	9
Figure 5: Research Process Strategy (Cooper, Schindler 2008)	10
Figure 6: Four Goals of Portfolio Management (Cooper, Edgett et al. 2000).....	17
Figure 7: Benefits of Effective Portfolio Management (Cooper, Edgett et al. 2000, Kilford, Cansoti.com 2008)	19
Figure 8: High Level Portfolio Management Process (Hughes, Collegiate Project Services 2007)	20
Figure 9: Portfolio Management Process (Wideman 2007)	21
Figure 10: Typical Portfolio Management Process (Merkhofer 2002).....	21
Figure 11: Key Steps in the Portfolio Management Process (Ernst & Young 2012)	22
Figure 12: Portfolio Management Models Based on Organisational Goals (Cooper, Edgett et al. 2000) ..	28
Figure 13: Decision Tree for Expected Commercial Value Analysis (Cooper, Edgett et al. 2000)	31
Figure 14: Project Scoring Model (ESI International 2006).....	34
Figure 15: Boston Matrix (QuickMBA 2010)	35
Figure 16: Risk-Reward Bubble Diagram (Cooper, Edgett et al. 2000)	36
Figure 17: Various Bubble Diagrams (Cooper, Edgett et al. 2000)	37
Figure 18: Typical Strategic Bucket (Cooper, Edgett et al. 2000).....	38
Figure 19: Benefits of SDLC's and Project Controls (Bhunu 2007), (Jessen 2011)	46
Figure 20: Spiral SDLC Method (Bhunu 2007).....	48
Figure 21: Incremental Design Method (Bhunu 2007)	49
Figure 22: Rapid Application Development Design Method (CASEMaker Totem 2000)	50
Figure 23: Evolutionary Design Method (IT Project Management Certificate Program 2005)	51
Figure 24: Agile Design Method (Bhunu 2007)	52
Figure 25: Project Controls System (Duncan, Director of Standards 1996), (DIS 2006)	56
Figure 26: Case Study Method (Yin 2009).....	68
Figure 27: High Level Overview of the Portfolio Management Process in Company Z	85
Figure 28: Proposed Portfolio Management Process Model.....	89
Figure 29: Graphical Representation of Research Objectives	107

List of Tables

Table 1: Popularity of Portfolio Management Models (Cooper, Edgett et al. 2000).....	40
Table 2: System Development Life Cycle Selection Criteria (Bhunu 2007), (Sharma 2011)	53
Table 3: Relevant Situations for Different Research Method (Yin 2009).....	66
Table 4: Patterns Identified in Case Study 1	83
Table 5: Patterns Identified in Case Study 2	86
Table 6: Common Patterns in Case Study 1 and 2	87



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Abbreviations

B/C	- Benefit to Cost Ratio
BD&I	- Business Development & Implementation
CAPEX	- Capital Expenditure
CEO	- Chief Executive Officer
DCS	- Distributed Control System
ECV	- Expected Commercial Value
EEP	- Engineering Execution Plan
EPCM	- Engineering, Procurement, Construction and Management
EPM	- Engineering, Procurement and Management
ETQP	- Engineering Track Quality Plan
KPI	- Key Performance Indicator
M&O	- Maintenance & Operational
MARR	- Minimum Attractive Rate of Return
MOC	- Management of Change
NCF	- Net Cash Flow
NEC	- New Engineering Contract
NPV	- Net Present Value
OCG	- Office of Government Commerce
OPEX	- Operational Expenditure
PEP	- Project Execution Plan
PI	- Productivity Index
PMBOK	- Project Management Body of Knowledge
PMI	- Project Management Institute
PMO	- Project Management Office
PTQP	- Project Track Quality Plan

PVP	- Potential Variation from Plan
PW	- Present Worth
RAD	- Rapid Application Development
ROI	- Return on Investment
SDLC	- System Development Life Cycle
VP	- Variation from Plan
WBS	- Work Breakdown Structure



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1. Introduction

1.1. Introduction and Context

In the competitive market environment that we live in, organisations strive to be at the forefront of continuous technology advancement and innovation. Driving innovation and sustainability, in most organisations, is usually accomplished by successful execution of projects and efficient delivery of services/products of the highest quality. Due to the current volatile economy, sustainability has become crucial for organisations across all sectors. It is imperative that organisations perform well over time and not just in short term interims, hence the drive towards organisational sustainability (Miller, McCartney January 2010).

Sustainability has become a major component in organisational success, yielding benefits which include; lower capital and operational expenditure, greater efficiencies, improved customer and stakeholder satisfaction and greater competitive advantage (Project Management Institute Inc. 2011). Based on research conducted by Accenture, 93% of CEO's see sustainability as important to their company's future success (Lacy, Cooper et al. 2010). In order to achieve this, it is imperative that effective management strategies coupled with strong technical expertise and effective project controls is applied.

There are various management fields discussed in business management literature, and common to all, is a field called portfolio management. Portfolio management as defined in the PMI Standard for Portfolio Management is, *"The centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives"* (Project Management Institute 2006). Too often, organisations execute projects that are not in line with; the business objectives / strategies, customer needs and market requirements, resulting in, and not limited to; increased capital costs, decreased ROI, decreased market share and a weakened competitive edge (Kilford, Cansoti.com 2008),(Thornton 2013).

As was stated in a research paper by OGC (Office of Government Commerce), *"In times of rapid change, budgetary constraints and high risk, it is shocking that some organisations continue to waste effort and resources by delivering the wrong Programmes and Projects"* (Kilford, Cansoti.com 2008) Benefits of effective portfolio management have been discussed

in various project management articles and studies. One such article was a study conducted by the Project Management Institute, which found that organizations that described themselves as highly effective in portfolio management increased the average number of projects meeting or exceeding their forecasted ROI by nearly 30% compared to those that described themselves as minimally effective. Hence it is imperative that the projects/programmes that optimally achieved organisational objectives and strategies are executed. The goal should always be to maximize the return on all projects in the portfolio (Portfolio Management Institute 2012).

Implementation of efficient system development life cycle models, as well as effective project control strategies is imperative for the support and realisation of organisational objectives and targets. Integrating system development life cycles and project control strategies with portfolio management will optimise the organisational portfolio, enhance the probability of project success and drive organisational sustainability.

Portfolio management, efficient system development life cycles and optimal project control strategies play a crucial role in achieving organisational objectives and driving sustainability (Miller, McCartney January 2010),(Bender RBT Inc. 2003),(Gilb 2005), as it integrates engineering and management skills with organisational strategic management, to provide the tools and strategies required for management and execution of organisational ventures.

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1.2. Defining Research Problem

Defining management focus points and strategies in any organisation is of vital importance, as it provides organisational direction and organisational venture execution governance (Meredith, Mantel 2012). Hence, management tools and techniques must be effectively and efficiently implemented in order to drive organisational sustainability.

In times of budgetary constraints, volatile economy and risk, companies continue to implement projects which are not in line with the organisational mission/strategy, resulting in financial losses, ineffective utilisation of resources and decrease in market share. (Kilford, Cansoti.com 2008), (Thornton 2013), (Ernst & Young 2012). Furthermore, poor project management, in terms of poor selection of projects execution methodologies, ineffective front end loading and inefficient project controls, have seen a multitude of organisational venture failures (Gilb 2005), (Bhunu 2007), (Attarzadeh, Hock Ow 2008). Cost overruns, schedule slippages and substandard delivery on quality are some of the consequences of ineffective project management (Attarzadeh, Hock Ow 2008).

The reason as to why organisations execute projects which are not in line with the organisational objectives is due to the fact that portfolio management is a relatively new field, and current best practices are unknown / followed incorrectly (Wideman 2007), (Pinto 2010). In fact, the first standard for portfolio management was developed by the Project Management Institute in 2006. Furthermore, due to the relative newness of portfolio management, there is a lack of awareness of portfolio management and the various strategies and processes thereof. Synthesis of various portfolio management processes, from organisations as well as the PMI standard for portfolio management, highlights the fact that, project execution methodology and lessons learnt are not incorporated in the early phases of the portfolio management process (Project Management Institute 2006), (Ernst & Young 2012), (Wideman 2007).

Based on personal experience of the researcher, being in a project driven environment, and supported by a paper written by Dr. Solomon Bhunu, "A closer look at project life cycles", it could be seen that once projects are selected (during the selection process in the portfolio management process), a standard system development life cycle (SDLC) is assumed. For some projects, the standard SDLC, may not be the optimal choice for the specific project, and could result in incorrect budget estimates, wrong techniques being applied and

inappropriate assumptions being made (Bhunu 2007). Hence, understanding the various commonly utilised SDLC's will be beneficial to the organisation, as optimal selection of system development life cycles will aid in cultivating a competitive market advantage, by ensuring that products are released quickly to the market, while ensuring optimal reliability and quality. Furthermore, based on personal experience of the researcher, and further supported papers written by Iman Attarzadeh and Siew Hock Ow "Project Management Practices: The Criteria for Success or Failure" and R. Mudau, L. Pretorius "Project Control and Risk Management for Project Success", it could be seen that, due to the poor focus on project controls throughout the SDLC, there has been many projects which have been executed over budget and beyond schedule.

Identifying projects that are in line with the strategic business objectives, incorporating best practices, SDLC and critical control points (based on SDLC selected) for projects into early phases of the portfolio management process, will ultimately result in, enhanced project prioritisation, selection and execution, driving organisation growth and sustainability.

Based on the research problems discussed above, the questions this mini dissertation sets out to answer needs to be determined. The research questions are presented in the next section.



1.3. Research Question

Based on the research problem discussed in Section 1.2, this mini dissertation is structured with the aim of answering the following two questions.

- What are current best practices, and commonly used methods for; Portfolio Management, SDLC and Project Controls?
 - What are commonly used models / methods for portfolio management and SDLC's, and critical project controls points?
 - Is there a standard process for portfolio management?
 - How does ineffective portfolio and project management affect project and organisational performance?
- Can the project portfolio management process be optimised, so as to create an enhanced prioritised and selected basket of projects?
 - Optimised meaning, that best practices (from PMI, and other literature) and commonly used methods, (financial, scoring, bubble diagrams) are incorporated into the portfolio management process, resulting in a selected basket of projects with their corresponding SDLC and project control points.

The questions the research aims to answer have been discussed above. In the next section, the research objectives will be presented.

1.4. Research Objectives

A graphical representation of the research objectives can be seen in Figure 1 below.

This mini dissertation attempts to highlight the best practices and commonly used methods of; portfolio management, system development life cycles, and project controls.

The research will be broken up into three sectors; portfolio management, system development life cycles and project controls. Each of these topics will be researched using the methods described in Chapter 1.5. These three sectors will then be interlinked to provide an integrated portfolio management solution.

With the aid of this research, best practices and commonly used methods for portfolio management will be known, enhancing the probability of portfolio management success in an organisation. Furthermore, including the element of SDLC's and project controls into the portfolio management process, will result in a basket of selected project, complete with an optimal execution strategy, in terms of SDLC's and control point, creating an optimised organisational portfolio.



Figure 1: Research Objectives Flow Diagram

Based on the research objectives presented above, a brief overview of portfolio management, system development life cycles and project controls is presented in the next section.

1.5. Brief Overview and Concepts

1.5.1. Portfolio Management

Portfolio management as defined in the PMI Standard for Portfolio Management is, “*The centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives*” (Project Management Institute 2006). The portfolio management process, as is discussed in the PMI Standard for Portfolio Management can be seen in Figure 2 below. This process will be discussed in Chapter 2. Organisations like; The Office of Government Commerce, Project Management Institute, Product Development Institute and Collegiate Project Services are some of many organisations which specify tools, techniques, benefits and implementation models (financial methods, business strategy approach, bubble diagrams, scoring models, check lists etc.) required for successful portfolio management. However, integration of SDLC’s and project control strategies is omitted. This shortfall can also be seen in many articles on portfolio management strategies.

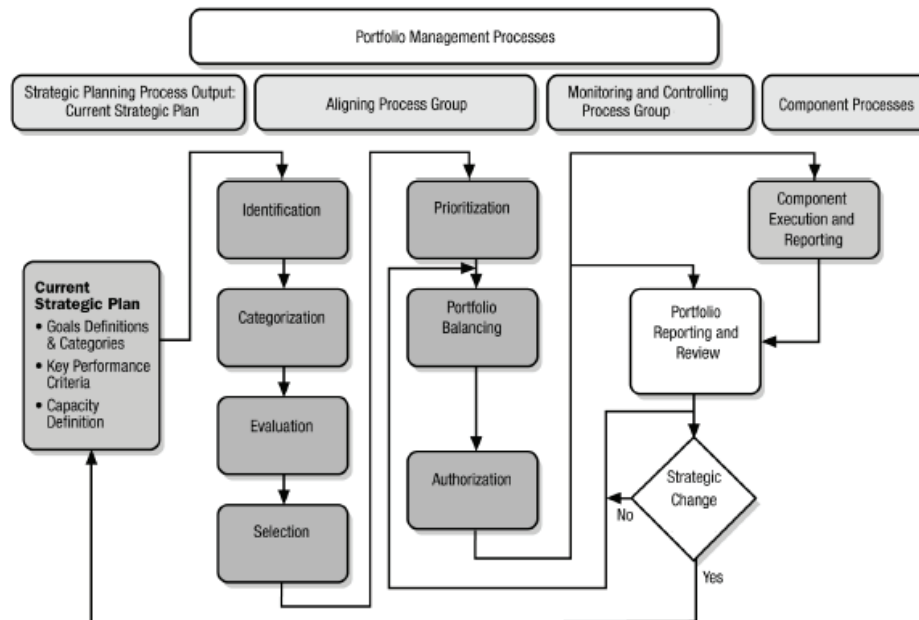


Figure 2: Portfolio Management Process (Project Management Institute 2006)

If the portfolio management process, shown in Figure 2, is analysed, it can be seen that the strategy utilised to execute the organisational venture is not discussed. A system development life cycle, that is most appropriate to the project scope and objectives should be selected. Selection of the incorrect SDLC may result in incorrect budget

estimates, wrong techniques being applied and inappropriate assumptions being made (Bhunu 2007). Hence, the optimal SDLC per project should be selected. The next section provides a brief introduction to SDLC's, which will be discussed further in Chapter 3.

1.5.2. System Development Life Cycles

Organisations usually execute projects according to a project life cycle model. These models generally have different project phases, with each phase having specific outcomes/deliverables (Bhunu 2007). Various life cycle models exist for project execution, some of which include, the Water Fall, Incremental, Spiral and Rapid Application Development models (Bhunu 2007). For example, a waterfall project execution model can be seen in Figure 3 below. The waterfall execution model comprises of various phases with specific stage gate requirements. Progression to the next phase is only permitted once the previous phase has been completed and the gate requirements are met.

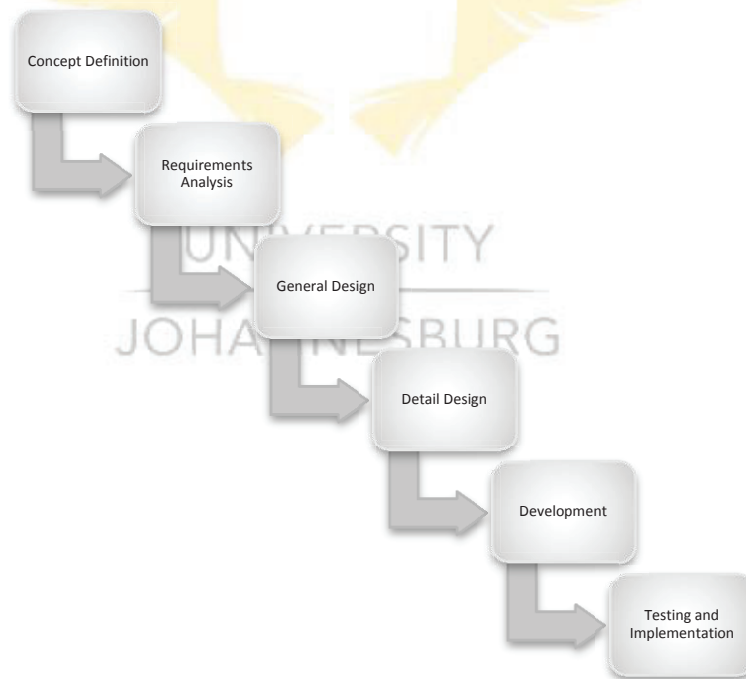


Figure 3: Water Fall Project Life Cycle Model (Bhunu 2007)

The model identified above is utilized once a project has been selected for execution. However, as was stated above, selection of the incorrect SDLC has adverse effects on

project planning and execution. Hence, it is imperative that the SDLC that is most appropriate, based on the objectives and scope of the project, is selected. Once the SDLC for a project has been selected, optimal project controls, based on the selected SDLC, is required to prevent adverse effects such as; cost over-run, schedule slippages and substandard delivery on quality (Mudau, Pretorius 2009). Hence, understanding the critical project control points is imperative. In a portfolio management environment, incorporating SDLC's, with effective project control points, into the portfolio management process, will result in an optimised basket of selected projects. A brief overview of project controls is discussed in the next section, and is further expanded in Chapter 3.

1.5.3. Project Controls Strategies

Increased capital and operational expenditure, schedule slippages and quality issues are all consequences of poor project controls (Mudau, Pretorius 2009). In order to effectively manage organisational ventures, it helps to understand the typical lifecycle of a project and how it applies to the specific project (BIS (Department for Business Innovation and Skills) November 2010). Figure 4 below shows some of the critical control points that must be effectively managed during the execution of a project. Organisations like; Project Management Institute, Department for Business, Innovation and Skills, as well as articles on project controls and the PMBOK, identify and discuss various control points for effective control of projects. Identifying control points, based on the SDLC, and integrating these control points into portfolio management processes, will provide a holistic approach to selection and execution of organisational ventures.

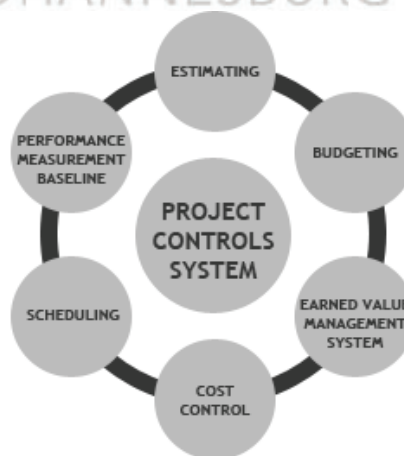


Figure 4: Typical Project Controls System (Erickson 2013)

1.6. Research Process Strategy

The research process defines the strategic approach undertaken to systematically achieve the purpose and objectives of the research. Figure 5 below shows a modified research process strategy based on a research process discussed in Business Research Methods by Donald R. Cooper and Pamela S. Schindler.

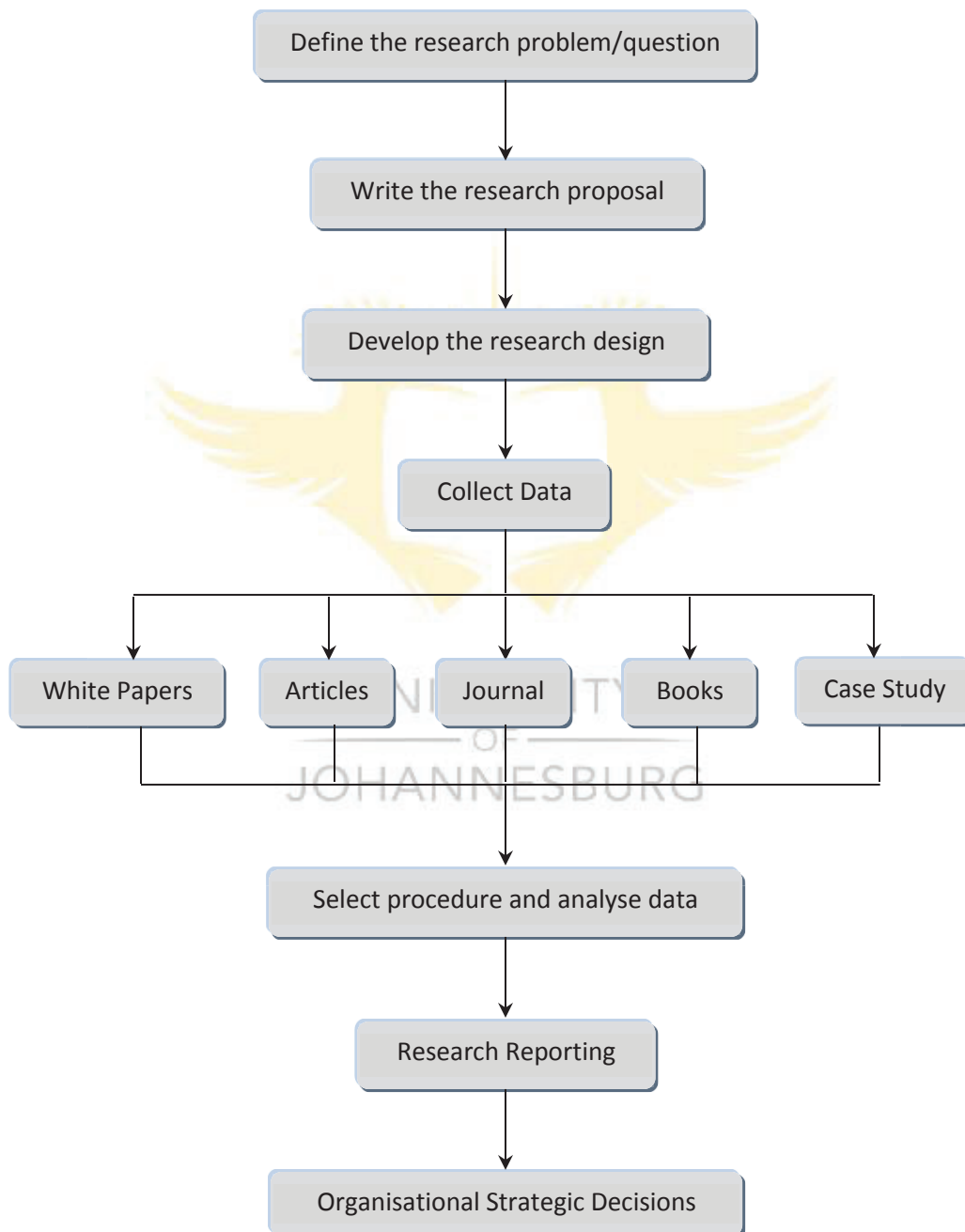


Figure 5: Research Process Strategy (Cooper, Schindler 2008)

1.6.1. Define the Research Problem/Question

The need for information/research is often born through problem identification which in turn gives rise to the research problem (Admadi, Simmering 2014). The research problem clearly defines the background and aim of the research. This may be seen in Section 1.3 and 1.4.

1.6.2. Write the Research Proposal

The research proposal highlights and discusses the background into the research as well as a clearly defined research problem. Once the research problem and objectives are defined, the procedures that will be followed in order to achieve the research objectives are discussed, with the aim of providing the reader with a clear heading and structure for the research. The research proposal, which highlighted the; research aim, research approach strategy, literature review and research planning, was submitted and approved for the research at hand.

1.6.3. Develop the Research Design

Once the research proposal has been accepted, the research design may be developed. The research design highlights the execution plan for conducting the research (Admadi, Simmering 2014). For the current research, a non-experimental approach was selected. This approach relies on analysis of existing literature and studies with the aim of synthesizing findings into a beneficially enhanced outcome. Furthermore, two case studies from various organisations will be presented. Based on the research questions and objectives, a qualitative approach was seen as the best way to conduct the research, hence the research strategy shown in Figure 5.

1.6.4. Collect Data

Data collection refers to the collection of material / data which will aid in achieving the research objectives. White papers, articles, journals, text books and case studies, from academic sources (e.g. IEEExplore), engineering based organisations, project and product development and management organisations and financial organisations, are some of the methods / instruments identified for collection of data, as these will provide the necessary information required to answer the research questions.

1.6.5. Select Procedure and Analyse Data

Once the data is collected, a suitable procedure for data analysis is selected. Based on the research design, a qualitative approach strategy for data analysis has been selected. Data from various sources will be, scrutinized, summarized, and documented such that the findings will aid in the realization of the research objectives.

1.6.6. Research Reporting

The findings and results of the data analysis process are documented in the report with the intent of providing answers to the research problems. Furthermore, the discussion of achievement of the research objectives is discussed in the final research report.

1.6.7. Organisational Strategic Decisions

Based on the outcomes of the research, enhanced strategic decisions can be made, yielding benefits to the parent organization.

1.7. Research Overview

There are five (5) chapters in this mini dissertation. These chapters are briefly discussed below.

Chapter 2: Portfolio Management

Chapter two of the mini dissertation will introduce the concept of the first strategic management field, portfolio management. A brief background, followed by the needs for, and benefits of, effective portfolio management will be discussed. The various models, best practices and strategies for effective portfolio will be identified, documented and discussed in chapter two.

Chapter 3: System Development Life Cycle (SDLC) and Project Controls

In order to strategically and structurally execute and manage organizational projects / ventures, a system development life cycle with effective project control points must be implemented. Various SDLC's along with critical control points will be identified and discussed in chapter three of the mini dissertation.

Chapter 4: Research Process Overview

In chapter four of this mini dissertation, the research process overview will be discussed, providing input into the types of research methodologies that will be used in this mini dissertation. Furthermore, the process that will be followed for the research methodology will be highlighted.

Chapter 5: Findings and Integration Analysis

In chapter five, the research topics and case studies are analysed and the information is synthesized into an integrated management strategy for portfolio management.

Chapter 6: Conclusions and Recommendations

The mini dissertation will be concluded in chapter six, providing an overview of the; background into the research, research problem and research objectives. Furthermore, the realization of the research objectives and answers to the research questions will be highlighted in chapter six. Recommendations based on the research outcomes will be provided in chapter six with the intention of driving continuous improvement.



1.8. Conclusion

In the current competitive market environment, coupled with the volatile economy, the implementation of a management strategy, aimed at driving sustainability, optimising return on investments, enhancing customer and stakeholder satisfaction and cultivating a competitive market advantage, is imperative for organisation growth and sustainability (Miller, McCartney January 2010),(David 2011). Effective management strategies must be efficiently implemented, monitored and controlled. Failure to implement, monitor and control effective management strategies ultimately result in; financial loss due to increased capital and operational expenditure, schedule slippages, substandard delivery on quality and depreciation of market share (Mudau, Pretorius 2009),(Thornton 2013).

Implementation of a management strategy which aims to; identify projects which are in line with the strategic business objectives, highlight appropriate system development life cycles and specify effective project control points within the execution model, will ultimately result in successful execution of organisational ventures / projects, optimised return on investment, market share growth and ultimately, organisational sustainability.

This mini dissertation attempts to highlight the importance of, and best practices for, portfolio management, system development life cycles and project controls. Furthermore, in this mini dissertation, various strategies for portfolio management will be discussed, along with various system development life cycles and project control strategies to drive organisational portfolio optimisation and ultimately, organisational sustainability. The research will be broken up into three sectors; portfolio management, system development life cycles and project controls. Each of these topics will be researched using the methods described in Section 1.5. These three fields will then be interlinked to provide an integrated portfolio management solution.

In the next chapter, an introduction into portfolio management along with the various portfolio management strategies will be identified and discussed.

2. Portfolio Management

2.1. Introduction to Portfolio Management

In today's growing international and domestic competitive environment, volatile economy, budgetary constraints and shrinking experienced workforce, optimal investment decisions coupled with, alignment of business strategies/objectives and effective project execution plans, are paramount in driving organisational success and sustainability (Walls 2004). Achievement of business objectives and driving innovation is usually accomplished by successful execution of projects/organisational ventures and efficient delivery of services/products of the highest quality. However, organisations continue to deliver projects which are not in line with the business strategy, ultimately resulting in decreased return on investments, ineffective utilisation of resources, increased capital expenditure and diminished organisational growth. This was further stated in a research paper by the Office of Government Commerce (OGC), *"In times of rapid change, budgetary constraints and high risk, it is shocking that some organisations continue to waste effort and resources by delivering the wrong Programmes and Projects"* (Kilford, Cansoti.com 2008). In order to drive optimal project/organizational venture selection while simultaneously ensuring alignment to corporate strategies / objectives, effective management strategies must be efficiently executed. One such field in management aimed at achieving this, is a field called portfolio management. In order to fully understand the definition of portfolio management, a project, program and portfolio needs to be clearly defined.

A project is a temporary endeavour undertaken to create a unique product or service (Duncan, Director of Standards 1996), in which, temporary implies that the project has a defined life cycle. Hence a project has a defined duration with a specified start and completion date. A program, as defined in the PMI Standard for Portfolio Management is, *"A group of projects managed in a coordinated way to obtain benefits not available from managing them individually"* (Project Management Institute 2006). A collection of programs and projects is defined as the organisational portfolio, of which are effectively managed and coordinated such that the business strategy and objectives are supported and benefits to the parent organisation are realised.

Portfolio management as defined in the PMI Standard for Portfolio Management is, *"The centralized management of one or more portfolios, which includes identifying, prioritizing,*

authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives” (Project Management Institute 2006).

Organisations are fast understanding the importance of integrating effective portfolio management strategies into the overall business strategy. A study conducted by Product Development Institute Inc., highlighted the importance of portfolio management. Some of the reasons include; maximizing returns on investment, create and maintain a competitive advantage, effectively manage resource allocation, create alignment with business strategies, achieve organisational balance and focus and enhance organisational communication. These are inherent properties of executing portfolio management strategies effectively. However, there are four main goals of portfolio management, which are centered on organisations.

The goals discussed above, coupled with the benefits realized from effective portfolio management are discussed in the next section of this mini dissertation. Furthermore, in Section 2.3, various lifecycles / processes for portfolio management are identified and discussed. Section 2.4 focuses on the various portfolio optimisation and management techniques. These techniques include; financial, scoring, bubble diagrams and various other implementation models. To emphasize the usage of these models in various organisations, the popularity of each model is discussed in Section 2.5 of this mini dissertation, followed by the challenges experienced with execution of portfolio management strategies. This is discussed in Section 2.6. This chapter is then concluded, providing a summary and discussion of the findings in this chapter.

2.2. Goals and Benefits of Effective Portfolio Management

Organisations, which execute their business objectives by means of implementation of projects/ventures, aim to achieve a specific measurable outcome once the objective of the project/venture has been achieved. However, too often, the reason as to why the project or organisational venture was pursued is not clearly defined or strategized (Meredith, Mantel 2012). Understanding the rationale or goal behind any project / organisational venture is imperative, as it provides the basis for organisational portfolio optimisation. Portfolio management strategies may be subdivided into four main high level organisational goals. These goals may be seen in Figure 6 below.

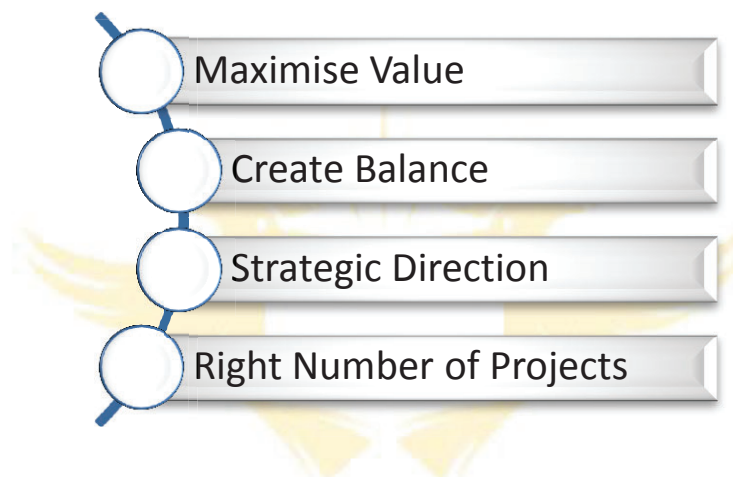


Figure 6: Four Goals of Portfolio Management (Cooper, Edgett et al. 2000)

2.2.1. Maximise Value

One of the main goals in many organisations, as was highlight in a study conducted by the Project Management Institute, was the goal of maximizing value. This was further explained in terms of effective and efficient allocation and utilisation of resources in order to maximize return on investments, yield long term profitability and enhance sustainability (Cooper, Edgett et al. 2000). Furthermore, inherent results of the goal of maximization of value are; enhanced customer and stakeholder satisfaction, improved market position and improved competitive advantage.

2.2.2. Create Balance

In order to ensure satisfaction of market demands and organizational portfolio diversity, a balance of projects / organizational ventures must be attained. This further improves organizational competitiveness and market position. Parameters for balancing of

organizational portfolios include, and are not limited to; long term projects verse short term projects, high risk and low risk, market diversification, different technologies, project types etc. As is stated in the Portfolio Management Guide by The Office of Government Commerce, “A *balanced portfolio is the mix that has the greatest potential to collectively achieve the organisation’s strategic objectives within the constraints of resources, time and risk*” (Kilford, Cansoti.com 2008)

2.2.3. Strategic Direction

Organisations are established with the aim of providing specific objectives/services. Strategies are developed in order to achieve the organizational objectives/goals. Projects serve as the primary response to achieving business objectives which ultimately result in an improved competitive edge (Antonio, Madelena 2009). The goal of strategic direction is to ensure that above all else, the organizational portfolio is truly aligned with the business objectives and strategy.

2.2.4. Right Number of Projects

As was identified in a study conducted by Ernst & Young (Strategy deployment through portfolio management), organisations implement too many “must have” projects even though resources are limited. The consequence of doing this is; ineffective utilisation of resources, expenditure growth due to opportunity costs, poor / delayed delivery of services to the market and failure to achieve business objectives. Hence, it is imperative that the right number of projects is selected in order to prevent adverse consequences.

The above four goals are seen as the basis high level organisational goals when it comes to strategic management of portfolios. Juxtaposed to the four goals, are various techniques / models, for achieving the specific goal. These models / techniques will be explained in further detail in section 2.4.

Various benefits of effective portfolio management are highlighted in the goals discussed above. There are further benefits highlighted in many portfolio management and project management surveys and studies. A summary of the benefits of portfolio management, as was synthesised from various studies, may be seen in Figure 7.

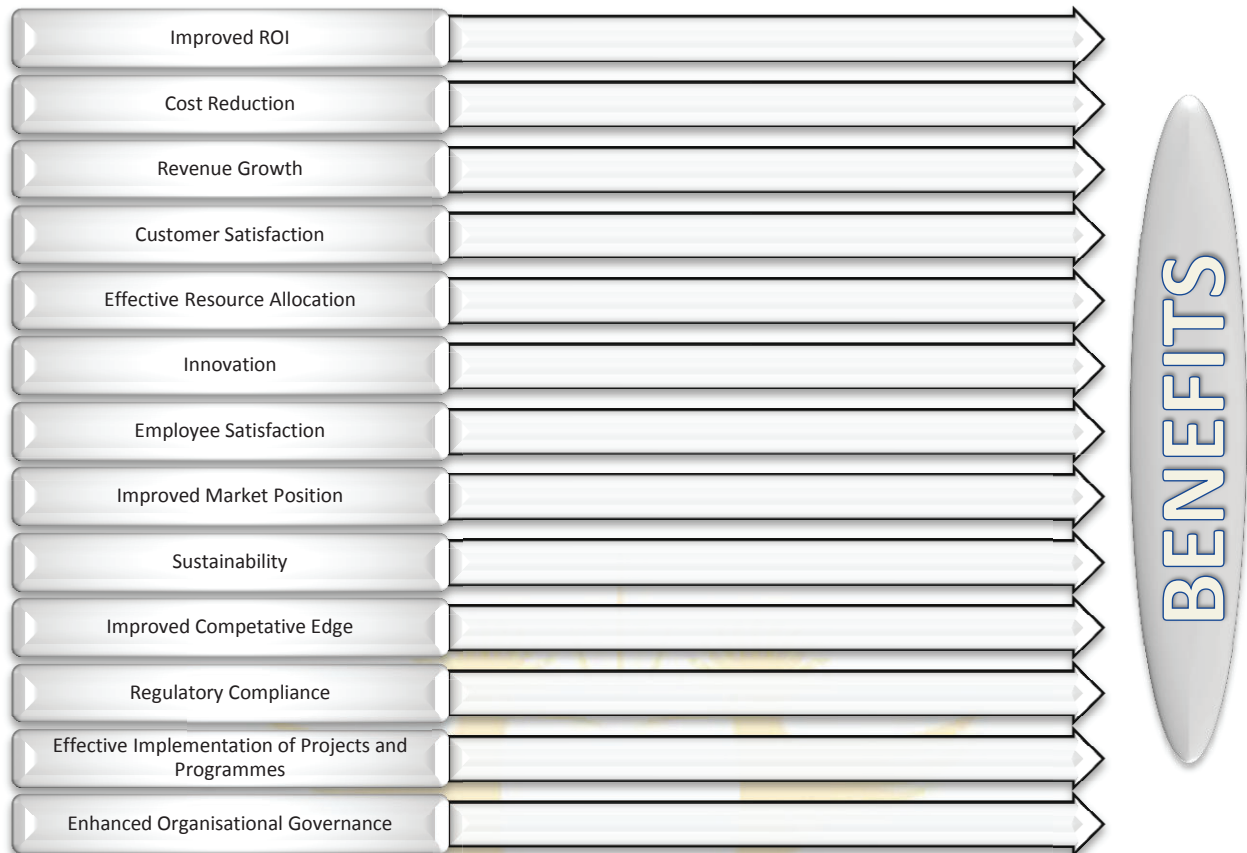


Figure 7: Benefits of Effective Portfolio Management (Cooper, Edgett et al. 2000, Kilford, Cansoti.com 2008)

As was stated above, benefits of effective portfolio management have been discussed in various project and portfolio management articles and studies. One such article was a study, that justifies some of the benefits discussed in Figure 7, was conducted by the Project Management Institute, which found that organizations that described themselves as highly effective in portfolio management increased the average number of projects meeting or exceeding their forecasted ROI by nearly 30% compared to those that described themselves as minimally effective. Another such study was conducted by PM Solutions (The State of Project Portfolio Management 2013), which found that organisations which implemented a portfolio management process, improved return on investments of projects by a minimum of 25%. Furthermore, customer and stakeholder satisfaction was enhanced, and resources were more efficiently utilised.

It may be seen that based on the studies conducted by various institutes and the benefits generated, effective portfolio management plays a pivotal role in achieving organizational objectives and strategy, and ultimately driving organizational sustainability. Seeing as the

benefits and goals of portfolio management have been clearly identified, an efficient structured approach to executing portfolio management is required.

2.3. The Portfolio Management Process

In order to achieve effective portfolio management within an organisation, the development of a portfolio management execution model is required, providing a structured approach to realisation of portfolio management goals (Cooper, Edgett et al. 2001),(Project Management Institute 2006). Implementation of portfolio management strategies in line with an execution model further provides a means of control and governance throughout the process, hence enhancing the probability of success. There are a number of execution models / processes for portfolio management discussed in various strategic and project management literatures, however, each organisation will have a process / execution model tailor made for the specific business, culture and size (Ernst & Young 2012). Below are typical portfolio management processes, as was identified in various strategic and project management literature.

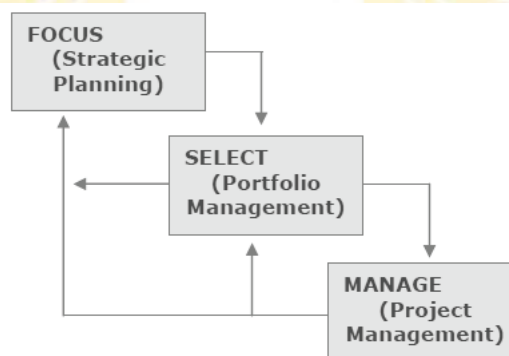


Figure 8: High Level Portfolio Management Process (Hughes, Collegiate Project Services 2007)

Figure 8 above shows a typical high level portfolio management process. This was discussed in a paper, Successful Portfolio Management by Collegiate Project Services. The first step identified was strategic focus. This entails development of organisational strategic plans and refinement / alignment of organisational objectives. The second step of the process is the physical management of organisational portfolios. Projects are evaluated using an applicable model and projects providing the most value are selected. The final high level step is management, management of the process and driving continuous improvement interventions (Hughes, Collegiate Project Services 2007).

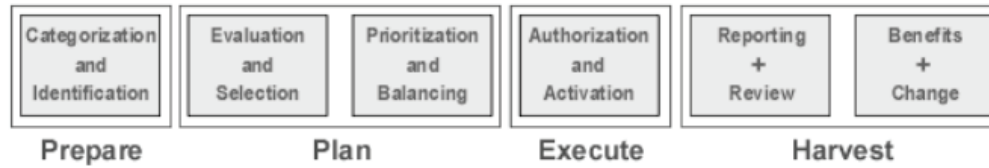


Figure 9: Portfolio Management Process (Wideman 2007)

Figure 9 shows a portfolio management process developed by AEW Services. It can be seen that the model consists of four high level processes, which are broken down onto further detail. The first step is to prepare, with the focus being on categorization and identification. This step entails identification of organisational strategies and objectives and categorizing of organisational ventures. The next step according to the process is planning, with the focus being on evaluation and selection, and prioritizing and balancing. In this step, organisational portfolios are evaluated and projects which provide the maximum value are implemented. The third step is executing the initiative. Projects which were selected are formally activated. The final step of the process is the harvest phase, where the strategies developed for the process and project are reviewed and continuous improvement strategies are implemented (Wideman 2007).

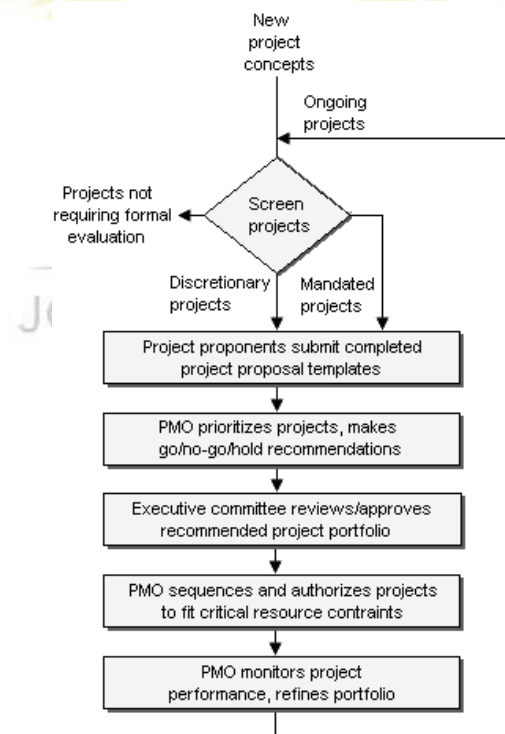


Figure 10: Typical Portfolio Management Process (Merkhofer 2002)

Lee Merkhofer Consulting is a company which specialises in providing project portfolio management strategies and guidelines for effective portfolio management. Figure 10 represents one of the portfolio management process prescribed by the company. The process is described clearly in Figure 10, hence requiring no further explanation.

A study conducted by Ernst & Young “*Strategy deployment through portfolio management*” synthesises findings from various portfolio management processes (currently utilised in various organisations) into key steps required for effective portfolio management, hence it will be beneficial to analyse the outcomes of this study. The key steps can be seen in Figure 11 below.

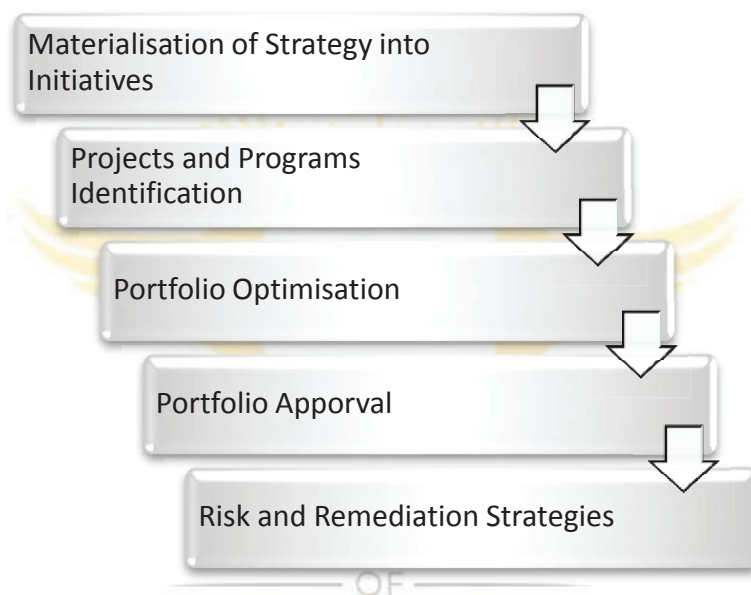


Figure 11: Key Steps in the Portfolio Management Process (Ernst & Young 2012)

The first step of the process shown in Figure 11, involves aligning organisational initiatives to the business objectives and strategy. These initiatives are normally projects and programs, and are vehicles for materialization of organisational objectives. Hence it is imperative to ensure that these initiatives support the organisational objectives and strategy. The various initiatives, which were identified for achievement of the organisational objectives, are then translated into projects or programs. These projects / programs are further defined in terms of scope and a high level business plan. As was highlighted in the study by Ernst & Young, risk plays an important factor in this step, followed by a properly defined scope. Too often, these factors are omitted in the portfolio management process, resulting in organisational initiative failure.

The third step entails optimization of organisational portfolios with the aid of various portfolio management models and proper facilitation. Various models exist to support portfolio optimization and these models will be discussed in section 2.4 of this mini dissertation. Based on the organisations evaluation factors, projects and programs may be stopped, initiated, accelerated and decelerated at this point, hence optimizing organisational value and sustainability. Based on the organisational framework, the projects / programs which provide optimal value, and which efficiently achieve the business objectives, may be selected. Key factors to consider during this step are resource availability and allocation, and risk (Ernst & Young 2012). Once the organisational portfolio has been optimized, capital is required for execution of the projects and programs within the portfolio. The portfolio will be analysed by an executive committee and the portfolio is formally approved.

The final step of the process seen in Figure 11 serves as the closed loop to the portfolio management process. The projects and programs are continuously monitored to evaluate the risks and issues encountered during the execution of the initiative. These risks and issues are then fed back into step 2 and 3 with the aim of driving continuous improvement, and to enhance future decision making. Too often, these critical lessons learnt are not filtered back into the portfolio management processes and as a result, these issue and risk materialize when a similar initiative is implemented.

As was stated above, and as is discussed in the PMI Standards for Portfolio Management, each organisation will have its own portfolio management process. Hence the importance of the study conducted by Ernst and Young, as it looks at key factors/steps of portfolio management processes currently being followed. Furthermore, the issues experienced in the processes are also discussed.

Taking the above processes into account, the backbone for these processes must be understood. These processes were selected, as they were found to have similar key steps. The PMI Standard for Portfolio Management discusses the portfolio management process which applies globally and across industry groups. Looking at the various processes above, it could be seen that they comprise of some of the key steps specified in the PMI standard process for portfolio management. The portfolio management process, as is discussed in the Standard for Portfolio Management can be seen in Figure 2 in Chapter 1.

The process seen in Figure 2, as well as the key steps and findings in the Ernst & Young study will serve as the basis for the portfolio management process for this mini dissertation. This is due to the fact that the process highlighted in the Standard for Portfolio Management (Figure 2) applies globally and the findings from the Ernst & Young study looks at processes currently being used. Seeing as each step of the process is important, these steps will be explained in further details.

2.3.1. Step 1: Identification

From Figure 2, it can be seen that the current strategic plan must be in-place as this is a prerequisite to the identification step, and the portfolio management process. In this step, the identification of all ongoing and new initiatives (projects, programs etc.) is conducted. The initiatives are then defined in terms of their objectives. Furthermore, the initiatives are analysed in terms of, and not limited to; the class of initiative (project, program, business case etc.), new revenues, return on investments, net present value, strategic alignment, key stakeholders, timescale, business unit etc. At the end of this step, a comprehensive list of all new and ongoing initiatives is generated, including key descriptors for each initiative.

2.3.2. Step 2: Categorization

In this step, the various initiatives which were identified for achievement of the organisational objectives are categorized. This implies that the initiatives are grouped in terms of common goals so that these initiatives can be measured on the same basis when it comes to the evaluation, selection, prioritization and balancing phase (Project Management Institute 2006). Some of the categorization factors may include, and not limited to; legal obligation, process improvement, continuous improvement, business imperatives and risk reduction (Project Management Institute 2006). The outcome of this step is a complete categorization of the listed initiatives.

2.3.3. Step 3: Evaluation

This step entails gathering of information to evaluate the initiatives, with the purpose of comparing these initiatives in order to streamline the selection process (Project Management Institute 2006). Qualitative as well as quantitative information can be used in the evaluation process. There are various strategies for evaluation and these will be

discussed in Section 2.4. The outcome of the evaluation step should be a comprehensive evaluation of all listed initiatives.

2.3.4. Step 4: Selection

Once each of the listed initiatives have been evaluated, initiatives are selected based on the organisational selection criteria. The selected initiatives are then included in the organisational portfolio.

2.3.5. Step 5: Prioritization

After the selection step, the initiatives, which have been selected, are prioritized. The purpose of prioritization is to rank the initiatives within the various categories (as is discussed in Section 2.3.2). Various prioritization methodologies may be used, like scoring or weighted criteria, and these will be discussed in Section 2.4. The outcome of this step is a prioritized list of initiatives that will be subjected to portfolio balancing.

2.3.6. Step 6: Portfolio Balancing

The purpose of this step is to establish a balance between the prioritized initiatives so as to optimize the achievement of organisational objectives. The organisational portfolio is balanced in terms of; but not limited to; the organisations desired risk profile, specific objectives, financial returns, investment diversification and capacity constraints. Strategies used for portfolio balancing are discussed on Section 2.4. The outcome of the portfolio balancing step is a complete list of initiatives that will be approved for execution.

2.3.7. Step 7: Authorisation

Once the organisation portfolio has been established, initiatives within the portfolio are formally authorized for execution. At this point, capital, as well as human resources, is allocated to execute the initiative. It should be noted that at this point, budgets and resources from inactive / terminated initiatives may be reallocated to prioritized initiatives.

2.3.8. Step 8: Portfolio Reporting and Review

The aim of portfolio reporting and review is to gather performance indicators so as to monitor the organisational portfolio in terms of alignment to organisational strategy and ensure optimal utilisation of resources. Various inputs for the reporting and reviewing

process may be taken into account. Some of the inputs are; information on the various initiatives (budget, expected return, progress against plan etc.), resource allocation, environmental constraints, organisational governance standards, selection criteria and strategic goals. The outcome of the review process will identify initiatives which perform as expected, and those which do not. For the affected initiatives, direction is provided to the owners and resources may be reallocated, the initiative may be subjected to realignment with organisational strategies and the initiative may be suspended or terminated.

2.3.9. Step 9: Strategic Change

If there are any changes in the organisational strategy, the portfolio management process must be able to accommodate and adapt to such changes. This is the purpose of this step. If the strategic change is small, the initiatives may be re-evaluated in terms of organisational portfolio balance. However, if the strategic change is significant, a new strategic direction is taken, and the entire organisational portfolio process will have to be repeated.

2.3.10. Step 10: Component Execution and Reporting

The purpose of this step is solely to provide information on the execution of the initiative, which is fed back into the portfolio reporting and review phase. This was one of the short falls discussed in the study conducted by Ernst & Young, as feedback on the execution of projects is not fed back into the organisational portfolio management process. Furthermore, the lessons learnt and process execution methodology, used on similar initiatives is not incorporated into the evaluation process of the overall portfolio management process. Including these factors into the evaluation process provides completeness to the evaluation process and drives informed decision making.

The key steps for effective portfolio management have been clearly defined above and the importance of each step has been highlighted. It could be seen that in most of the steps, various models were required to aid in the optimisation of organisational portfolios. Furthermore, as was stated in Section 2.2 of this mini dissertation, based on the organisational goals, various models may be implemented. The goals discussed in Section 2.2 are aimed at organisational portfolio optimisation; hence it is linked to the steps of the portfolio management process.

An important factor to consider is, the personnel required during the portfolio management process. Based on the PMI Standard for Portfolio Management, it is best practice to ensure that the following personnel are included in the process; executive managers, portfolio review board, portfolio managers, sponsors, program managers, project managers, project/program management office, project team, operations management, functional managers, financial managers, customers and business partners (Project Management Institute 2006).

Based on the goals discussed in Section 2.2, the various models, which will aid in achieving the organisational goals, will be discussed in the following section. These models will also feed into the steps of the portfolio management process.

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2.4. Portfolio Management Models

Portfolio optimization is a key factor in organisational strategies. Optimisation of organisational portfolio provides a means of translating projects and programs into value adding business initiatives, hence enhancing the probability of organisational success and sustainability. As was stated in Section 2.3, defining organisational goals is imperative to driving portfolio optimisation. For each goal, there are various models that may be used to aid with the portfolio optimisation process. Figure 12 below, based on a paper “Portfolio Management Fundamental for New Product Success” by Product Development Institute Inc., highlights the models most commonly used for portfolio optimisation, based on organisational goals.

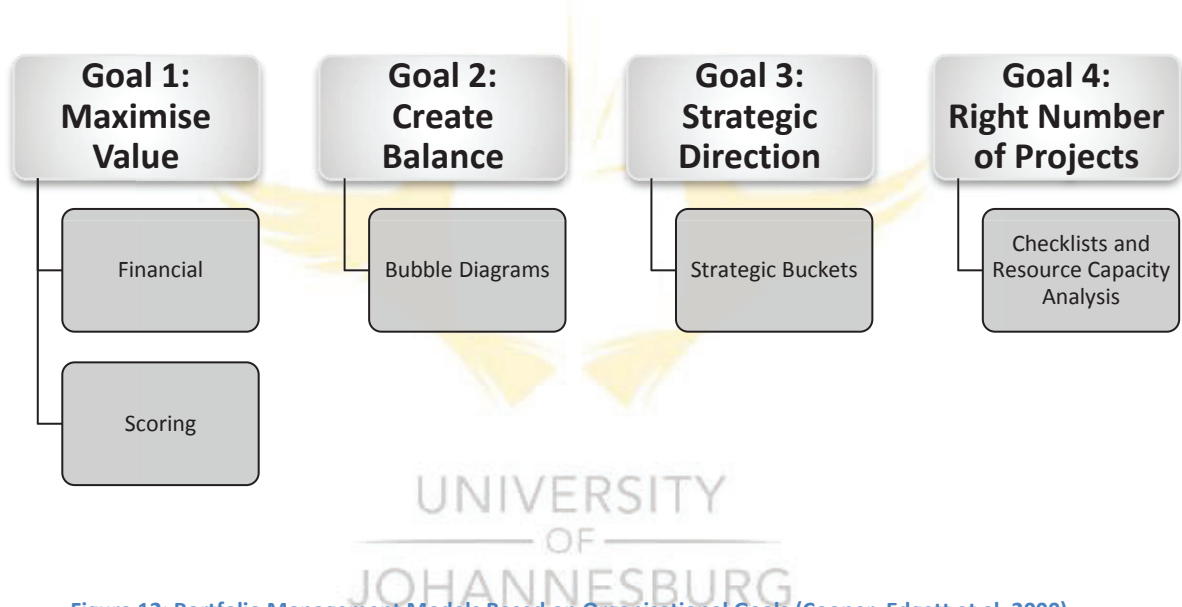


Figure 12: Portfolio Management Models Based on Organisational Goals (Cooper, Edgett et al. 2000)

As was stated above, Figure 12 shows the most commonly used methods for the specific organisational goals. This was an outcome of the study conducted by Product Development Institute Inc. and it provides a guideline for model selection for the portfolio optimisation process. Models may be used and interchanged to further aid in achievement of organisational goals. Hence, the models identified in Figure 12, if used correctly, may be used for achievement of another organisational goal.

The following sub-sections will discuss each model in further detail, highlighting the benefits, disadvantages and popularity (in terms of usage) within organisations.

2.4.1. Financial Methods

Financial methods are one of the most commonly utilised methods when it comes to portfolio optimisation (Cooper, Edgett et al. 2001). This is inherent in the fact that organisations strive to enhance business value by optimisation of investments in terms of financial returns. Various methods can be used for financial assessments, such as; net present value (NPV), estimated commercial value (ECV), and cost/benefit or productivity index. These methods will be explained in further detail below.

2.4.1.1. Net Present Value

The most popular financial tool used for decision making, is net present value analysis, which determines the NPV of each project in the portfolio (Pinto 2010). In order to determine the NPV of a project, various factors are required. These factors include; foreseeable cash inflows and outflows, the organisational minimum attractive rate of return (MARR), inflation and useful life of each project.

These factors are normally populated on a spreadsheet for all the projects in the organisational portfolio. With the aid of the organisational MARR and inflation, the net cash flow for each project is discounted to the present value. The sum of the present value of future income, minus the initial investment yields the project's net present value. This is explained in the equation below.

$$NPV \equiv I_0 + \sum \frac{F_t}{(1+r+p_t)^t}$$

Where:

F_t = net cash flow for period t,

r = minimum attractive rate of return,

I_0 = initial investment at time 0 (start),

p_t = inflation during period t. (Pinto 2010)

The net present value determined, will enable to organisation to analyse which projects would yield the greatest value / benefit to the organisation. A project with a positive NPV implies that the project is a lucrative organisational initiative / investment as it will provide increased (exceeded original MARR) returns on the initial investment. Conversely, a negative NPV implies that the implementation of the

project will result in an organisational loss; hence, the project should be stopped. Using this method, all projects in the organisational portfolio are compared against each other, and the projects which yield the greatest benefits, are selected.

There are however, disadvantages with the NPV financial method, as was discussed in the study conducted by Project Development Institute. The NPV method relies on accurate financial projections. Very often, these projections are too optimistic, yielding inaccurate modelling results. Furthermore, the NPV method does not take risk, probabilities and organisational strategy into consideration (Cooper, Edgett et al. 2001).

2.4.1.2. Discounted Payback

The premise around the discounted payback period method is based on NPV calculations and the time period it takes to pay off an initial investment. The predicted income generated by projects over a specific time is discounted (based on the organisational MARR) to the present time. When the sum of the discounted net cash inflows, over a period of time, equals that of the initial investment, the period of time will be equal to the payback period.

One of the main advantages of the discounted payback financial method is that it provides organisations with information which will aid with strategic future investment decisions. The timeframe required for an investment to provide returns will be known and knowing this will aid with financial planning and strategies. Again however, seeing as the discounted payback method is based on NPV calculations, the disadvantages of the NPV methodology will be filtered through to the discounted payback period method.

2.4.1.3. Expected Commercial Value

The expected commercial value method aims to maximize the value of an organisational portfolio in terms of commercial value, taking into consideration; future income cash-flows, probability of commercial success, probability of technical success, costs associated with commercialization and development costs (Cooper, Edgett et al. 2001). Each project in the portfolio is analysed in terms of their expected commercial value and is based on a decision tree analysis. Figure 13 shows the

decision tree used for expected commercial value analysis, as was depicted in the study conducted by Product Development Institute Inc. “*Portfolio Management: Fundamental for New Product Success*”

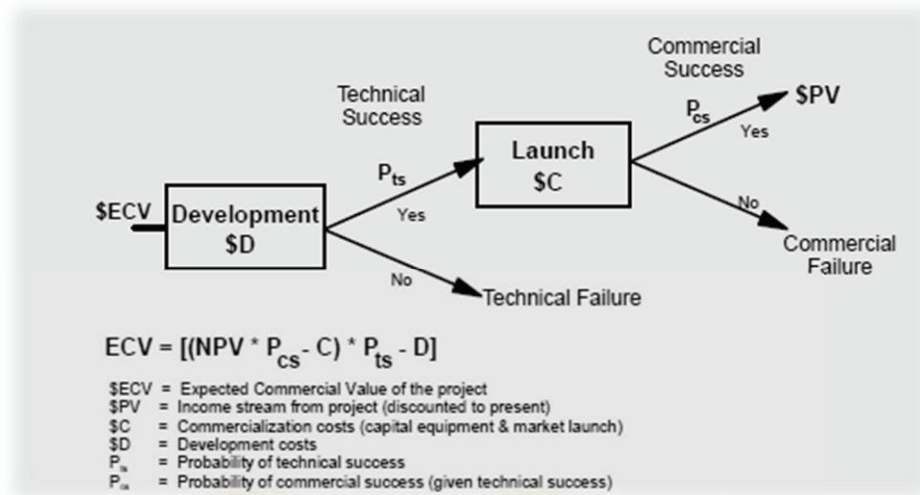


Figure 13: Decision Tree for Expected Commercial Value Analysis (Cooper, Edgett et al. 2000)

An important factor to consider in the calculation of expected commercial value is the resource allocation to the basket of projects. The resource costs must be taken into consideration. The objective is to optimize the expected commercial value based on the number of resources allocated to the specific project. Hence, when deciding on which project to implement, the ratio of ECV to resource costs must be considered. Project with the highest ratios are selected first, until the portfolio budget is expended. Selection of the projects with the highest ratio implies that those specific projects will yield the most value commercially for the resources allocated to the project.

One of the main advantages of the expected commercial value analysis is that it takes resources into account. Furthermore, it aims to maximize the value of the portfolio based on the resources and probability factors. However, one of the main disadvantages of this method is that it relies on the availability of extensive financial data, which needs to be accurate. This poses a problem when it comes to estimating probabilities. Furthermore it can be seen that this method does not consider the balance of organisational portfolio.

2.4.1.4. Productivity Index (PI)

The productivity index method for financial analysis is very similar to the expected commercial value method, with the differences being; the resource constraints and probability adjusted NPV. The equation for PI can be seen below.

$$PI = \frac{ECV \times P_{ts}}{Resource\ Costs}$$

Where:

ECV = Probability or risk adjusted NPV

P_{ts} = Probability of technical success (Cooper, Edgett et al. 2001)

With the value of the productivity index calculated for each project, projects may be selected based on the organisational value they generate for the specified resource constraints. The productivity index is a more conservative method for financial analysis as it considers probabilities and risks associated with future cash-flows. Seeing as the productivity index model is very similar to that of the expected commercial value model, the productivity index model experiences the same disadvantages of the EVP model.

2.4.1.5. Benefit / Cost Analysis and Profitability Index

Benefit to cost ratio analysis is a commonly used tool for project selection in the private and public sector (Blank, Tarquin 2012). The B/C ratio discounts all project benefits, disbenefits and maintenance and operational costs either to a present worth or annual worth. The denominator is the initial investment (cost), which is also expressed as a present worth or annual worth. Once the amounts have been discounted, the B/C ratio is calculated as follow.

$$\frac{B}{C} = \frac{Benefits - Disbenefits - M\&O\ costs}{Initial\ investments}$$

Disbenefits as is stated in Engineering Economy 7th edition by Leland Blank and Anthony Tarquin, is “*expected undesirable or negative consequences to the owners if the alternative is implemented. Disbenefits may be indirect economic disadvantages of the alternative*”. Each project in the organisational portfolio is assessed using the benefit/cost ratio, and a project is economically viable if the ratio

is greater than 1. That is $B/C > 1$. These projects may be pursued. If the B/C ratio is less than 1, the project is not economically viable and should not be considered. There are situations where the B/C ratio is equal to 1, and in these situations, an alternate project evaluation technique should be used.

A modification to the B/C ratio formula yields an alternate method of project analysis. This is called the profitability index and is based on the present worth of future net cash flows (PW of revenues – PW of costs), divided by the present worth of the initial investment. The profitability index is expressed as follows.

$$PI = \frac{PW \text{ of } NCF_t}{PW \text{ of initial investment}}$$

Similar to the B/C ratio, if the PI is greater than 1, the project is accepted at the discounted rate and if the PI is less than 1, the project is not economically viable. PI is usually used when the capital budget is limited (Blank, Tarquin 2012)

2.4.2. Scoring Models

A scoring model is a model that aids with portfolio optimisation by means of scoring projects, in the organisational portfolio, against each other based on several strategic criteria. Each criterion is weighted based on importance, and projects are ranked based on each of the specified criteria. Ranking is normally 1-10, but it can vary based of organisational preference. Some of the criteria commonly used are:

- Strategic alignment,
- Value to organisation,
- Risk vs reward,
- ROI,
- Product advantage,
- Duration etc.

A typical scoring model may be seen in Figure 14. The scoring model is usually set up on a spreadsheet, listing all the projects in the organisational portfolio. The ranking criteria are also included in the spreadsheet along with the weights of each criterion. Projects are then ranked according to their achievement / satisfaction of each criterion.

The sum of the weighted ranking (weight multiplied by rank) becomes the projects score. Each organisation will specify a “pass” score that is acceptable for project initiation and the projects with the highest scores will have resources allocated to them first.

Selection Criteria	Alignment with core competencies	Alignment with strategic goals	Internal rate of return in excess of 15%	Improve customer service	Urgency	Total Score
Weight	2.0	3.0	1.5	3.0	2.0	
Proposal 1	2	7	3	5	3	50.5
Proposal 2	3	4	1	5	3	40.5
Proposal 3	9	6	3	3	3	55.5
Proposal 4	5	0	9	7	8	56.5
Proposal 5	3	8	4	9	4	69.5

Figure 14: Project Scoring Model (ESI International 2006)

Scoring models are used less often than financial methods; however, scoring methods have been praised for their ability to align organisational portfolios to organisational strategy. Furthermore, the scoring method yields an organisational portfolio of high value projects. A downfall of scoring methods is inherent in the fact that ranking of projects are based on a subjective approach.

2.4.3. Bubble Diagrams

As is shown on Figure 12, bubble diagrams are the preferred method for creating organisational portfolio balance. Bubble diagrams are a graphical representation of an organisational portfolio, taking the following into account; resources, probabilities, ROI, implementation time, strategic fit etc. Organisations plot projects on a four quadrant x-y axis (based on two strategic criteria), and further, allocate resources to those projects. This provides a holistic view of an organisational portfolio. A commonly used strategic model is the Boston Matrix, which may be seen in Figure 15. The Boston matrix comprises of four quadrants based on two dimensions, market growth rate and market share. The four quadrants are; stars, cash cows, dogs and question marks / problem child.

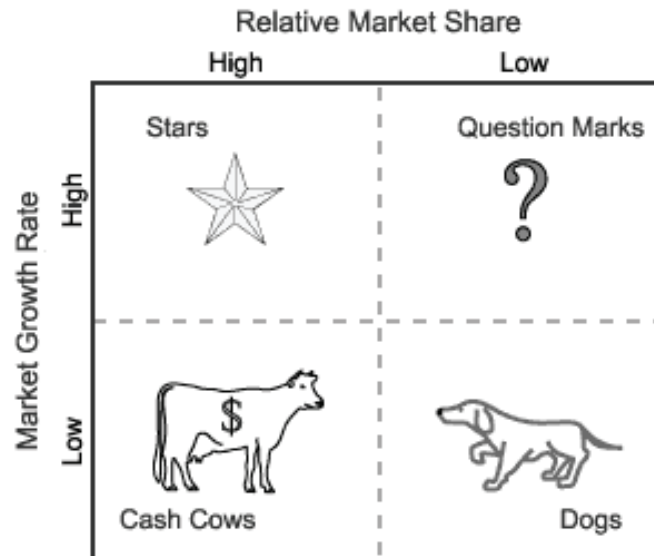


Figure 15: Boston Matrix (QuickMBA 2010)

From Figure 15, it can be seen that projects which are classified as “Dogs” are projects which should be stopped. This is owing to the fact that they are not value adding initiatives and their resources are ineffectively utilised. “Cash cows” are projects which provide returns but with very low growth rates. Revenues generated by these projects may be re-invested in more growth oriented initiatives. Projects which fall into the “question mark” quadrant are projects which experience a high growth rate with a low market share. These projects have the potential to become “star” with nurturing and the correct allocation of resources. Stars are organisational assets as these projects experience a high growth rate and high market shares, yielding maximum benefit / value to the organisation.

The Boston matrix was first proposed in 1970 and since then, there have been a multitude of strategic models developed based on the principles of the Boston matrix. One such model is called the Risk-Reward model, and based on a study conducted by Product Development Institute Inc., the Risk-Reward model is the most commonly used bubble diagram method for achieving / driving organisational portfolio balance. Similar to the Boston matrix, the Risk-Reward model is based on a two dimensional criteria with four quadrants. The Risk-Reward model may be seen in Figure 16.

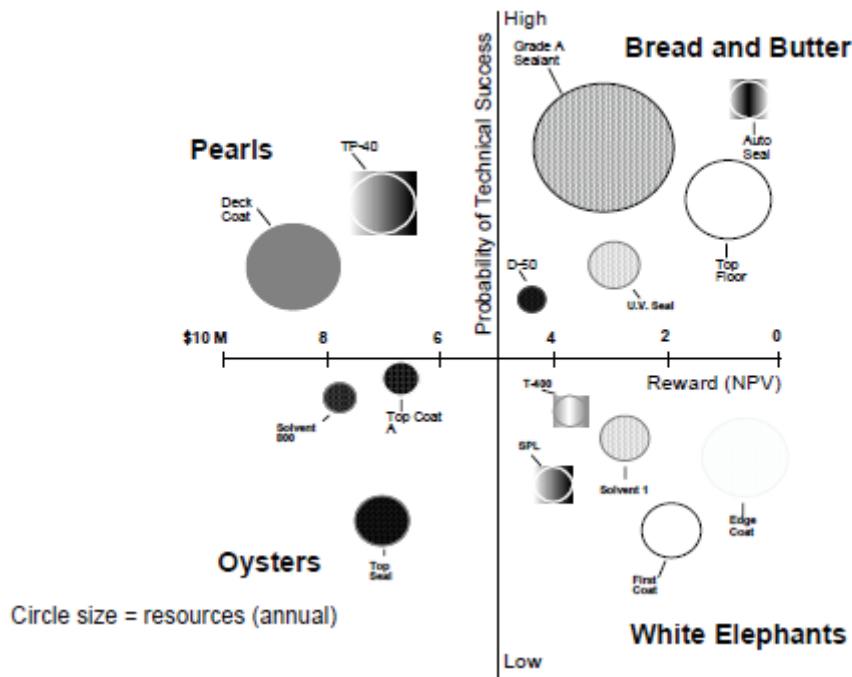


Figure 16: Risk-Reward Bubble Diagram (Cooper, Edgett et al. 2000)

Projects are plotted on the matrix based on two factors; NPV and Probability of technical success. The size of the circles represents the resources allocated to the projects. The four quadrants are broken up into; bread and butter, pearls, oysters and white elephants.

The bread and butter quadrant comprises of projects which are small and not complex. Probability of success is high, but with low economic value. Pearls on the other hand are the star projects, as is shown on the Boston matrix. Pearls are projects with a high probability of success and high value to the organisation. Businesses aim to achieve more “pearl” projects as it provides the greatest value to the organisation. Oysters are projects which have a high value, but a low probability of technical success. White elephants are projects with a low probability of technical success and low value projects. These are the projects which organisations need to identify and stop. Resources are being ineffectively utilised resulting in financial losses and reduced organisational value. These resources should be allocated to other projects which have a high probability of becoming “pearls”.

It may be seen that with the aid of bubble diagrams, an organisational portfolio may be graphically represented and a holistic view of the existing portfolio balance may be analysed. Although bubble diagrams are a good tool for optimisation of portfolios in terms of balance, bubble diagrams are often used in conjunction with other tools. As was stated above, various bubble diagrams may be used based on different organisational requirements. The various bubble diagrams that can be used may be seen in Figure 17.

Rank	Type of Chart	First dimension plotted		Second dimension plotted	Percent of businesses using bubble diagrams*
1	Risk Vs. Reward	Reward: NPV, IRR, benefits after years of launch, market value	by	Probability of success (technical, commercial, overall)	44.4%*
2	Newness	Technical newness	by	Market newness	11.1%
3	Ease Vs. Attractiveness	Technical feasibility	by	Market attractiveness (growth, potential, consumer appeal, life cycle)	11.1%
4	Strength Vs. Attractiveness	Competitive position (strengths)	by	Attractiveness (market growth, technical maturity, years to implementation)	11.1%
5	Cost Vs. Timing	Cost to implement	by	Time to implement	9.7%
6	Strategic Vs. Benefit	Strategic focus or fit	by	Business intent, NPV, financial fit, attractiveness	8.9%
7	Cost Vs. Benefit	Cumulative reward	by	Cumulative development costs	5.5%

Figure 17: Various Bubble Diagrams (Cooper, Edgett et al. 2000)

The table seen in Figure 17 is the result of a study conducted by Product Development Institute Inc. in a paper called “*Portfolio Management: Fundamental for New Product Success*”, and it shows the various bubble diagrams which may be developed. Furthermore, it can be seen that the most popular method used by organisations is the Risk-Reward method. It was further stated in the study that most senior management of the organisations investigated, found bubble diagrams to be an effective tool for optimisation of organisational portfolios.

2.4.4. Strategic Buckets

Organisations strive to achieve their strategy / objectives by implementation of projects and programs. In order to ensure that projects, which are implemented, are in line with organisational strategies, an effective strategic method is required. One such method, which is commonly used in private and public sectors, is a method called strategic buckets.

The strategic bucket model encompasses various organisational strategies, which forms the various buckets, and projects are allocated to these buckets. That is, projects which are in line with the specific organisational strategy, are put into that “bucket”. Each bucket is then prioritized and capital is allocated to the various buckets. Once all the projects in the organisational portfolio have been allocated to the strategic buckets, the projects in each bucket are then prioritized based on ranks (Chao, Kavadias 2006). Ranking of the projects, within strategic buckets, may be achieved using some of the methods described above. Scoring models or financial methods may be used, depending on subsidiary organisational strategies. A budget is then approved for each project and resources are allocated accordingly. A typical scoring model can be seen in Figure 18 below.

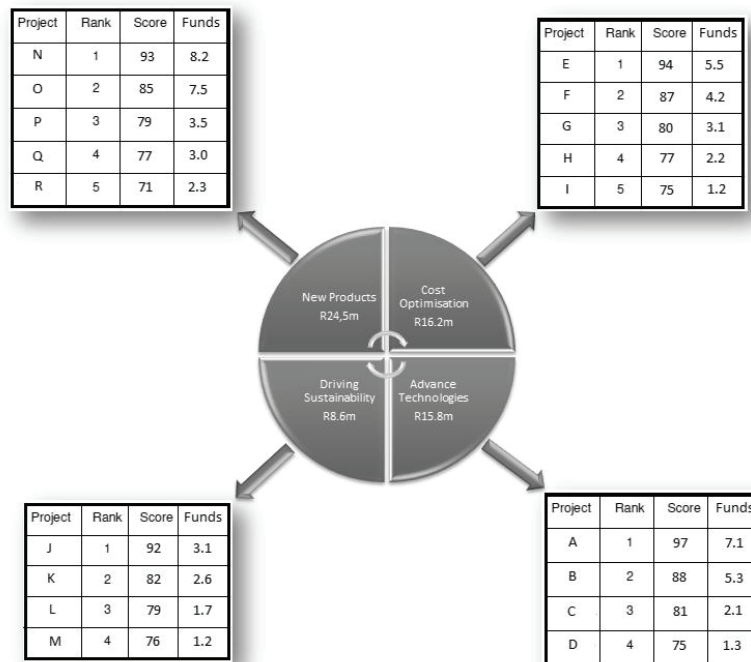


Figure 18: Typical Strategic Bucket (Cooper, Edgett et al. 2000)

From Figure 18, it can be seen that four organisational strategies have been defined. Based on the organisation, this may vary. It can be seen that one of the major advantages of the strategic bucket model is that it closely links projects to the organisational strategy. Furthermore, additional models, such as financial and scoring models, may be integrated into the strategic bucket model for an enhanced portfolio optimisation. The various baskets may utilize different strategic criteria for assessment of projects hence providing an independent assessment of projects per organisational strategy.

2.4.5. Checklists and Resource Capacity Analysis

The principle around checklists is based on a very simplistic approach. A checklist model simply includes questions which are strategically developed based on various factors. These factors may include; meeting customer satisfaction, in line with organisational strategy, technical solution feasible, market demand satisfaction, return on investments, stakeholder satisfaction, resources available etc. These questions are then answered (Yes/No), by the executive committee and project management office. The strategic questions may be prioritized and mandatory “yes” answers will be required for certain questions. If the answer to a mandatory question is “no”, the project is eliminated from the analysis. A final score/total of required “yes” answer will be calculated and pending a threshold point set by the organisation, projects will pass the analysis and will be investigated further or implemented. Checklists are normally not used solely for portfolio optimisation, but are rather used as a filter model before applying an additional model.

All the models discussed above are constrained by one common factor; organisational resources. Too often, the project pipeline is gridlocked due to the limited organisational resources. This ultimately yields undesired consequences to the project and the organisation. In order to prevent this, a resource capacity analysis should be conducted. A resource capacity analysis aims to optimize resource allocation and utilization by analyzing the resource utilization on current projects as well as resource requirement for new project. Inherent in the analysis, is the determination of the number of projects that should be pursued based on organisational resource availability. For existing projects, the projects are first prioritized using a financial or scoring model. Using the detail execution plan, the resources per activity are determined. The resource requirement is

based on man-hours required to complete the activity. Once the man-hours have been determined for each department, the available departmental capacity is determined. The percentage utilization is calculated by dividing the cumulated times required for all the prioritized projects, by the available capacity. The same process is followed for new projects, with the only difference being the detailed execution plan. For new projects, a preliminary execution plan will be determined and key activities will be specified.

With the aid of this method, the source of the resource constraint may be determined. This is often caused by too many resources being allocated to low priority projects. Furthermore, with the aid of this model, the right number of projects based on resources may be determined.

2.5. Popularity of Portfolio Optimisation Models

As was stated above, Product Development Institute Inc. conducted an investigative study on thirty leading companies, centred on portfolio management. In this study, the popularities of portfolio management / optimisation models were investigated. It was found that organisations use various portfolio optimisation models; hence, the dominant organisational models were also specified. The popularity of portfolio optimisation models may be seen in Table 1.

Table 1: Popularity of Portfolio Management Models (Cooper, Edgett et al. 2000)

Model	Popularity (%)	Dominance (%)
Financial	77	40
Strategic	65	27
Bubble Diagrams	41	13
Scoring Models	38	5
Checklists	20	3
Other	24	12

From Table 1, it can be seen that the most popular model for portfolio optimisation is financial models. This is inherent in the fact that organisations strive to improve market share by optimising returns on investments. Although financial models are most popular, it was pointed out in the study, that popularity does not mean that the model is most effective.

2.6. Challenges in Portfolio Management

Based on the benefits and results discussed in section 2.2, it may be seen that implementation of portfolio management is essential for organisational growth. There are however certain challenges that must be mitigated in order to ensure effective organisational portfolio management. A survey conducted by PM Solutions “*The State of Project Portfolio Management 2013*” identified some of the major challenges faced by organisations which currently use portfolio management as a part of their strategy. These challenges are:

- Silo mentality within organisations,
- Assuring the consistent application of defined processes,
- Reliability and accuracy of information for projects,
- Lack of information on resources, and
- Inadequate project portfolio management skills. (PM Solutions 2013)

Based on the above challenges, it can easily be seen how these challenges will pose adverse effects on portfolio management. A silo mentality prevents effective and efficient communication within the organisation and furthermore, poses a problem in terms of gaining support for the portfolio management strategy. Various portfolio management processes were identified in section 2.3 and the importance of consistently executing the portfolio management process was stated. Inconsistent execution of the portfolio management processes, will ultimately result in failure of the portfolio management strategy. The lack of information on projects and the consequences thereof were identified and discussed in the financial models for portfolio optimisation. Reliable and accurate data is imperative for portfolio management. The lack of information on resources as well as inadequate skills will ultimately result in ineffective execution of the portfolio management strategy.

The survey further discussed the strategies various organisations have implemented in order to mitigate these challenges. These included; communication sessions, enhanced governance procedures, training, use of technology (software tools) and the use of external consultants (PM Solutions 2013).

2.7. Conclusion

In order to advance competitive market advantages, improve market shares, enhance customer and stakeholder satisfaction, optimise return on investments and drive organisational sustainability, effective organisational strategies must be efficiently implemented. It is imperative that optimal investment decisions coupled with, alignment of business strategies/objectives and effective project execution plans, be executed in order to ultimately achieve organisational success and sustainability (Walls 2004). Organisational strategies are usually achieved by successful execution of projects/organisational ventures and efficient delivery of services/products of the highest quality. Hence it is imperative that the right projects (projects which best achieve the organisational strategy and objectives) are selected and executed correctly. One such management strategy which aims to achieve this is a strategy called portfolio management.

This chapter of the mini dissertation focusses on portfolio management. Portfolio management as defined in the PMI Standard for Portfolio Management is, *“The centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives”* (Project Management Institute 2006). Furthermore, an introduction into portfolio management is provided in Section 2.1 of this mini dissertation. Succeeding the introduction to portfolio management, goals and benefits of effective portfolio management was highlighted and discusses. Four main goals were highlighted in Section 2.2. These were; maximize value, create balance, strategic direction and right number of projects. Each of these goals was discussed in further detail. Juxtaposed to the goals of portfolio management, the benefits thereof were highlighted. Some of the benefits include; improved ROI, cost reduction, revenue growth and customer and stakeholder satisfaction.

In order to provide structure and execution governance to the portfolio management strategy, an execution model / process must be implemented. Various portfolio management executions models have been identified and discusses in Section 2.3. It was found that the identified execution models all possessed very similar steps. Hence it was imperative to synthesize these steps in order to identify the key steps required for effective portfolio management execution. A study conducted by Ernst & Young *“Strategy deployment through portfolio management”* synthesised findings from various portfolio management processes,

used in various organisations, into key steps required for effective portfolio management. These key steps were identified and discussed in Section 2.3 of this mini dissertation. Furthermore, the globally accepted portfolio management process, as is specified in the PMI Standard for Portfolio Management, is highlighted and discussed in Section 2.3.

One of the key steps in portfolio management was identified as portfolio optimisation which is based on organisational goals or strategies. Various models for portfolio optimisation, based on organisational goals and strategies, were identified and discussed in Section 2.4. These models included; financial, scoring, bubble diagrams, strategic buckets and checklist and resource capacity analysis. Furthermore, the benefits and disadvantages of these models were identified.

Based on a study conducted by Product Development Institute Inc. the popularity of portfolio optimisation models was highlighted. These statistics were based on the investigation of thirty firms. A table, adapted from the study, showing the various portfolio optimisation models and their corresponding popularity with various organisations, was generated in Section 2.5.

Finally, as with any new strategic implementation, there are many challenges. That is the same with portfolio management. Various challenges associated with portfolio management were identified in Section 2.6. These challenges were identified in a survey conducted by PM Solutions “*The State of Project Portfolio Management 2013*”, which consisted of 495 respondents. Juxtaposed to the challenges, various strategies were presented for the mitigation of the identified challenges. These mitigation strategies were also discussed in Section 2.6 of this mini dissertation.

In the next chapter, an introduction to system development life cycles and project control will be identified and discussed. Furthermore, various system development life cycles will be identified and discussed and key factors for effective project controls will be highlighted.

3. System Development Life Cycles (SDLC) and Projects Controls

3.1. Introduction to System Development Life Cycles and Projects Controls

Project driven organisations strive to achieve their business strategies and objectives by mean of successful project/organisational venture implementation and execution. Ensuring that the project is executed efficiently and effectively is imperative for business optimisation and organisational success. Cost over-runs, schedule slippage and substandard delivery on quality are some of the critical adverse consequences of poor project management and execution, and elimination of these consequences is pivotal. Poor; project design, planning, risk management and project controls are some of the primary causes of poor performance in projects (Gawler 2005). Furthermore, as was highlighted in an International Journal of Scientific & Engineering Research paper, a larger number of projects fail, and billions are spent on failed projects. Lacks of poor selection process of SDLC models is one of the top reasons of such failure (Sharma 2011).

In order to mitigate the primary causes of poor project performance and to minimise the effects of adverse consequences, a model for system development and execution should be established. The project development/execution model is usually represented in terms of a life cycle, starting from the idea generation phase, up until product disposal, and aims to provide a structured and governed approach to project execution. There are various methodologies that exist for project execution and a method that best suits the objectives and timeframe of the project must be selected. (BIS Department for Business Innovation and Skills November 2010).

As was stated in a study conducted by Design Council, design plays a fundament role in the success of many of the world's leading companies (Design Council 2007). In this study, the following companies were identified, due to their success, and their design processes were analysed; Alessi, BskyB, BT, LEGO, Microsoft, Sony, Starbucks, Virgin Atlantic Airways, Whirlpool, Xerox and Yahoo. The study concluded that design and effective process execution was one of the leading contributors to project and organisational success. Adopting a system development life cycle and executing a project in line with the methodology, is imperative as selection of an incorrect model may result in; incorrect budget estimates, wrong techniques being applied and inappropriate assumptions being made

(Bhunu 2007). Some of the system development life cycles that will be discussed in this chapter include; waterfall, spiral, incremental, and agile.

Juxtaposed to executing a project in line with a SDLC, effective and proactive project control is required to eliminate adverse effects such as those identified above. Poor planning and poor project controls are prime contributing factors to project failure and failure to achieve the three dimensional goals; meeting project output, budget and schedule (Mudau, Pretorius 2009). Project control focuses on the tracking and monitoring of identified critical project parameters. This is done by establishing a baseline for the parameters identified and ensuring that adherence to these parameters is achieved. Some of the important project parameters include; cost, schedule, scope, quality and risk management. It may be seen that failure to monitor and control these parameters will ultimately result in project failure. Hence, in order to enhance the probability of project success, effective and efficient project control is required throughout the lifecycle of the project.

In this chapter, system development life cycles and project controls are discussed. The goals and benefits of; executing a project in line with a system development life cycle and exercising effective project control are discussed in Section 3.2. In Section 3.3, the various commonly used system development life cycles for project execution are discussed. Selection criteria, based on the system development life cycle identified in Section 3.3, are tabulated in Section 3.4. Furthermore, the advantages and disadvantages of each method are highlighted in Section 3.4. The critical factors for effective project controls are then identified and discussed in Section 3.5. The chapter is then concluded in Section 3.5.

3.2. Goals and Benefits of SDLC's and Effective Project Controls

System development life cycles aim to provide a structure and governed approach to project execution. With the aid of an execution methodology, effective project management, as well as, project control strategies may be implemented and controlled. The main goal of project control is to optimise on predetermined project parameters so as to enhance the probability of project success. Some of the benefits of design methodologies and project control may be seen in Figure 19 below.

Benefits of Design Methodologies and Project Controls

- Clearly defined stages
- Measurable progress
- More accurately captures requirements
- Supports changing requirements
- Structured approach
- Creates execution governance
- Optimises probability of project success
- Prevention of cost over-runs
- Prevention of schedule slippage
- Enhanced quality control
- Drives sustainable development
- Enhances customer satisfaction
- Enhanced project communications
- Drives effective risk management

Figure 19: Benefits of SDLC's and Project Controls (Bhunu 2007), (Jessen 2011)

The benefits identified in Figure 19 have been synthesised from various project management and project controls literature. One such study that discuss these benefits was conducted by the University of Pretoria “*Project Controls and Risk Management for Project Success: A South African Case Study*”, which found that project controls and risk management have a significant influence on the performance of a project and therefore, on the success of the company (Mudau, Pretorius 2009). Furthermore, it was stated that 91% of the 61 respondents found that project management and project controls directly contribute to the success of the products produced.

Based on the studies conducted by various institutions and the benefits generated, it can be seen that implementation of an appropriate SDLC, based on the type and nature of a project, and effectively controlling projects, plays a pivotal role in achieving the business objectives and enhancing organisational sustainability. This was further supported by an International Journal of Scientific & Engineering Research paper, which discussed that by selecting right SDLC's, a better and higher quality product can be found within budget and time (Sharma 2011). Seeing as executing a project, in line with a SDLC, is beneficial to the organisation, the various commonly used SDLC's must be identified and discussed.

3.3. System Development Life Cycles

Enhancing project/process execution, in line with world project execution standards, requires a well-defined organisational strategy. This strategy should define a structured approach for project/process execution, ensuring effective and efficient governance throughout the process. There are various methodologies that exist for project execution, and each organisation will have a different execution method based on their specific business objectives. Although the method may look different, these models are still based on the principle of basic design methods. Below is typical commonly used SDLC's that exist.

3.3.1. Waterfall Method

The water fall execution method is based on a linear execution method, where the project goes through various phases of design (from concept design to testing and implementation and maintenance).—In each phase, there are certain deliverables that must be achieved for various tracks. These tracks may include, and are not limited to; business, project management, engineering, operations and a sponsor track. For each track, the achievement of the phase deliverables will be evaluated at the end of the phase. The evaluation usually occurs at a gate review, where personnel from the various tracks are present to verify that the deliverables have been achieved successfully. Furthermore, application for capital for the next phase is assessed at the gate review, prior to the final executive board meeting. Progression to the next phase is only permitted once the previous phase has been completed and the gate requirements have been achieved (Bassil 5 May 2012). It can be seen that a stage gate approach for project execution provides control and governance over the complete project development process. A typical waterfall design method can be seen in Figure 3 in Chapter 1.

3.3.2. Spiral Method

Unlike the waterfall method, which is a linear execution model, the spiral execution method is a cyclic method consisting of four fundamental phases; planning (objectives, constraints etc.), risk analysis, engineering and evaluation (Reilly 2001). These four phases form the four quadrants of the model. This can be seen in Figure 20 below. The project first starts of at the planning phase, where the requirements and objectives are initially defined. Once the objectives of the project have been defined, a complete risk assessment is conducted. Each organisation will follow the organisational risk management strategy during this phase. Succeeding the risk management phase, a prototype of the design is created during the engineering phase. At this point, steps in the waterfall model may be used. The first prototype is then evaluated in terms of satisfaction of objectives and customer requirements. The project then undergoes a few iterations through the four phases, if feasible, until a final complete design/product is produced (Bhunu 2007).

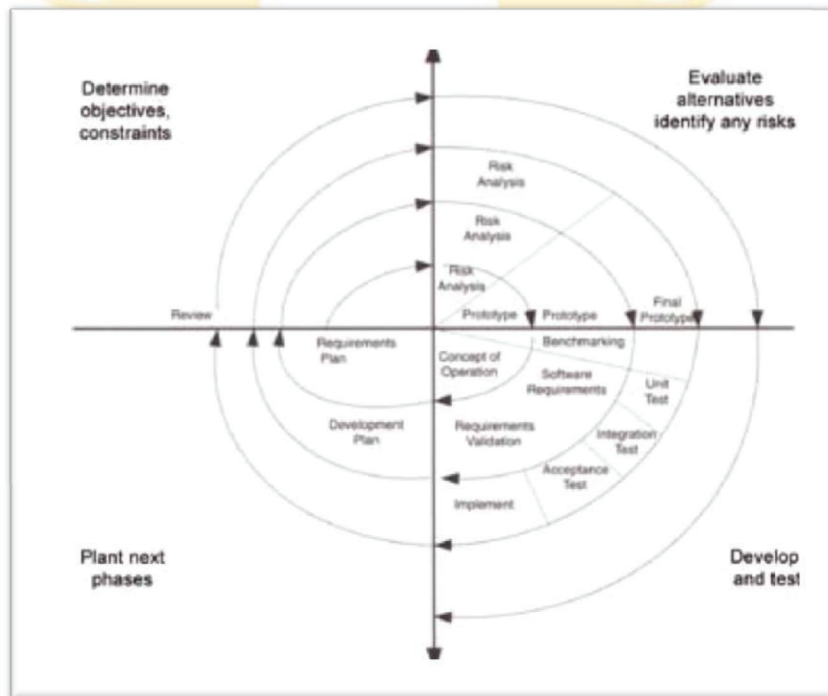


Figure 20: Spiral SDLC Method (Bhunu 2007)

3.3.3. Incremental Design Method

The incremental design method is focused on producing usable products at the end of each phase, so as to satisfy market demands and enhance organisational efficiency. Various design stages run concurrently and at the end of each process, a product is made available to the market. The incremental design method uses the waterfall design method as a backbone, yet optimises the waterfall design for efficiency. The steps in the waterfall design method are applicable to the incremental design method. First the conceptual design is done, specifying the requirements and objectives. The design phase then proceeds the concept phase where a basic design, followed by a detail design is completed. Finally, the design is implemented, where a final product is produced. The final product of one process may feed into a concurrently running process, so as to optimise another product, or because it could form an integral part to another product. Furthermore, the products from any process may be marketable at the end of that specific process. A typical incremental design method may be seen in Figure 21 below.

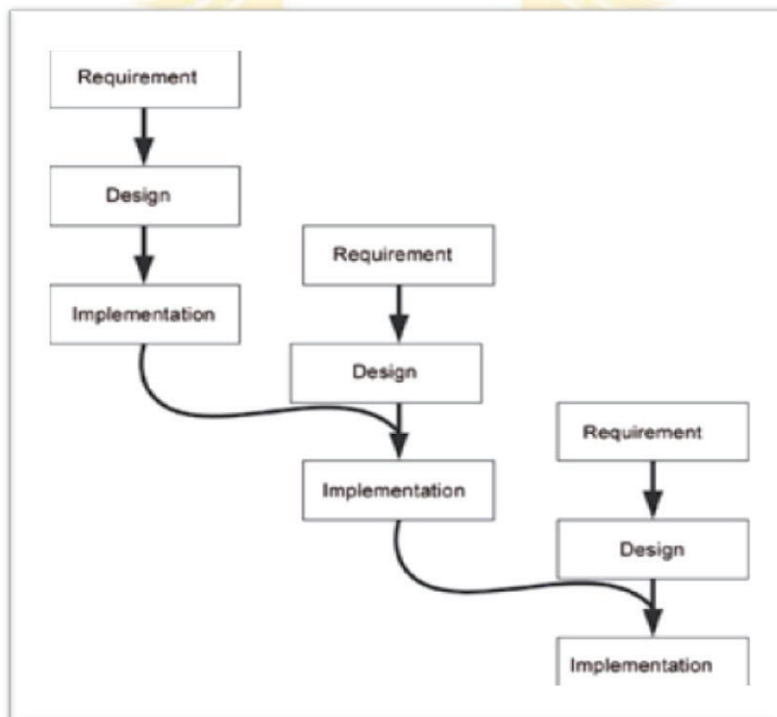


Figure 21: Incremental Design Method (Bhunu 2007)

3.3.4. Rapid Application Development (RAD)

Rapid application development is a design method which was developed for the software engineering field. However, the principles behind RAD have been carried over to other fields, due to the effectiveness and efficiency of the method. RAD is a methodology for compressing the analysis, design, build and test phases, into a series of short, iterative development cycles (Liang 2007). This may be seen in Figure 22 below. The RAD method is a cyclic iterative process, which produces products faster, by prototyping products early in the design process. In this way, customer feedback, into the design, is received early in the design, and improvements, based on customer requirements, can be made. The product is fed back into the design phase, taking into account the requirements and lessons learned from the first version of the product. This process is repeated until a final product, which meets customer requirements, is produced. The phases of the RAD method are shorter, which is why benefits are realised early in the process. Furthermore, early risk identification and management can be achieved with the use of the RAD method.

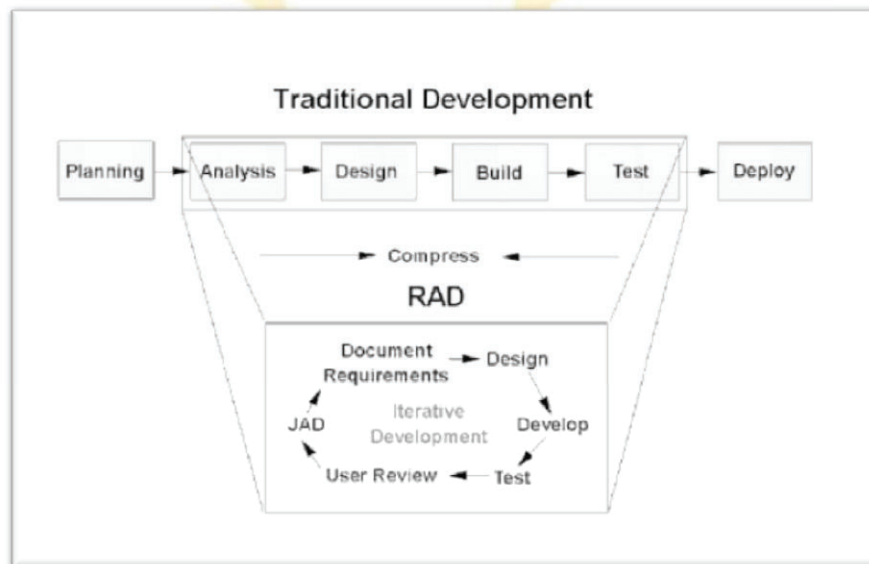


Figure 22: Rapid Application Development Design Method (CASEMaker Totem 2000)

3.3.5. Evolutionary Design Method

The evolutionary design method is similar to the principles of the incremental design method, in that, this method focusses on producing interim marketable products (IT Project Management Certificate Program 2005). There are various phases to the method, which have a natural cascading topology. This can be seen in Figure 23. The first phase involves planning, where the requirements and objects/scope of the project is defined. A prototype is then produced during the build phase. Based on feedback received after the first version testing, the prototype undergoes a further revision and the build phase is repeated. This iterative process is followed until a final product is produced. The final product undergoes a final quality assurance analysis, and once completed, the product is released to the market.

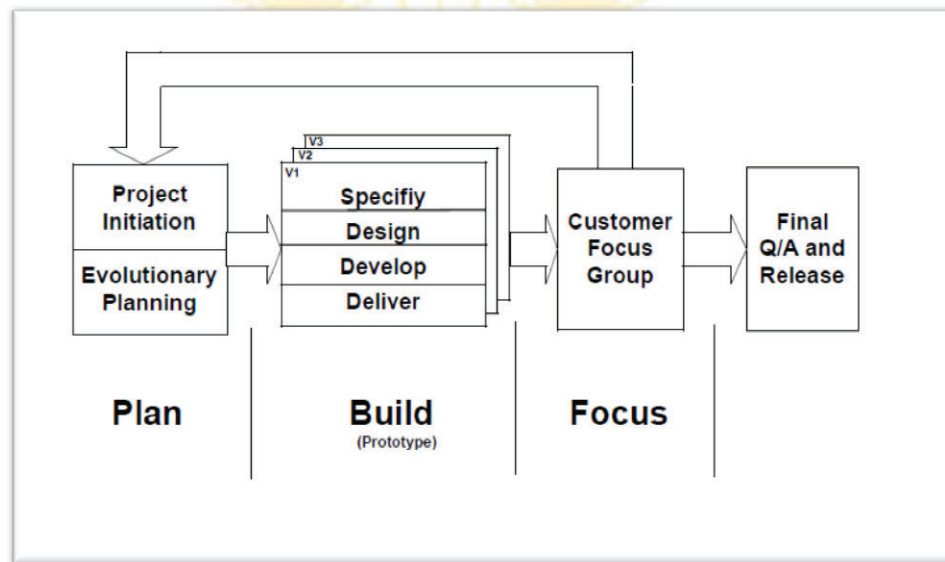
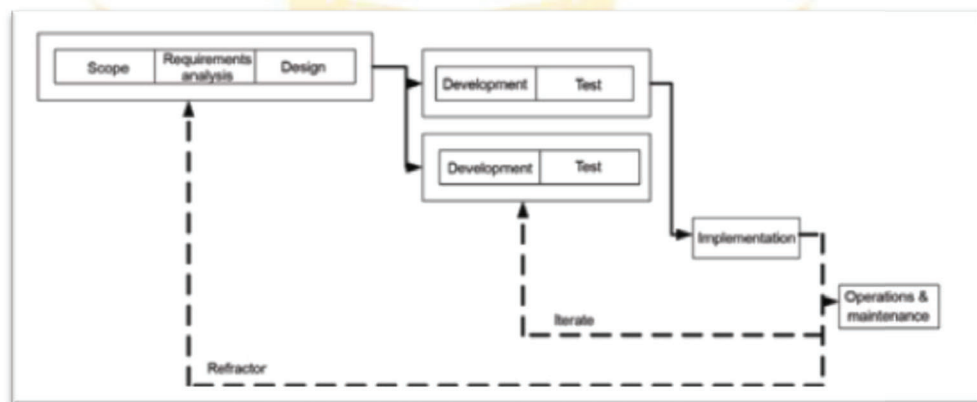


Figure 23: Evolutionary Design Method (IT Project Management Certificate Program 2005)

3.3.6. Agile Design Method

The agile design method is a method which aims to fast track the conventional design process by limiting the “documentation requirements” and drive production and implementation. Furthermore, the agile design method seeks to; reduce system complexity by prototyping, enhance development process, drive customer satisfaction and response efficiently to change (Stelzmann 2012). The emphasis is on reaching implementation as quickly as possible, usually in a few days, instead of months and years (Bhunu 2007). The steps of the agile design process are based on the waterfall method, with the exception being in the planning and execution phase. The planning phase is compressed, such that design and prototyping may commence immediately. The scope and requirements are refined during the design phase of the project, which like the incremental design method, follows an iterative process. This may be seen in Figure 24 below.



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Figure 24: Agile Design Method (Bhunu 2007)

From Figure 24, it can be seen that the scope, requirements analysis and design, as well as the development and testing of the product, are compressed into one step respectively. This is done in order to reach implementation as soon as possible. Upon completion of the development and testing phase, the implementation phase of the product is kicked off. Any further requirements or scope changes, found during the operations and maintenance phase, results in the product undergoing a further iteration of the process. These iterations will continue until all requirements are satisfied.

Various SDLC's were discussed above. Knowing when to use a specific SDLC is important. In the next section, selection criteria for SDLC's will be presented.

3.4. System Development Life Cycle Selection Criteria

As it can be seen in Section 3.3, there are various SDLC's that may be used for project execution. Selecting the correct method for a specific type of project is imperative. An organisational strategic fit for types of projects and design methodologies must be made, so as to optimise on cost, schedule and quality. A brief overview of the criteria for methodology selection, as well as the advantages and disadvantages of each method is shown in Table 2 below.

Table 2: System Development Life Cycle Selection Criteria (Bhunu 2007), (Sharma 2011)

Method	Criteria	Advantages	Disadvantages
Waterfall	Budget: High Schedule: Long Term Functionality: Static Funding for project Stable.	Clearly defined stages Assures delivery of initial requirements Well documented process and results	Lack of measurable progress within stages Cannot accommodate changing requirements Resistant to time and/or budget compression
Incremental	Budget: High Schedule: Short Term Functionality: Static Integration type project. Or Budget: Low Schedule: Long Term Functionality: Static	Early and periodic results Measurable progress Supports parallel development efforts	Demands increased management attention Can increase resource requirements No support for changing requirements
Evolutionary	Budget: Low Schedule: Long Term	Supports changing requirements Minimizes time to initial operating capability (IOC)	Increases management complexity IOC only partially satisfies requirements

	Functionality: Dynamic	Achieves economies of scale for enhancements	Risk of not knowing when to end the project
Spiral	Budget: High Schedule: Long Term Functionality: Dynamic Project reliability is a must.	Supports changing requirements Allows for extensive use of prototypes More accurately captures requirements	Increases management complexity Defers production capability to the end of the life cycle Risk of not knowing when to end the project
RAD	Budget: High Schedule: Short Term Functionality: Dynamic Enhancement to existing system.	Minimizes time to delivery Accommodates changing requirements Measurable progress	Increases management complexity Drives costs forward in the life cycle Can increase resource requirements
Agile	Budget: Low Schedule: Short Term Functionality: Dynamic Or Budget: Low Schedule: Short Term Functionality: Static	Rapid demonstrable functionality Minimal resource requirements Supports fixed or changing requirements	Not conducive to handling complex dependencies Creates quality assurance risks Increased risk of sustainability, maintainability and extensibility

Table 2 above was adapted from a paper written by Dr. Solomon Bhunu, “A closer look at project life cycles”, as well as from an International Journal of Scientific & Engineering Research paper by Manish Sharma “A survey of project scenario impact in SDLC models selection process”. In these papers, various SDLC’s were investigated and the criteria for selection were specified. Three important factors were considered, namely; budget, schedule and functionality. The budget and schedule factors are self-

explanatory. Functionality on the other hand deals with the functional requirements of the project. Static functional requirements imply that the requirements are relatively fixed for the duration of the project, whereas dynamic functional requirements imply that the requirements may change during the duration of the project.

The selection criteria highlighted in Table 2 above is merely a guideline for methodology selection. Each organisation must analyse the strategic intent of each project and best fit an execution method to the specific project. Various SDLC's were discussed in Section 3.3, all of which aid in efficient project execution. However, in order to optimize efficiency and effectiveness of project execution and enhance the probability of project success, effective project control must be implemented throughout the project execution model.

3.5. Project Controls

Project controls is a formal process in project management which focusses on the metrics of a project such as; time, cost, quality, resources etc.(Gianluca di Castri 2011). More specifically, the formal definition of project controls, as is defined in the PMBOK, is;

“A project management function that involves comparing actual performance with planned performance and taking appropriate corrective action (or directing others to take this action) that will yield the desired outcome in the project when significant differences exist” (Duncan, Director of Standards 1996)

Dissecting the PMBOK's definition of project controls, it can be seen that there are three main steps to project controls, that is; establish a baseline plan and compare the actual progress to the planned progress, evaluate deviations to see if corrective action is required, and finally, selecting and implementing a corrective plan where deemed necessary (Lanigan 1994). In order to establish a baseline for project controls, various factors must be defined and quantified. These factors, seen in Figure 25, have been synthesized from various project controls literature and are discussed in the subsections that follow.



Figure 25: Project Controls System (Duncan, Director of Standards 1996), (DIS 2006)

3.5.1. Scope Definition and Control

The scope of a project defines the goals and objectives of the project (Seesing 1995). It defines the boundary for which the project shall adhere to and the objectives the project should achieve. As can be seen in Section 3.3, all of the SDLC's discussed begin with defining the scope of the project. This is a fundamental step for every project. Controlling the scope throughout the project SDLC is imperative, as there are knock-on effects on other project controls parameters, if the scope is not controlled effectively and efficiently. Before the knock-on effects are discussed, the fundamentals of scope control should be explained further. The scope of a project is normally discussed and preliminarily fixed in a framing meeting, which occurs during the feasibility/planning phase of a project. All the relevant project stakeholders are present at the framing meeting and the project scope is clearly defined, highlighting the battery limits for the project. Juxtaposed to the scope of the project, all aspects which are out of the project scope are also clearly defined. The framing report is then signed off by the key stakeholders and this forms the first baseline plan, for one of the project parameters, for project controls.

If there are scope changes, or an addition to the project scope, this must be controlled effectively. The knock-on effects of poor scope control would result in, and not limited to, cost creeps (to implement change), possible safety hazard, schedule slippages, poor financial control, poor quality and dissatisfied customers. Ultimately, the effects of poor scope control will result in project failure.

The scope of a project may be controlled in various ways. One such method, which is commonly used, is a scope change request form. This is a form which details every aspect of the scope change. The specific project name, followed by the author/person who initiated the change, is specified on the form. Next, a detailed analysis of the change is provided. The background, cost/benefit analysis and motivation for the change are provided. Finally, the full details of the change are specified, including supporting documentation (drawings, narratives, simulations etc.) where necessary. Furthermore, the scope, schedule and cost to implement the change must be clearly specified. Once the details have been stated, a hazard study should be conducted to analyse the effects of the change. Only once the hazard study has been completed, should the change request be subjected to approval. Approval is generally achieved by discussions of the change with the project team, client, sponsors, and other relevant stakeholders. Once the change is approved, capital is approved for the change and the implementation date is specified. The implementation date is then built into the overall project schedule and a new baseline for the scope and schedule is established.

Various other methods may be used for scope control, like management of change processes (MOC), but all are based on the simple principles detailed above. It can be seen that controlling scope in a project is imperative for project success. Very seldom does the scope of a project remain constant, hence establishing a control strategy for the scope changes is vital.

3.5.2. Schedule Control

Schedule control is normally the most difficult parameter to control in a project. This is owing to the fact that there may be multiple vendors and service providers contracted to execute phases of the project. Furthermore, aspects such as the weather, strikes, economic environment etc. also play a role in schedule issues. Taking all those factors into account, schedule control focusses on identifying the variances from the specified schedule baseline, and implementing recovery plans to realign the schedule with the baseline.

An important first step in building a project schedule is to break the work down into various packages. This is known as a work breakdown structure (WBS). The WBS creates the framework for the project and project schedule. Based on the scope of this

dissertation, details on the WBS will not be discussed. Once the WBS is developed, the project schedule, based on the WBS, is developed. Project schedules may be developed using various software packages. Two of the commonly used scheduling packages includes; Microsoft Project and Primavera. The project schedule will include all the activities and durations for each activity, required to achieve the project objectives. Furthermore, schedule milestones are developed for critical points in the project. Based on the project schedule, a baseline for the schedule is established. This baseline forms the control points for the project.

Once the project phases commence, the schedule should be closely tracked against the baseline. Various methods may be used for schedule and process control. The earned value method is once such method. Whichever method is selected, the main focus should be on identification of variances, and implementation of recovery plans. It is imperative that the schedule be distributed to the project team, as well as the client, on a regular basis, so as to create an overall schedule control and tracking environment.

It should be noted that recovery plans are naturally “fast track” plans, owing to the fact that the schedule needs to be realigned with the baseline as quick as possible. Taking this fact into consideration, extensive care must be taken to ensure that quality and safety is not compromised. Furthermore, to mitigate the risk of cost creeps, a strategic decision on the types of contracts placed with service providers must be made. Contracts control will be discussed later on in this section.

3.5.3. Cost Control

In the competitive market environments, optimizing on cost savings, by reducing operational and capital expenditure is imperative. Very often, project costs exceed the approved project capital, or projects die prematurely due to depleted funds. Cost control focusses on identification of variances from the forecasted budget, and taking corrective actions to rectify the variance, in order to ensure financial integrity of the project. Controlling the cost of a project is imperative as it affects other project control parameters such as quality and schedule (DIS 2006).

The project budget is first established by generation of a semi-definitive estimate, taking into account, all the work packages identified in the WBS. Every activity is budgeted for,

as well as secondary costs such as; engineering man hour's, travel and living, subcontracting, office costs (printing, paper, filing) etc. Furthermore, escalation, risk and contingency factors are built into the cost estimate. Once the total project budget is approved by the Executive Board, the approved budget becomes the cost baseline for the project.

As was stated above, a change in scope may result in cost creeps. When there are any changes that results in a cost creep, a system must be established to effectively manage and control the change. Normally, when there are foreseeable future issues in the execution of the project, an early warning is issued to the project manager. If there are cost implications, this will be stated on the early warning. This early warning allows the project team to anticipate and plan for an upcoming variance to the project plan in advance. At this point in time, the cost controller should register a formal potential variation from plan (PVP), which will be distributed to the project team. A PVP form is similar to that of a scope change request, detailing all the aspects on the potential variation. Should the potential variation materialize, a formal compensation event is issued to the project manager. The cost controller would then register the compensation event and a formal variation from plan (VP) is issued. The variation from plan is distributed to the project team and the cost control base is updated. It should be noted that the entire process is governed by approvals from the project team, sponsor and business representatives.

Further to the controlling costs based on VP's from service providers, internal project costs such as engineering man hours must be implemented. A monthly cash flow is produced by forecasting the payments and man hours, assuming a realistic turnaround time after delivery dates, and projecting the remaining costs from the current actual cumulative payments already made. The cash flow should be updated monthly with the actual project expenditure and a revised forecast should be carried out based on the latest available project indicated total cost and progress status.

3.5.4. Quality Control

Quality control involves monitoring specific aspects/deliverables during the life cycle of a project to ensure that the quality standards, as was specified for the project, are achieved. This is imperative as quality variances would ultimately result in schedule and cost variances, and furthermore, may result in project failure and customer dissatisfaction.

The first step in quality control is to establish a quality baseline. A quality plan for the execution of the project is developed, reviewed and approved by relevant stakeholders. In the engineering field, an engineering track quality plan (ETQP) is developed. The ETQP details every phase of the SDLC, and the expected deliverables of that specific phase. The quality standard for each deliverable is then determined. Templates, expectations and reviews frequencies are documented for each deliverable and this should be distributed to the engineering team and the business counterparts. Further to the ETQP, a hold and review plan should be developed. The hold and review plan is a subsidiary to the ETQP and it specifies exactly which deliverables are critical (hold points), and which document will be reviewed. The deliverables identified as hold points, must be approved by the selected approval body (usually consisting of the engineering team, business counterparts and the project sponsor) prior to the project commencing. The ETQP then forms a part of an overall engineering execution plan (EEP), which specifies the roles and responsibilities of every stakeholder involved in the project, as well as the backbone for overall project quality.

Juxtaposed to the engineering track, a project track quality plan (PTQP) should be developed. The PTQP is similar to the ETQP, in that all the phase deliverables for project management is quantified and planned for. The PTQP forms a part of the project execution plan (PEP), in which the overall project management strategy for the project is documented. The PEP normally covers the nine knowledge areas as is specified in the PMBOK.

The EEP and the PEP form the baseline for quality control. Any deviations from the respective plans are handled in terms of a non-conformance, detailing all aspects of the variance, and recovery plans and future mitigation strategies are developed.

3.5.5. Risk Control

Managing and controlling risk, as with the factors discussed above, is imperative for project success. Failure to effectively and proactively manage risk in a project will result in project failure. Risk control involves development of a baseline risk management plan, in which, risks are; identified, quantified (causes and consequences), assessed (probability of occurrence), treated (accept, avoid, reduce and transfer), monitored and controlled. Each organisation will have its own risk management plan, but the steps for risk management and control are based on the basic steps highlighted above.

During early phases of the project life cycle, a risk review meeting should be held. All relevant stakeholders should be present at this meeting. In this meeting, all risks (technical, business, external etc.) are identified and quantified. Furthermore, risk treatment strategies are developed in these meetings. Once the risk register is completed, it will become the baseline for risk management and control on the project.

A good project practice, which is not normally done, is to hold a risk review meeting with all relevant stakeholders every month. This will ensure that risks are reviewed frequently during every phase of the project, and effective management and control over the risks identified is performed.

Should an action date for the risk treatment strategy be missed, a formal review of the variance should be conducted. The consequences for the delay in risk treatment must be evaluated and quantified, and a recovery plan must be implemented.

3.5.6. Contracts Control

Although contracting strategies may seem like a simple concept, it may result in schedule delays, overruns on budgets and quality issues, if not chosen strategically or managed and controlled effectively. In the engineering industry, contracts are placed according to the NEC (New Engineering Contract). The NEC 3 is the latest version, specifying the legal, engineering, costing, project management and commercial requirements for every contract placed. There are 6 types of contracts that may be placed. These are:

- Option A: Priced Contract with activity schedule.
- Option B: Priced Contract with bill of materials.
- Option C: Target Contract with activity schedule.
- Option D: Target Contract with bill of materials.
- Option E: Cost re-imburement.
- Option F: Management contract. (Thomas Telford Services Ltd 2010)

Each of the above mentioned contracts options has its requirements and risks associated with them (this may be read in the NEC document, and is not a part of this dissertation). Furthermore, the NEC specifies contracts for Professional Services as well as Construction. Each of these options is broken up into combinations of EPCM (Engineering, Procurement and Construction Management). As an example, on a high priority project, it would not be advisable to place an Option E contract with a service provider, unless the scope of the project is defined to an extent that the possibility of scope creep is eliminated. This is owing to the fact that all risk associated with the cost of the project is transferred to the parent organisation. Furthermore, if it is beneficial to the project schedule and in line with the project execution plan, to include the procurement activities (generation of request for information, request for quotation, scope of purchase, technical bid evaluations etc.) into a service provider's scope of work, then placing an Option A contract based on EPM (Engineering, and Procurement Management) should be the contracting strategy employed.

It can be seen that selecting an appropriate contracting strategy, taking into account schedule, scope, cost, risk and the phase the project is in, or going into, is of vital importance. Upon selection of an appropriate contracting strategy, the conditions of the contract must be clearly known. Once a contracting strategy is fixed for specific contracts for the project, and the contracts are awarded to service providers, the contract clauses, decisions, technical scope and terms and conditions becomes the control baseline for contract controls. Any deviation from the contract may result in a breach of contract or non-conformances may be issued to the service providers, which have financial penalties. Financial penalties however do not aid in progress recovery, hence effective recovery plans must be implemented.

3.6. Conclusion

Projects and organisational ventures are some of the main vehicles organisations use to implement their business objectives and organisational mission. Seeing as organisational objectives are achieved by execution of projects, ensuring that projects are executed in line with world standards for project execution, is imperative for the parent organisation. Failure to do so will result in adverse consequences such as; cost over-runs, schedule slippages and substandard quality, all of which results in project failure. Furthermore, ensuring that vital parameters, such as; cost, schedule, risk and quality, are effectively and proactively monitored and controlled are imperative for project success. In order to drive organisational sustainability and enhance the probability of project success, SDLC's and critical project control parameters must be identified and effectively implemented in the organisation.

This chapter of the mini dissertation focusses on system development life cycles as well as effective project controls. An introduction to system development life cycles and project controls was provided in Section 3.1. Succeeding the introduction into the two fields, the goals and benefits of each field were highlighted in Section 3.2. One of the main goals of system development life cycles is to provide a structured and governed approach to project execution. Furthermore, utilisation of an execution methodology promotes effective project management, as well as, efficient project control. One of the main goals of project controls, as was identified in project controls literature, is to optimise on predetermined project parameters so as to enhance the probability of project success. The benefits of system development life cycles and projects controls were further discussed in this section and some of the benefits included; clearly defined stages, measurable progress, structured approach, optimises probability of project success and prevention of cost over-runs.

In order to make strategic decisions for fitting projects to system development life cycles, the various SDLC's options must be known. Various commonly used SDLC's have been identified and discussed in Section 3.3. The SDLC's that were identified and discussed include; the waterfall method, spiral method, incremental design method, rapid application development, evolutionary design method and agile design method. Seeing as there are many ways in which a project may be executed, based on the SDLC's, a selection criteria for methodology selection needed to be developed. These selection criteria were specified in Section 3.4 of this chapter. Juxtaposed to the selection criteria, the advantages and disadvantages of each method were highlighted. The selection criteria were adapted from a

paper written by Dr. Solomon Bhunu, “A closer look at project life cycles”, as well as from an International Journal of Scientific & Engineering Research paper by Manish Sharma “A survey of project scenario impact in SDLC models selection process”. Three important factors for model selection were considered, namely; budget, schedule and functionality. Functionality dealt with the functional requirements of the projects, and focused on whether the requirement will be static or dynamic throughout the life-cycle of the project.

Implementing a SDLC is the first step in enhancing the probability of project success (Sharma 2011). To further minimise or eliminate the risk of project failure, various project parameters must be effectively and proactively monitored and controlled. Section 3.5 of this mini dissertation focusses on effective project controls. Project controls, as is defined in the PMBOK, is:

“A project management function that involves comparing actual performance with planned performance and taking appropriate corrective action (or directing others to take this action) that will yield the desired outcome in the project when significant differences exist” (Duncan, Director of Standards 1996)

As per the definition of project controls, a baseline for each project control parameter needs to be established first. These parameters were synthesised from various project controls literature and was discussed in Section 3.5. The parameters which were identified and discussed include: scope, schedule, cost, quality, risk, and contacts control.

In the next chapter, the research process overview will be discussed, providing input into the types of research methodologies that will be used in this mini dissertation. Furthermore, the process that will be followed for the research methodology will be highlighted.

4. Research Process Overview

4.1. Introduction

There are various options that exist for research methodologies and some of the research options include; experiments, surveys, archival analysis, history and case studies (Yin 2009). The foundation of these options is based on similar principles, which include, collecting and analysing evidence in order to provide specific results. Knowing when and how to apply specific research method is an important step towards answering of research questions (Noor 2008).

In this chapter, the research process overview will be discussed. A background into the selection of a research methodology will be presented in Section 4.2. In Section 4.3, the case study research and introduction will be discussed, further highlighting the types of case studies that may be conducted. The selection and reasoning behind selection of a specific type of case study will also be discussed in Section 4.3. In Section, 4.4, the case study research process and design that will be followed in this mini dissertation will be discussed. The chapter is then concluded in Section 4.5.



4.2. Selection of Research Methodology

In order to implement the most effective research method and avoid misfits, understanding when to use specific research methods is imperative. As was stated above, there are various options that exist for research methodologies. Based on the research questions posed, the extent of control the researcher has over events, and the degree of focus on contemporary as opposed to historical events, optimal research methodologies may be selected (Yin 2009). The various methods and the corresponding selection criteria may be seen in Table 3.

Table 3: Relevant Situations for Different Research Method (Yin 2009)

Method	Form of Research Question	Requires Control of Behavioural Events	Focuses on Contemporary Events
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/no
History	How, why?	No	No
Case Study	How, why?	No	Yes

Based on the information presented in Table 3, it can be seen that the conditions for the research methodology selection is simple to understand. Furthermore, based on the research questions this mini dissertation set out to answer, the research methodologies that optimally achieve the desired results were selected. Archival analysis as well as the case study research methodology was employed to optimally achieve answers to the research questions. An introduction into the case study research is presented in the next section.

4.3. Case Study Research

Case studies are the optimal choice of research methods when it comes to examining of contemporary events, when the relevant behaviour cannot be manipulated (Yin 2009). There are various types of case study research and these include; exploratory, descriptive, causal and explanatory (Noor 2008). Exploratory case studies focus on criteria or parameters instead of purpose (Yin 2009). As the names suggest, descriptive case studies are used to describe certain parameters, and explanatory case studies aim to explain certain conditions/parameters, such as processes in a company (Noor 2008). Based on the; research questions posed in this mini dissertation, guidelines from academic literature, and the requirement to achieve an in-depth understanding of certain conditions, it was decided that the optimal case study research method to use is the explanatory case study method.

Seeing as the case study research method has been selected, the case study research process that will be followed needs to be developed and discussed. This process will be discussed in the next section.

4.4. Case Study Research Process

The case study research process may be seen as a blueprint to structure of the research (Yin 2009). In order to achieve the objectives of the case study, a logical and structured approach to conducting the case study is required. The steps that will be followed have been taken from (Yin 2009). These steps are as follows:

- Designing the case study,
- Preparing and collection of data,
- Analysing case study evidence, and
- Reporting the results

A graphical representation of the case study methodology may be seen in Figure 26.

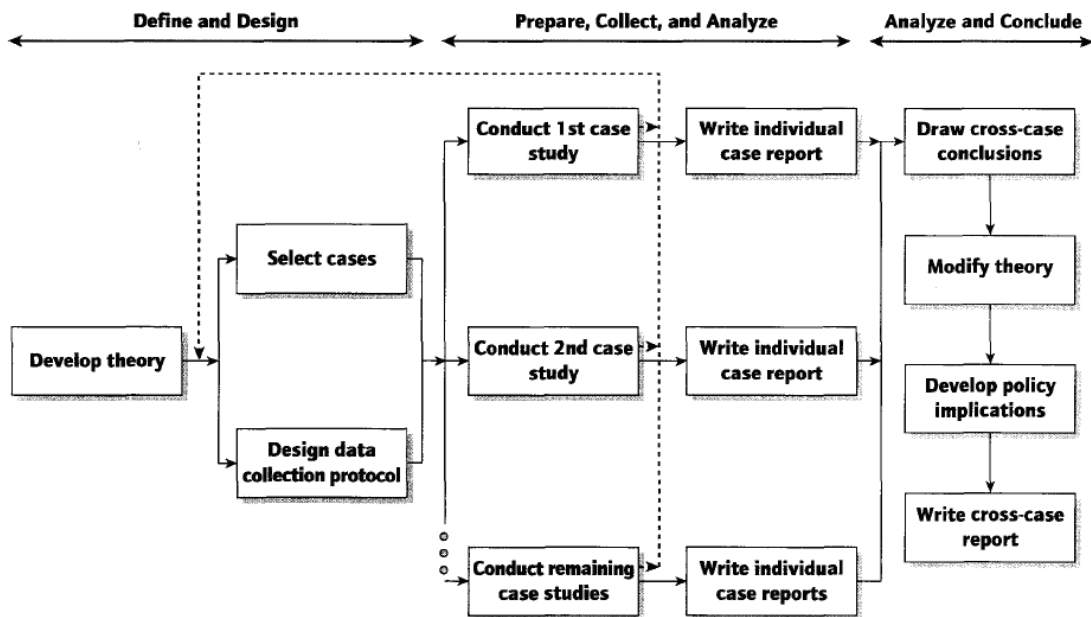


Figure 26: Case Study Method (Yin 2009)

The four steps listed above are the holistic view of the critical steps required to conduct a case study. However, there are sub-steps that must be implemented in order to effectively execute the critical steps. These steps, along with the associated strategies for this mini dissertation, are explained in the sub-sections that follow.

4.4.1. Designing the Case Study

In designing a case study, there are five components that must be taken into account. These components are: the study's questions, propositions (if any), unit of analysis, logic linking and criteria for interpreting the findings (Yin 2009). Each of these components will be discussed in relation to this mini dissertation.

4.4.1.1. Study's Questions

As the title suggests, the study's questions are the questions the case study sets out to answer. For this mini dissertation, the case study is set out to answer the following question:

- How does ineffective portfolio and project management affect project and organisational performance?

4.4.1.2. Proposition

The aim of specifying a proposition is to direct attention to specific aspects that should be studied within the scope of the case study (Yin 2009). In other words, based on the proposition, direction for the case study is achieved. Based on the study question, the proposition that is made for this study is as follows:

- One of the reasons why projects fail in an organisation is due to the lack of best practices in portfolio management strategies.

4.4.1.3. Unit of Analysis

The unit of analysis defines what the “case” is in a case study (Yin 2009). The unit of analysis for the case study that will be used in this mini dissertation will be organisations.

4.4.1.4. Linking Data to the Proposition

There are various methods that may be employed for linking data to the proposition. These methods include; pattern matching, explanation building, time-series analysis, logic models and cross-case synthesis (Yin 2009). Understanding which method to use creates a solid foundation for later analysis of the case study (Yin 2009). Based on the various methods listed above, the case study question and proposition, it was decided that the optimal method for linking data to the proposition would be pattern matching and cross-case synthesis.

4.4.2. Preparing and Collection of Data

There are various factors that must be taken into account when preparing to collect data. Some of the factors include; asking good questions, being a good listener, adaptiveness and flexibility, having a firm grasp of the issue being studied and avoiding bias (Yin 2009). These factors have been exercised in order to yield optimal beneficial results of the mini dissertation. In order to proceed with the data collection phase, a strategy for case study selection was first required.

The case study selection, followed by the data collection protocol and preparation is discussed in the following sub-sections.

4.4.2.1. Case Study Selection

Case study selection focusses on the identification and selection of cases studies that are in line with the original study question and proposition. Case studies that provide in-depth insight and understanding into the questions at hand should be selected. For this mini dissertation, the objectives of the case studies are to provide insight into the current portfolio and project management strategies in various organisations.

In order to select optimal case studies to answer the study's questions, the following guidelines were used:

- The case study information is reliable and from credible sources;
- The case study focuses on the study question and the data is easily assessable; and
- The case study selected should contain sufficient information such that data may be extracted and analysed so as to maximize the potential of answering the research questions (Yin 2009).

Based on the objectives of the case study, the study's question, the proposition and the guidelines presented above, two case studies were selected to gain insight into the current portfolio and project management strategies in organisations. One of the two case studies presented, was selected from the researchers organisational environment, where the researcher took part in observing and participation of the initiative execution. The second case study was based on academic literature on two international companies. The case studies selected were based on engineering orientated organisations, local and international, so as to understand and highlight the problems experienced locally and internationally.

4.4.2.2. Data Collection Protocol

Building a strong case study requires a firm data collection strategy. There are various ways in which data may be collected and (Yin 2009) provides guidelines for data collection. These guidelines were used in this mini dissertation and they include:

- Use multiple sources of evidence,
- Create a case study database, and

- Maintain a chain of evidence (Yin 2009).

Furthermore, based on the guidelines listed above, the following was used for sources of evidence;

- Documentation (progress reports, minutes of meetings, formal studies, organisational technical policies and organisational media),
- Archival records (organisational records),
- Participant observation, and
- Academic Literature.

4.4.3. Analysing Case Study Evidence

The crux of data analysis is focused on; examining, categorizing, tabulating, testing and recombining both quantitative and qualitative evidence to address the initial proposition of the study (Yin 2009). There are various ways in which case studies may be analysed. According to (Yin 2009), there are analytic strategies, general strategies and specific analytic techniques. For this mini dissertation, combination of a general and analytical strategy was found to be the optimal choice for analysis of the case study evidence.

The general strategy employed was based on the guidelines presented in (Yin 2009), and focuses on relying on theoretical propositions. Using this method, as was described in (Yin 2009), helps shape the data collection plan and gives priorities to the relevant analytic strategies. Furthermore, this strategy helps focus attention on certain data and ignore other useless data (Yin 2009).

Based on the general strategy, the specific analytic techniques used for analysis of the case study evidence was; pattern matching and cross-case synthesis. These strategies were chosen based on the fact that two case studies will be presented in this mini dissertation and using these strategies will strengthen the validity of the case studies.

4.4.4. Reporting the Results

Once the evidence of the case study has been analysed, the findings in the case study should be clearly documented. The documented findings will aid in providing insight into the case studies and furthermore, drive continuous improvement.

4.5. Conclusion

Understanding when and how to apply specific research methodologies is imperative when research is being conducted as it allows the researcher to select the optimal research methodology based on the research questions specified. Various research methodologies were identified and these methods included; experiments, surveys, archival analysis, history and case studies (Yin 2009). Although there are various research methodologies, each method is based on the same principle of collecting and analysing evidence in order to provide specific results (Yin 2009).

In this chapter, a guideline to selection of research methodologies was presented in Section 4.2. Based on the research questions this mini dissertation set out to answer, the research methodologies that optimally achieve the desired results were selected. Archival analysis as well as the case study research methodology was employed to optimally achieve answers to the research questions. Once the selection of research methodologies was presented, an introduction into the case study research was highlighted. This was discussed in Section 4.3. Based on the; research questions posed in this mini dissertation, guidelines from academic literature, and the requirement to achieve an in-depth understanding of certain conditions, it was decided that the optimal case study research method to use was the explanatory case study method.

In section 4.4 of this chapter, the case study research process was described. The process consisted of four high level steps as was synthesised from (Yin 2009), and these included; designing the case study, preparing and collection of data, analysing case study evidence, and reporting the results. These steps were then explained in greater detail, providing the associated decisions applicable to this mini dissertation.

In the next chapter, the research topics discussed in Chapter 2 and Chapter 3 are analysed and the key information is synthesized and presented. Furthermore, two case studies will be presented based on the case study design and process discussed in this chapter. The information synthesised from chapter 2 and 3, as well as the findings from the case study, is used to develop an integrated portfolio management strategy, so as to satisfy the objectives of the mini dissertation.

5. Findings and Integration Analysis

5.1. Introduction

Implementation of effective organisational management strategies plays a pivotal role in achievement of business objective and organisational sustainability (David 2011). There are various fields to management and one such field is the field of portfolio management. Portfolio management, as defined in the PMI Standard for Portfolio Management is; *“The centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives”* (Project Management Institute 2006).

Inherent in the definition of portfolio management is the importance of organisational ventures such as projects, programs and other related work. These are the vehicles used to achieve organisational objectives. Hence ensuring that these vehicles are optimally executed is vital for organisational growth. There are various execution methodologies / system development life cycles that are available for project execution and selecting an execution model that best suits the nature of the project, is beneficial to the organisation.

Juxtaposed to the field of portfolio management, is the commonly known field of project management. Project management aims to effectively and efficiently management and control organisational initiatives throughout the lifecycle of the initiative (Meredith, Mantel 2012). Project controls is a formal process in project management which focusses on the metrics of a project such as; time, cost, quality, resources etc. (Gianluca di Castri 2011). More specifically, the formal definition of project controls, as is defined in the PMBOK, is; *“A project management function that involves comparing actual performance with planned performance and taking appropriate corrective action (or directing others to take this action) that will yield the desired outcome in the project when significant differences exist”* (Duncan, Director of Standards 1996)

The field of portfolio management, system development life cycles and project controls have been discussed in Chapter 2 and 3 of this mini dissertation. In these chapters, the background into these fields was discussed, furthermore highlighting the goals and benefits of each field. Various processes as well as models / strategies, which are commonly used in these fields, have been discussed in Chapter 2 and 3.

In this chapter, findings from portfolio management, system development life cycles and project controls are synthesized and discussed, with the intention of proposing and integrated management solution of the three fields. The key findings from portfolio management, system development life cycles and project controls are discussed in Section 5.2 of this chapter. Section 5.3 will then highlight two case studies that will highlight some of the main issues with current portfolio and project management process. Based on the findings and case studies, an integrated portfolio management solution, will be presented and discussed in Section 5.4. The chapter is then concluded in Section 5.5.



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5.2. Key Findings for Portfolio Management, SDLC's and Project Controls:

5.2.1. Portfolio Management

Based on the definition of portfolio management in Section 5.1, it can be seen that portfolio management is centred on, identifying, prioritizing, authorizing, managing and controlling organisational initiatives so as to achieve the business objectives. There are various strategic management, portfolio management and project management literature which highlight the benefits of portfolio management in an organisational environment. Some of the benefits include; improved ROI, create and maintain a competitive advantage effective resource utilisation and enhance organisational sustainability. However, it was found that some organisations continue to waste effort and resources by delivering the wrong programmes and projects (Kilford, Cansoti.com 2008), due to the absence of portfolio management strategies. Hence, understanding portfolio management and the implementation of portfolio management strategies is of vital importance.

Based on a paper by Product Development Institute Inc. it was found that there are four main goals to portfolio management. These goals are; maximise value, create balance, strategic direction and right number of projects. Furthermore, based on the above four goals, various models for portfolio optimisation was identified. The inter-relationship of these goals and optimisation models can be seen in Figure 12 in Chapter 2.

Identifying and understanding the organisational goal for portfolio management is best practice, as it creates focus. Once the goals of portfolio management were discussed, a way of implementing portfolio management strategies needed to be analysed. Various portfolio management processes exist for portfolio management, and each organisation was found to have its own process (for companies that were active in portfolio management). An important study on organisational portfolio management processes was conducted by Ernst & Young, which synthesised portfolio management processes into key steps. These steps are; materialisation of strategy into initiatives, projects and programs identification, portfolio optimisation, portfolio approval and risk and remediation strategies. It was found that risk management, proper scope definition of the organisational initiatives and feedback of lessons learnt was omitted in the portfolio management processes. Including these factors into the portfolio management process was identified as best practice.

When the various portfolio management processes were analysed closely, it was found that these processes are very similar to each other. In order to justify the similarity, the backbone of these models was identified. The backbone of these processes was based on the globally accepted portfolio management process. This process was defined in the Standard for Portfolio Management, which was developed by the Project Management Institute (PMI). The PMI specified process for portfolio management can be seen in Figure 2 in Chapter 1.

Following a defined process for portfolio management was identified as a best practice. Based on the portfolio management process highlighted in Figure 2, it was also found that including key stakeholders throughout the process is best practice. The key stakeholders, as was recommended in the Standard for Portfolio Management, include:

- executive managers,
- portfolio review board,
- portfolio managers,
- sponsors,
- program managers,
- project managers,
- project/program management office,
- project team,
- operations management,
- functional managers,
- financial managers and
- customers and business partners (Project Management Institute 2006).

Looking at the process defined in the Standard for Portfolio Management and the key steps identified in the study conducted by Ernst & Young, it was found that lessons learnt were included too late in the portfolio management process and the optimisation of the portfolio in terms of how the initiative should be executed was omitted. This was seen as an imperative step for specialist types of projects, especially when it is a single discipline project. Inclusion of these above steps will aid in the evaluation step as well as provide an enhanced selection of initiatives.

5.2.2. System Development Life Cycles

Poor; project design, planning, risk management and project controls are some of the primary causes of poor performance in projects (Gawler 2005). Furthermore, as was highlighted in an International Journal of Scientific & Engineering Research paper, a larger number of projects fail, and billions are spent on failed projects. Lack of poor selection process of SDLC models is one of the top reasons of such failure (Sharma 2011).

As was synthesised from various project management literature, system development life cycles aim to provide a structure and governed approach to project execution and aid in optimising the project management process. Furthermore, it was found that adopting a system development life cycle and executing a project in line with the methodology, is imperative, as selection of an incorrect model may result in; incorrect budget estimates, wrong techniques being applied and inappropriate assumptions being made (Bhunu 2007).

Various commonly used system development life cycle models were identified and discussed in Chapter 3 of this mini dissertation. The models discussed included:

- Waterfall,
- Spiral,
- Incremental,
- Evolutionary,
- Rapid application development (RAD) and
- Agile

Each of the models listed above were discussed in Chapter 3, providing a pictorial view of the critical steps required for the model. In addition to the discussion on the models, the benefits, as was synthesised from various literature, was highlighted. Some of the benefits included; clearly defined stages, more accurately captures requirements, drives sustainable development, more accurate estimates and supports changing requirements.

As was stated above, selection of an appropriate SDLC is imperative for project execution and success. Based on research conducted by Dr. Solomon Bhunu, “A closer look at project life cycles” and an International Journal of Scientific & Engineering

Research paper by Manish Sharma “A survey of project scenario impact in SDLC model selection process”, a selection criteria for SDLC’s was tabulated in Section 3.4 of Chapter 3.

5.2.3. Project Controls

Project controls is a formal process in project management which focusses on the metrics of a project such as; time, cost, quality, resources etc.(Gianluca di Castri 2011). More specifically, the formal definition of project controls, as is defined in the PMBOK, is;

“A project management function that involves comparing actual performance with planned performance and taking appropriate corrective action (or directing others to take this action) that will yield the desired outcome in the project when significant differences exist” (Duncan, Director of Standards 1996)

Based on the analysis of various project controls and project management literature, six key factors for effective project controls were identified. These key factors included:

- Scope,
- Schedule,
- Cost,
- Quality,
- Risk, and
- Contracts.

The above listed key factors was discussed in further detail in Chapter 3, based on analysis of academic literature as well as on the personal experience of the researcher. As was stated above, when projects are analysed, an appropriate SDLC should be selected. Based on the SDLC selected, the key project control points should be prioritised. From the researcher’s background, should the project be a single discipline project, for example, a Distributed Control System (DCS) Replacement Project, the prioritised project control point should be quality and not schedule or cost. The effects of poor project controls have been highlighted in various papers. In a paper written by Iman Attarzadeh and Siew Hock Ow “Project Management Practices: The Criteria for Success or Failure” and R. Mudau, L. Pretorius “Project Control and Risk Management for Project Success”, it was found that, due to the poor focus on project controls throughout the

SDLC, there has been many projects which have been executed over budget and beyond schedule, ultimately resulting in project execution failure.

Based on the analysis of portfolio management, SDLC's and project controls, it could be seen that each of these fields play a pivotal role in project success and ultimately organisational success and sustainability. Failure to effectively and efficiently execute these management strategies will result in the adverse consequences discussed above. To further analyse and highlight the effects of ineffective execution of these strategies, two case studies from industry will be highlighted and discussed in the next section.

5.3. Case Studies, Analysis and Reporting

In this section, two case studies are presented, following the detailed process and guidelines presented in Chapter 4. The purpose of the case studies is to highlight the current portfolio management processes and the selection/execution of organisational ventures in various organisations. Furthermore, the case studies aim to identify and discuss the effects of poor portfolio and project management processes, so as to answer the study's question and proposition.

5.3.1. Case Study 1: Paper Company X and Cable Company Y

5.3.1.1. Introduction

This case study focuses on the portfolio management strategy currently being used in Paper Company X and Cable Company Y, and aims to highlight the problems experienced thereof.

5.3.1.2. Brief Background on Companies

Paper Company X is a medium sized organisation that manufactures a variety of paper products, which includes specialty paper, such as coated paper, for the use in the photography and printing industry (Pinto 2010). Company Y on the other hand manufactures custom made interconnecting cables for the health, computer and various other industries (Milosevic, Patanakul et al. 2010).

5.3.1.3. The Case

Paper Company X:

Paper Company X is a medium sized organisation, where annual sales have grown steadily over the years, though very slow. However, in recent years, Company X has been having problems with the organisational project management process, resulting in numerous commercial projects being delivered late and over budget (Pinto 2010). Based on these problems, the company embarked on a new approach to their project management process. The goal was to improve profitability and generate additional sales volume by developing new commercial products quickly, with better targeting to specific customer needs (Pinto 2010).

Implementation of the new project management process did not yield the envisaged outcomes, and once again, products were delivered late and over budget. This failure resulted in the executive management of Company X, hiring a consultant to analyse, not only the project management processes, but also the manner in which the organisational portfolio was established.

The consultant found that the primary strategy for project selection in Company X, focused almost entirely on discounted cash flow models, such as net present value. If the project promised profitable revenues, it was approved and included in the organisational portfolio. This resulted in an organisational portfolio which was a collection of diverse, mismatched projects. Furthermore, due to the project selection strategy adopted, projects were not measured against the organisational strategic mission; organisational technical abilities were not assessed and lessons learnt from projects was not transferred. Due to this fact, some of the new projects failed as it required enhanced technical expertise and further organisational learning.

The consultant recommended that Company X relook at the project screening, selection process and project management process, to include alternative screening and selection strategies. It was further recommended that the new and existing projects be evaluated according to the organisational strategic goals and capabilities.

Cable Company Y:

Company Y, similar to company X, is a medium sized organisation producing various commercial products. Base on the project reports and statuses, the Vice-President of Engineering for Company Y, decided to embark on an initiative to analyse the current organisational portfolio management process. This was initiated due to the fact that the project reports revealed that none of the big projects were being undertaken by the organisation. Furthermore, the reports showed that 90 of his engineers were busy on small projects and 20 were on medium projects (Milosevic, Patanakul et al. 2010). Based on these finding, the Vice-President for Engineering hired a consultant to investigate the issues.

The consultant informed the Vice-President that the issues experienced in Company Y, is a common issue experienced in many companies, which ultimately leads to an unbalanced project portfolio. A recommendation from the consultant was to schedule a workshop to discuss the issues experienced, as well as identify and troubleshoot the current portfolio management process.

In the workshop, it was found that the marketing team was solely responsible for the organisational portfolio. A guy, called a bidder, would review customers' requests and would then select those with the highest net present value. This was the only process used for adding projects to the organisational portfolio. The Vice-President of Company Y suggested that a new approach to the management of the organisational portfolio, as well as processes thereof, be implemented.

5.3.1.4. Analysis of Case Study and Findings

Paper Company X:

Looking at Paper Company X, it could be seen that the omission of standard best practices for portfolio management resulted in project failure. Projects were delivered late and over budget. Furthermore, when Company X tried to implement a new strategy, by developing new commercial products quickly, the project management process was flawed. Some of the main issues found in Company X's portfolio and project management strategy include:

- Improper project management process to develop commercial products quickly. The delivery methodology was not in line with the development strategy and organisational goal.
- Best practices for portfolio management were not implemented. Company X did not have a portfolio management process and furthermore, project selection was almost entirely based on financial methodology (NPV). This approach in establishing an organisational portfolio resulted in a diverse number of mismatched projects, which ultimately resulted in project failure.
- Due to the absence of a portfolio management process, projects were not aligned to the organisational strategic mission, lessons learnt from projects were not transferable, and the technical abilities of the organisation were not assessed.

Cable Company Y:

Company Y experienced similar problems to that of Company X, in that, the absence of standard best practices for portfolio management resulted in an unbalanced portfolio, ineffective utilisation of resources and reduced organisational throughput. The main issues found in Company Y's approach to portfolio and project management include:

- Best practices for portfolio management were not implemented. Company Y did not have a portfolio management process and the marketing team was solely responsible for the organisational portfolio. The organisational portfolio was established purely by financial methodology (NPV) and no other process was followed.
- Due to the fact that there was no formal process for portfolio management, there was an ineffective utilisation of resources. This meant that valuable time and money was being spent on incorrect projects.

5.3.1.5. Patterns within Case Study 1

Analysis of case study 1 reveals the following patterns, which may be seen in Table 4 below.

Table 4: Patterns Identified in Case Study 1

Cause	Effect
1. Improper project management process for business strategy.	<ul style="list-style-type: none">Commercial products were not developed quickly, as per the business strategy, resulting in financial loss and project failure.
2. Absence of best practices in portfolio management.	<ul style="list-style-type: none">NPV analysis was the only strategy used for project implementation decisions, which resulted in a diverse number of mismatched projects. Projects ultimately failed.Resources were ineffectively utilised, technical abilities of the organisation were not assessed and lessons learnt were not transferable, resulting in financial loss and project failures.

5.3.2. Case Study 2: Petrochemical Company Z

5.3.2.1. Introduction

This case study focuses on a value adding initiative that was initiated in Petrochemical Company Z. The process, at which the initiative was initiated, how it was transferred to the project team, and the system development life cycle model that was used, will be discussed.

5.3.2.2. Brief Background on Company

Petrochemical Company Z is a large international organisation that produces high grade products for the chemical and petroleum sector.

5.3.2.3. The Case

Petrochemical Company Z is an organisation which has operations in various international countries. For optimisation reasons, and tracking of key performance

indicators (KPI's), senior executives found to the need to design and construct a centralised global monitoring control room. This required vast knowledge on telecommunication protocols and costs thereof, design of cyber security standards, network architecture and design, legal requirements etc. Hence, involvement of the engineering project team early in the initiative selection process was required.

Seeing as this was a first of a kind project for Company Z, a test prototype should be developed. Furthermore, the SDLC to be used should be discussed and decided upon. The SDLC model utilised by Company Z is based on the Waterfall SDLC, and this was the model used for the execution of all projects.

The project was initiated and capital was approved (for man-hours) for the feasibility phase of the project. A team of engineers were handed the project and was asked to execute the feasibility phase of the project, following the requirements of the organisational SDLC model. This required generation of various documents that would be included in the final concept package. The feasibility phase of the project was executed, taking 2 months, and various solutions to the project objectives were proposed in the concept package. Furthermore, a cost estimate for each solution was presented. Deliverables which had to be developed included:

- technology selection,
- siting and layout,
- upstream, downstream and utility interface requirements,
- automation, operation and maintenance integration philosophy,
- key process control success factors,
- advance process control opportunities,
- battery limits,
- assumptions and exclusions,
- business information system philosophy,
- system philosophy,
- process automation system diagram,
- applicable specification, and a
- semi-definitive cost estimate.

The high level portfolio management process that was used by Company Z may be seen in Figure 27 below.

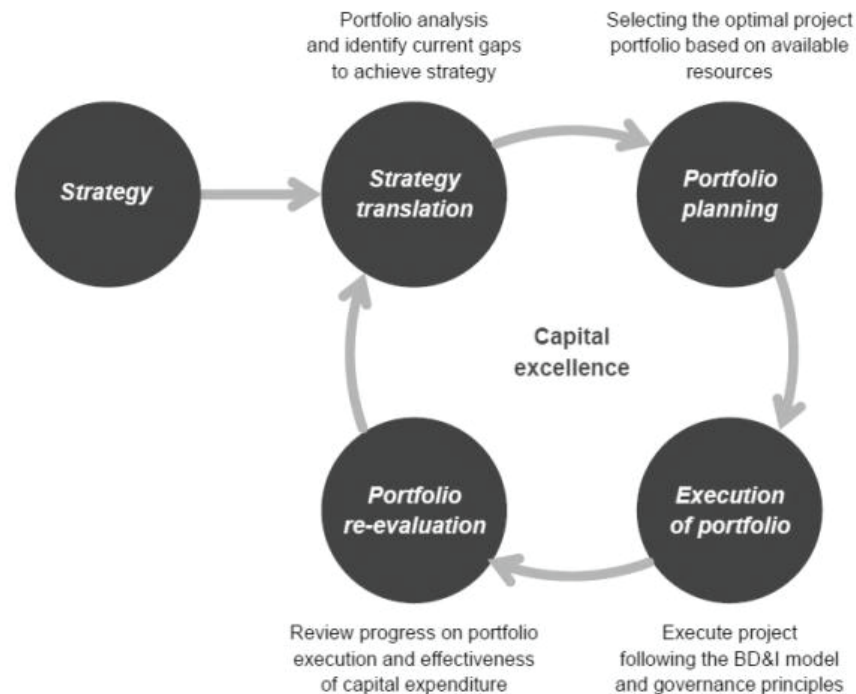


Figure 27: High Level Overview of the Portfolio Management Process in Company Z

After considering the outcomes of the concept package, the objectives of the project and the cost estimate, the project was cancelled.

5.3.2.4. Analysis of Case Study and Findings

Analysis of the case study on Company Z, would reveal that best practices for portfolio management was not followed, which resulted in; ineffective utilisation of resources, poor management of capital expenditure and poor project selection. Some of the main issues identified include:

- The SDLC chosen for execution of the project was not the optimal choice based on the scope of the project. A lot of time was spent in generation of documentation and design investigations (which also included investigation of international telecommunication standards, cyber security standards, etc.), without prototyping a design to verify the feasibility. Furthermore, uncertainties in the cost estimates were evident due to the uncertainty of the proposal implementation success.

- Best practices for portfolio management were not implemented. Company Z did not include key stakeholders in the original portfolio management process. The project team was not included and the most appropriate SDLC model to be used was not discussed. Seeing as this project had to be executed in a short period of time, a prototype should have been developed and tested in-house.
- Due to the absence of best practices in the portfolio management process, capital was spent on a project which did not proceed pass the feasibility phase and engineering recourses were ineffectively utilised.

5.3.2.5. Patterns within Case Study 2

Analysis of case study 2 reveals the following patterns, which may be seen in Table 5 below.

Table 5: Patterns Identified in Case Study 2

Cause	Effect
1. Improper project management process for business strategy.	<ul style="list-style-type: none"> • Selection of an incorrect SDLC resulted in cost estimation uncertainty and excessive time being wasted on documentation generation, which ultimately led to project failure.
2. Absence of best practices in portfolio management.	<ul style="list-style-type: none"> • Key stakeholders were not included during the portfolio management process, hence valuable technical input from the implementation team was not considered. Furthermore, capital was invested in a project which was not aligned with the business objectives. This resulted in the failure of the initiative.

5.3.2.6. Common Patterns in Case Study 1 and 2

When both case studies are analysed, a pattern may be seen. This pattern may be seen in Table 6 below.

Table 6: Common Patterns in Case Study 1 and 2

Case Study 1	Case Study 2	Common Pattern
Improper project management process for business strategy resulting in financial loss and project failure	Improper project management process for business strategy, resulting in cost estimation uncertainty and excessive time being wasted on documentation generation, which ultimately led to project failure.	Failure to strategically select an optimal project execution model, which is in line with the business strategy and project scope, ultimately resulted in adverse consequences and project failure.
Absence of best practices in portfolio management resulting in a diverse number of mismatched projects, ineffectively utilisation of resources, inability to assess technical ability, and financial losses, which ultimately lead to project failure.	Absence of best practices in portfolio management, resulting in key stakeholders not being included during the portfolio management process, and capital was invested in a project which was not aligned with the business objectives. This resulted in the failure of the initiative	Failure to implement a portfolio management process, as well as not applying best practices for portfolio management, resulted in an organisational portfolio which was not optimal, financial losses, ineffective utilisation of resources and various other adverse consequences. This ultimately resulted in project failure.

Upon conducting a cross-case synthesis of the above two case studies, a pattern in the analysis may be seen. In both case studies, an absence of best practices for portfolio management and project execution resulted in project failure. Furthermore, Company X, for example, wished to revise their strategy and aimed to produce products quickly, but their project management processes and execution methods were flawed. These flaws ultimately resulted in project failure. This could also be seen with company Z. Company Z did not follow best practices for portfolio management and the project execution strategy was not the optimal choice, resulting in project failure. The common patterns found and the

consequences thereof further justifies the adverse effects of ineffective implementation of best practices of portfolio management, SDLC's and project controls, which were discussed in the previous chapters. It can be seen that based on the analysis of the case studies, the case study proposition is verified.

Based on the facts highlighted above, it can be seen that a process for portfolio management, which incorporates best practices, SDLC selection and project control points, is required to enhance project selection and execution, ultimately enhancing the probability of project and organisational success.

5.4. Proposed Model for Portfolio Management Process

Based on the discussions in Chapter 2 and 3, as well as the case studies above, it can be seen that a formal process, incorporating best practices, for portfolio management is imperative in an organisation for project success. Furthermore, selection of an SDLC model with corresponding project controls, based on the initiative objectives and scope, is necessary early in the selection process. From the case studies above, it can be seen that due to the lack of portfolio management processes, incorrect selection of a SDLC and poor project controls, projects were delivered late, over budget, not in line with organisational strategy and ultimately resulted in project failure. The model presented below integrates best practices, SDLC's and project controls into the PMI standard process for portfolio management, aiming to create an optimised portfolio management process, to enhance the probability of project and organisational success.

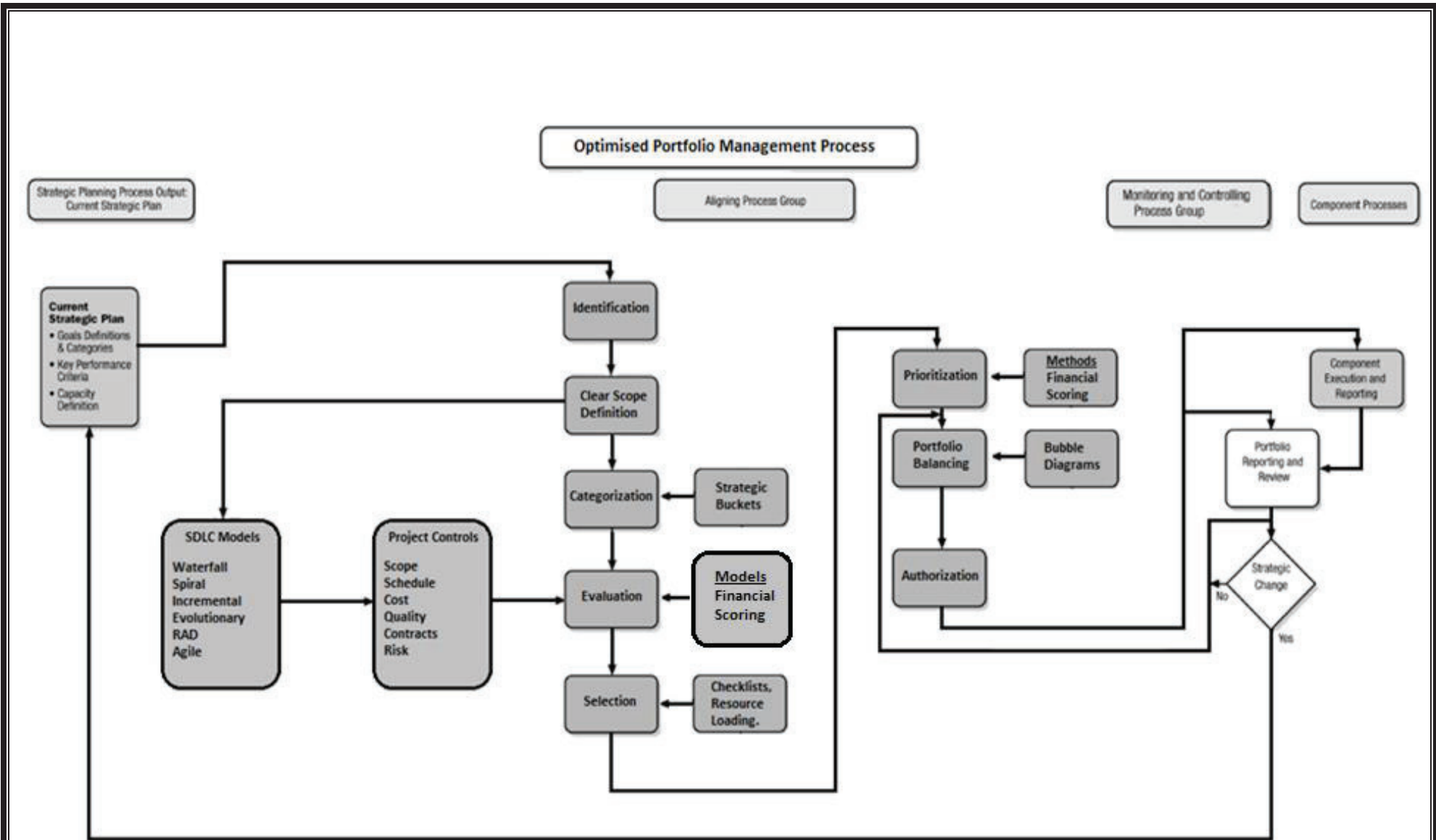


Figure 28: Proposed Portfolio Management Process Model

Based on the model shown in Figure 28, it can be seen that various additional steps were included, as well as commonly used models for certain steps, to the original process. The commonly used models were derived from academic research and studies conducted. This was discussed in Chapter 2 and 3 of this mini dissertation. In order to understand the model, each step needs to be clarified.

5.4.1. Step 0: Key Stakeholders

Prior to commencing with the portfolio management process, it is best practice to first have all the relevant stakeholders present. The key personnel required for the portfolio management process has been identified and listed in Section 5.2.1.

5.4.2. Step 1: Current Strategic Plan

The first step in the portfolio management process is to clearly define the organisational strategic plan. The organisational vision and mission statement must be clearly defined and understood by all stakeholders. Furthermore, the goals and key performance criteria must be documented and clearly understood. The organisational strategic plan forms the basis of the portfolio management process. Once the strategy is clearly defined, the various organisational initiatives may be identified.

5.4.3. Step 2: Identification

In this step, the identification of all ongoing and new initiatives (projects, programs etc.) is conducted. The initiatives are then defined in terms of their objectives. Furthermore, the initiatives are analysed in terms of, and not limited to; the class of initiative (project, program, business case etc.), new revenues, return on investments, net present value, strategic alignment, key stakeholders, timescale, business unit etc. At the end of this step, a comprehensive list of all new and ongoing initiatives is generated, including key descriptors for each initiative. Furthermore, the list should include all initiatives that in not in line with the organisational strategy. Once all the initiatives have been identified, a clear scope definition for each new initiative is required.

5.4.4. Step 3: Clear Scope Definition

As was identified in the study conducted by Ernst & Young, clear scope definition of initiatives is not always conducted in a portfolio management process. This should be handled as a separate step in order to emphasize the importance of scope definition. In

this step, the scope of each initiative is clearly defined. Furthermore, the aim of the initiative should be specified along with the nature of the project. The nature of the initiative refers to, and not limited to, whether it is a single or multi-disciplinary initiative, new technology, evolutionary design and quick to market. Once the scope of each initiative has been defined and documented, the various initiatives may be categorized.

5.4.5. Step 4: Categorization

In this step, the various initiatives which were identified for achievement of the organisational objectives are categorized. This implies that the initiatives are grouped in terms of common goals so that these initiatives can be measured on the same basis when it comes to the evaluation, selection, prioritization and balancing phase (Project Management Institute 2006). Some of the categorization factors may include, and not limited to; legal obligation, process improvement, continuous improvement, business imperatives and risk reduction (Project Management Institute 2006). As was highlighted in Chapter 2, strategic buckets are a good tool for the categorization step, as it not only creates a basket of projects with the same objectives, but it can also form the basis for the evaluation and prioritization phase. The outcome of this step is a complete categorization of the listed initiatives.

5.4.6. Step 5: SDLC Selection and Project Control Points Prioritization

In step 3, the scope of each new initiative was clearly defined. Based on the scope and nature of the initiative, an optimal SDLC, that is most appropriate to the scope and nature of the initiative, may be selected. Selecting an optimal SDLC will enhance the probability of making correct budget estimates and assumptions in the evaluation and prioritization phase. Prioritized project control points go hand in hand with the SDLC selected. Based on the SDLC selected, the Project Management Office (PMO) can prioritize project control points for each initiative. This way, the front end loading phase may be proactively planned. At the end of this step, a categorized basket of projects, complete with the SDLC and prioritized project control points is established. The basket of project may then be evaluated.

5.4.7. Step 6: Evaluation

At this point, a comprehensive list of categorized projects, complete with optimal SDLC selection and prioritized project control points is available. In this step, information is

gathered in order to evaluate the initiatives, with the purpose of comparing these initiatives to streamline the selection process (Project Management Institute 2006). Qualitative as well as quantitative information can be used in the evaluation process.

Evaluation criteria may include, and is not limited to; business criteria (strategic alignment, business impact, productivity, intellectual property), financial benefits criteria (NPV, ROI, payback period), risk-related criteria (business risk, technology risk, market acceptance risk, project management risk), legal/regulatory compliance criteria, human resource-related criteria (specific competency, resource availability, human resource capacity), marketing criteria (market impact, time to market, probability of success), technical criteria (conformity to standards, success probability, reliability, availability, supportability) (Project Management Institute 2006). Various models may be used in the evaluation step, and the most commonly used methods include the financial and scoring methods. Based on the evaluation criteria, it is clear as to why these methods are commonly used. These methods and the variations thereof are discussed in Chapter 2 of this mini dissertation. Furthermore, a key factor to include in this step is lessons learnt from previous initiatives. This was a shortfall identified which was identified and discussed in Chapter 2. The outcome of the evaluation step should be a comprehensive evaluation of all listed initiatives.

5.4.8. Step 7: Selection

Based on the organisational selection criteria, various initiatives are then selected. Checklists and resources loading analysis are some of the models commonly used to aid in the selection step. This step is executed as is explained in Section 2.3.4.

5.4.9. Step 8: Prioritization

Upon completion of the initiative selection step, each initiative is then prioritized. This step is executed as is explained in Section 2.3.5. Prioritization methodologies that are commonly used include, scoring / weighted and financial methods.

5.4.10. Step 9: Portfolio Balancing

The purpose of this step is to establish a balance between the prioritized initiatives so as to optimize the achievement of organisational objectives. The organisational portfolio is balanced in terms of; but not limited to; the organisations desired risk profile, specific objectives, financial returns, investment diversification and capacity constraints. The method most commonly used for balancing of organisational portfolios is bubble diagrams. The variations of this method are discussed in Chapter 2. The outcome of the portfolio balancing step is to achieve an organisational portfolio that is balanced.

5.4.11. Step 10: Authorisation

Once the organisation portfolio has been established, initiatives within the portfolio are formally authorized for execution. At this point, capital, as well as human resources, is allocated to execute the initiative. It should be noted that at this point, budgets and resources from inactive / terminated initiatives may be reallocated to prioritized initiatives.

5.4.12. Step 11: Portfolio Reporting and Review

The aim of portfolio reporting and review is to gather performance indicators so as to monitor the organisational portfolio in terms of alignment to organisational strategy and ensure optimal utilisation of resources. Various inputs for the reporting and reviewing process may be taken into account. Some of the inputs are; information on the various initiatives (budget, expected return, progress against plan etc.), resource allocation, environmental constraints, organisational governance standards, selection criteria and strategic goals. The outcome of the review process will identify initiatives which perform as expected, and those which do not. For the affected initiatives; direction is provided to the owners and resources may be reallocated, the initiative may be subjected to realignment with organisational strategies and the initiative may be suspended or terminated.

5.4.13. Step 12: Strategic Change

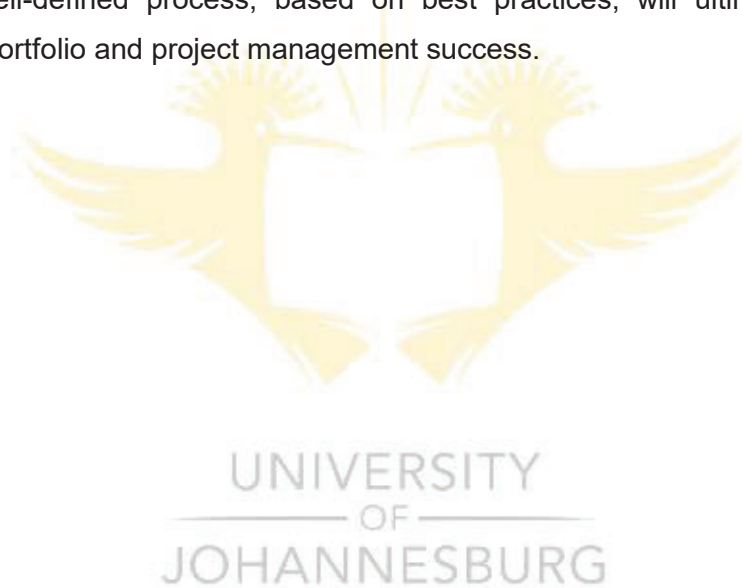
If there are any changes in the organisational strategy, the portfolio management process must be able to accommodate, and adapt to, such changes. This is the purpose of this step. If the strategic change is small, the initiatives may be re-evaluated in terms of organisational portfolio balance. However, if the strategic change is significant, a new

strategic direction is taken, and the entire organisational portfolio process will have to be repeated.

5.4.14. Step 13: Component Execution and Reporting

The purpose of this step is solely to provide information on the execution of the initiative, which is fed back into the portfolio reporting and review phase. Each organisation will have a reporting and communication governance structure in place and that can be used in this step.

Figure 28 highlights the proposed model for the portfolio management process. Based on the literature presented in Chapter 2 and 3, and the case studies above, it is evident that following a well-defined process, based on best practices, will ultimately enhance the probability of portfolio and project management success.



5.5.Conclusion

In Chapter 2 of this mini dissertation, the field of portfolio management was discussed. It highlighted best practices and commonly used models for portfolio management, based on academic research. Furthermore, Chapter 3 focussed on commonly used SDLC models and critical project control points. This was the foundation required for satisfaction of the research objectives.

This chapter of the mini dissertation focusses on highlighting of the main findings from Chapter 2 and 3, and furthermore, integrating the three fields so as to create an optimised portfolio management process. An introduction to the chapter was provided in Section 5.1, followed by the key findings for portfolio management, SDLC's and project controls. This was discussed in Section 5.2. Section 5.3 of this mini dissertation presented two case studies, which highlights the current portfolio management processes and the selection/execution of organisational ventures in various organisations. Furthermore, the case studies aim to identify and discuss the effects of poor portfolio and project management processes. For case study 1, two companies were looked at, a company specialising in paper (Company X), and a company that manufactures cables (Company Y). Case study 2 focussed on an international petrochemical company (Company Z).

Both case studies were analysed and the root causes of the major issues experienced was evident. Some of the critical findings from the case studies included;

- Improper project management process to develop commercial products quickly. Delivery methodologies were not in line with the development strategy and organisational goal.
- Best practices for portfolio management were not implemented in Company X, Y and Z. Company X did not have a portfolio management process and furthermore, project selection was almost entirely based on financial methodology (NPV). This approach in establishing an organisational portfolio resulted in a diverse number of mismatched projects, which ultimately resulted in project failure.
- Due to the absence of a portfolio management process, projects were not aligned to the organisational strategic mission, lessons learnt from projects were not transferable, and the technical abilities of the organisation were not assessed.

- Due to the fact that there was no formal process for portfolio management, there was an ineffective utilisation of resources. This meant that valuable time and money was being spent on incorrect projects.
- The SDLC chosen for execution of the projects were not the optimal choice based on the scope of the project. A lot of time was spent in generation of documentation and design investigations without prototyping a design to verify the feasibility. Furthermore, uncertainties in the cost estimates were evident due to the uncertainty of the proposal implementation success

Based on analysis of the case studies, it could be seen that a formal process, incorporating best practices, for portfolio management is imperative in an organisation for project success. Furthermore, selection of an SDLC model with corresponding project controls, based on the initiative objectives and scope, is necessary early in the selection process. Analysis of the case studies revealed that due to the lack of portfolio management processes, incorrect selection of SLDC and poor project controls, projects were delivered late, over budget, not in line with organisational strategy and ultimately resulted in project failure. Based on the analysis of the case studies, as well as the findings from Chapter 2 and 3, an enhanced model for portfolio management was proposed. This model was discussed in Section 5.4 of this mini dissertation.

The proposed portfolio management model includes the selection of SDLC's and prioritised project control points, as well as commonly used methods for certain steps. The proposed model uses the PMI portfolio management process as a backbone; however, with the proposed model, optimal SDLC's with prioritised project control points may now be; discussed amongst all key stakeholders, and selected. In this way, an optimal execution strategy for initiatives is established, further achieving alignment with the organisational strategy and mission. Each step of the proposed model was further discussed in Section 5.4 of this mini dissertation. The aim of the proposed model is to create an optimised portfolio management process, so as to enhance the probability of project and organisational success.

In the next chapter, the final conclusion to this mini dissertation is presented. An overview of the; background into the research, research problem and research objectives was be presented in the next chapter. Furthermore, the realization of the research objectives, and

answers to the research questions will be highlighted in chapter five. Recommendations based on the research outcomes will be provided in chapter five with the intention of driving continuous improvement.



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6. Conclusion and Recommendations

6.1. Introduction

In the current competitive market environment, coupled with the volatile economy, the implementation of a management strategy, aimed at driving sustainability, optimising return on investments, enhancing customer and stakeholder satisfaction and cultivating a competitive market advantage, is imperative for organisation growth and sustainability (Miller, McCartney January 2010),(David 2011). Effective management strategies must be efficiently implemented, monitored and controlled. Failure to implement, monitor and control effective management strategies ultimately result in; financial loss due to increased capital and operational expenditure, schedule slippages, substandard delivery on quality and depreciation of market share (Mudau, Pretorius 2009),(Thornton 2013).

In order to minimise the probability of failures, a management strategy that aims to “do the right things” and “do things right”, should be implemented (Ernst & Young 2012).

In Chapter 1 of this mini dissertation, the research problem was clearly defined, followed by the questions the research sets out to answer. Succeeding the research questions, the research objectives were defined. The research questions and objectives will be restated in this chapter. An introduction to, and overview of, portfolio management, system development life cycles and project controls, followed by the research process strategy, was also presented in Chapter 1 of this mini dissertation.

Chapter 2 of this mini dissertation focused on portfolio management and best practices thereof. The goals and benefits, as was synthesized from various academic literatures, were highlighted in Chapter 2. Furthermore, various portfolio management processes were presented in Chapter 2, with particular focus on the portfolio management process specified in the PMI Standard for Portfolio Management. There are various steps in the portfolio management process, and for certain steps, based on academic research, there are commonly used models that may be used to aid in execution of the step. The various commonly used models and strategies for portfolio management were discussed in Chapter 2.

In Chapter 3, system development life cycles (SDLC) and project controls were discussed. The goals and benefits of SDLC's and project controls were further highlighted in Chapter 3. Based on academic literature, the commonly used SDLC's were presented. These included; waterfall, spiral, incremental, rapid application development (RAD), evolutionary and agile. In order to aid with the selection of an appropriate SDLC, a selection criteria, based on academic research, was tabulated in Chapter 3. Succeeding the SDLC selection criteria, the critical project control points, based on the PMBOK and additional literature, was discussed. The critical control points included; scope, schedule, cost, quality, risk and contracts control.

Chapter 4 of this mini dissertation focussed, and provided details, on the research process. A guideline to selection of research methodologies was presented in chapter 4, with the aim of promoting optimal research methodology selection. Once the selected research methodologies were presented, an introduction into the case study research was highlighted. Various types of case studies were presented and an optimal case study option was selected. Based on the case study selected, the case study research process was then described. The process consisted of four high level steps as was synthesised from (Yin 2009), and these included; designing the case study, preparing and collection of data, analysing case study evidence, and reporting the results. These steps were then explained in greater detail, providing the associated decisions applicable to this mini dissertation.

Chapter 5 of this mini dissertation discussed the findings from the previous chapters, highlighting the best practices and commonly used methods for portfolio management, system development life cycles and project controls. To further highlight the effects of poor; portfolio management, SDLC selection and project management, two case studies were presented in Chapter 5. Based on the case studies, and discussion in Chapter 2 and 3, an enhanced model for portfolio management was proposed. The proposed portfolio management model includes the selection of SDLC's and prioritised project control points, as well as commonly used methods for certain steps. The aim of the proposed model is to create an optimised portfolio management process, so as to enhance the probability of project and organisational success.

In this chapter, the research problem is restated in Section 6.2. Section 6.3 highlights the research questions and presents the answers to each research question. The research objectives and achievement of the objectives are discussed in Section 6.4 of this chapter. Recommendations based on the research outcomes will be provided in Section 6.5 with the intention of driving continuous improvement. The mini dissertation is finally concluded in Section 6.6.



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6.2. Restatement of the Research Problem

Defining management focus points and strategies in any organisation is of vital importance, as it provides organisational direction and organisational venture execution governance (Meredith, Mantel 2012). Hence, management tools and techniques must be effectively and efficiently implemented in order to drive organisational sustainability.

In times of budgetary constraints, volatile economy and risk, companies continue to implement projects which are not in line with the organisational mission/strategy, resulting in financial losses, ineffective utilisation of resources and decrease in market share (Kilford, Cansoti.com 2008),(Thornton 2013),(Ernst & Young 2012). Furthermore, poor project management, in terms of poor selection of projects execution methodologies, ineffective front end loading and inefficient project controls, have seen a multitude of organisational venture failures (Gilb 2005),(Bhunu 2007),(Attarzadeh, Hock Ow 2008). Cost overruns, schedule slippages and substandard delivery on quality are some of the consequences of ineffective project management (Attarzadeh, Hock Ow 2008).

The reason as to why organisations execute projects which are not in line with the organisational objectives is due to the fact that portfolio management is a relatively new field, and current best practices are unknown / followed incorrectly (Wideman 2007),(Pinto 2010). In fact, the first standard for portfolio management was developed by the Project Management Institute in 2006. Furthermore, due to the relative newness of portfolio management, there is a lack of awareness of portfolio management and the various strategies and processes thereof. Synthesis of various portfolio management processes, from organisations as well as the PMI standard for portfolio management, highlights the fact that, project execution methodology and lessons learnt are not incorporated in the early phases of the portfolio management process (Project Management Institute 2006),(Ernst & Young 2012),(Wideman 2007).

Based on personal experience of the researcher, being in a project driven environment, and supported by a paper written by Dr. Solomon Bhunu, "A closer look at project life cycles", it could be seen that once projects are selected (during the selection process in the portfolio management process), a standard system development life cycle (SDLC) is assumed. For some projects, the standard SDLC, may not be the optimal choice for the specific project, and could result in incorrect budget estimates, wrong techniques being applied and

inappropriate assumptions being made (Bhunu 2007). Hence, understanding the various commonly utilised SDLC's will be beneficial to the organisation. Furthermore, based on personal experience of the researcher, and further supported papers written by Iman Attarzadeh and Siew Hock Ow "Project Management Practices: The Criteria for Success or Failure" and R. Mudau, L. Pretorius "Project Control and Risk Management for Project Success", it could be seen that, due to the poor focus on project controls throughout the SDLC, there has been many projects which have been executed over budget and beyond schedule.

Identifying projects that are in line with the strategic business objectives, incorporating best practices, SDLC and critical control points (based on SDLC selected) for projects into early phases of the portfolio management process, will ultimately result in, enhanced project prioritisation, selection and execution, driving organisation growth and sustainability.

Based on the research problems discussed above, the questions this mini dissertation sets out to answer needs to be determined. The research questions, as well as the answers to each question are presented in the next section.



6.3. Answers to Research Question

Based on the research problem discussed in Chapter 1, and restated in Section 5.2 above, this mini dissertation was structured with the aim of answering the two questions. The research questions, followed by the answers to each question can be seen below.

Question 1:

What are current best practices, and commonly used methods for; Portfolio Management, SDLC and Project Controls?

- What are commonly used models / methods for portfolio management and SDLC's, and critical project controls points?
- Is there a standard process for portfolio management?
- How does ineffective portfolio and project management affect project and organisational performance?

Answers to Question 1:

Based on the academic literature presented in Chapter 2 and 3, as well as the analysis and findings from the two case studies presented in Chapter 5, it can be seen that a formal process, incorporating best practices, for portfolio management is imperative in an organisation for project success. Furthermore, selection of an SDLC model with corresponding project controls, based on the initiative objectives and scope, is necessary early in the selection process. The best practices and commonly used models identified for portfolio management, SDLC's and project controls are:

- Best practices for portfolio management, SDLC's and project controls:
 - Identify the organisational goal for portfolio management. Organisational goals for portfolio management, based on academic literature, has been presented in Chapter 2, Section 2.2,
 - Follow a process for portfolio management. The portfolio management process, as was defined in the PMI Standard for Portfolio Management, was presented in Chapter 2, Section 2.3,
 - Include key stakeholders throughout the portfolio management process. Key stakeholders were highlighted in Chapter 5, Section 5.2.1,
 - Understand the commonly used models and methods for portfolio management, SDLC's and project control. Commonly used methods for the

three fields have been identified in Chapter 2, Section 2.4, Chapter 3, Section 3.3 and Section 3.5,

- Incorporate lessons learnt from previous projects early in the portfolio management process,
 - Clearly define the scope of all initiatives,
 - Include SDLC selection and project control points in the portfolio management process,
 - Understand some of the main challenges in portfolio management and develop mitigation strategies accordingly. Based on academic literature, some of the major challenges faced by organisations, which are currently active in portfolio management, were identified in Chapter 2, Section 2.6,
 - Select the most appropriate SDLC based on the scope and nature of the initiative. Various commonly used SDLC models were presented in Chapter 3, Section 3.3. Furthermore, a selection criteria, based on academic literature was synthesised and tabulated in Chapter 3, Section 3.4,
 - Understand critical project control points as well as management techniques for each point. Furthermore, prioritise project control points based on the specific SDLC selected. Critical project control points, based on academic literature and the PMBOK, have been identified and discussed in Chapter 3, Section 3.5.
- What are commonly used models / methods for portfolio management and SDLC's, and critical project controls points?
 - Portfolio management:
 - i. Financial,
 - ii. Scoring models,
 - iii. Bubble diagrams,
 - iv. Strategic buckets, and
 - v. Checklists and resource capacity analysis.

Each of the models identified above, have been highlighted and a discussed in Chapter 2, Section 2.4, Furthermore, the popularity of each model, based on academic studies, was presented in Chapter 2, Section 2.5.

- System Development Life Cycles (SDLC):
 - i. Waterfall,
 - ii. Spiral,
 - iii. Incremental,
 - iv. Rapid application development (RAD),
 - v. Evolutionary, and
 - vi. Agile.

The SDLC's identified above have been highlighted in Chapter 3, Section 3.3. Furthermore, for each SDLC, a pictorial overview of the critical steps was presented in Section 3.3.

- Critical Project Controls Points:
 - i. Scope definition and control,
 - ii. Schedule control,
 - iii. Cost control,
 - iv. Quality control,
 - v. Risk control, and
 - vi. Contracts control.

The critical project control points, as was highlighted in the PMBOK, was listed and discussed in Chapter 3, Section 3.5.

- Is there a standard process for portfolio management?
 - A standard process for portfolio management does exist. The standard process for portfolio management, as was specified in the PMI Standard for Portfolio Management, was presented in Chapter 2, Section 2.3. Each step of the model was further discussed in Section 2.3.
- How does ineffective portfolio and project management affect project and organisational performance?
 - Based on the analysis of the two case studies, cross-case synthesis and pattern matching revealed that the absence of best practices for portfolio management and project execution resulted in project failure.

Question 2:

Can the project portfolio management process be optimised, so as to create an enhanced prioritised and selected basket of projects?

- Optimised meaning, that best practices (from PMI, and other literature) and commonly used methods, (financial, scoring, bubble diagrams) are incorporated into the portfolio management process, resulting in a selected basket of projects with their corresponding SDLC and project control points.

Answers to Question 2:

Based on the standard process presented in Section 2.3, it could be seen that the process may be optimised. Furthermore, based on the findings in Chapter 2 and 3, as well as consequences presented from the two case studies, which were presented in Chapter 5, Section 5.3, it can be seen that best practices, SDLC and project control selection and prioritisation, may be incorporated into the standard portfolio management model, so as to create an optimised portfolio management process.

- Proposed model for portfolio management process:
 - i. A proposed model for the portfolio management process has been presented in Chapter 5, Section 5.4. The proposed model still uses the backbone and key steps from the standard PMI portfolio management process, but the proposed model includes the selection of SDLC's and prioritised project control points, as well as best practices and commonly used methods for certain steps. With the inclusion of the additional steps, optimal SDLC with prioritised project control points may be; discussed amongst all key stakeholders, and selected. In this way, an optimal execution strategy for initiatives is established, further achieving alignment with the organisational strategy and mission.

Each step of the proposed model has been discussed in Chapter 5, Section 5.4. Furthermore, some guidelines on executing the step, as well as the intended outcome of each step, were presented in Section 5.4.

The answers to the research questions have been discussed above. In the next section, the achievement of the research objectives will be presented.

6.4. Restatement and Achievement of the Research Objectives

In Chapter 1, the objectives of this research were clearly specified. The objectives were further explained in terms of a graphical representation. This graphical representation may be seen in Figure 29 below, followed by a discussion on how the objectives were achieved:

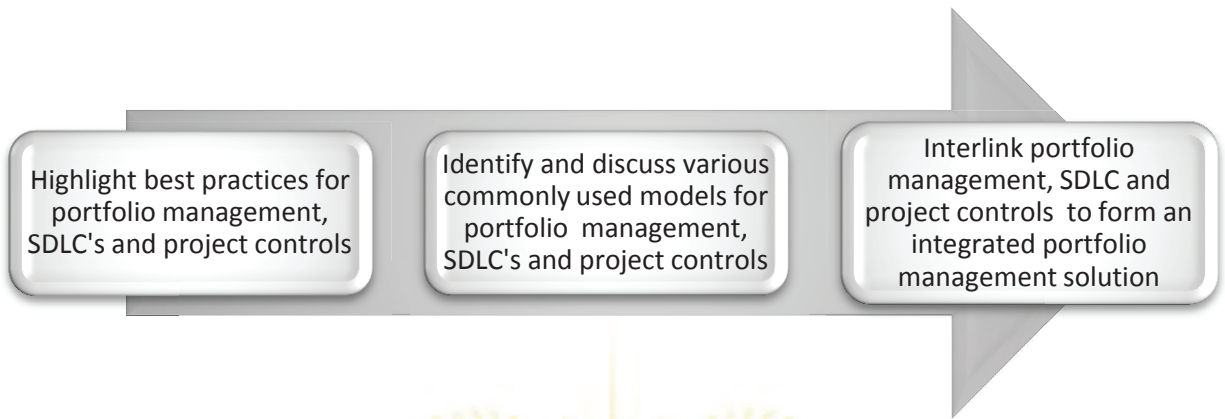


Figure 29: Graphical Representation of Research Objectives

Objective 1: Highlight best practices for portfolio management, SDLC's and project controls

Based on the findings in the case studies presented in Chapter 5, as well as the findings in Chapter 2 and 3, it is apparent that best practices and various models for portfolio management, SDLC's and project controls, is not well known. In order to document best practices, various academic literatures were analysed. For current best practices on portfolio management, the PMI Standard, as well as academic papers and studies were referred to. The PMI Standard for Portfolio Management, as well as academic literature, highlighted various current best practices, which were clearly highlighted in Chapter 2. Some of the best practices included; identify the organisational goal for portfolio management, following a process for portfolio management, including key stakeholders throughout the process, incorporating lessons learnt early in the process and clearly defining the scope of initiatives. The best practices identified were presented in Section 6.3. Academic literature and studies were used to highlight best practices for SDLC's and a selection guideline for SDLC's were further presented in Chapter 3. Seeing as project controls is a field in project management, the best practices in terms of critical project control points were synthesised from the PMBOK and various other academic literatures, and was clearly highlighted and discussed in Chapter 3. Furthermore, guidelines and strategies for each control point were presented.

Objective 2: Identify and discuss various commonly used models for portfolio management, SDLC's and project controls

Based on academic studies and papers, the commonly used methods and strategies for portfolio management, SDLC's and project controls were presented in Chapter 2 and 3. The commonly used models for portfolio management included; financial models, scoring models, bubble diagrams, strategic buckets and checklists and resource capacity analysis. Commonly used models identified for SDLC's included; waterfall, spiral, evolutionary, incremental, rapid application development and agile, and the critical project control points identified included; scope, schedule, cost, risk, quality and contracts. Each of the models and strategies, identified from the various literatures, were clearly discussed in Chapter 2 and 3. These models and strategies provide the user with the tools required to execute the proposed portfolio management process.

Objective 3: Interlink portfolio management, SDLC and project controls to form an integrated portfolio management solution

Based on the findings in academic literature and case studies presented, an integrated portfolio management solution was presented in Chapter 5. The proposed portfolio management model may be seen in Figure 28 of Section 5.4, where the proposed model includes the selection of SDLC's and prioritised project control points, as well as commonly used methods for certain steps. The proposed model still follows the model in the PMI standard; however, with the proposed model, optimal SDLC's with prioritised project control points may be; discussed amongst all key stakeholders, and selected. In this way, an optimal execution strategy for initiatives is established, further achieving alignment with the organisational strategy and mission.

In Section 6.3 and 6.4, the answers to the research questions, as well as the achievement of the research objectives were discussed. As with any research, based on the scope and findings, there are possible recommendations that may be specified in order to further develop the research and drive continuous academic improvement. In the next section, recommendations, based on the findings in this mini dissertation, are presented.

6.5. Recommendations

Based on the findings in this mini dissertation, as well as the proposal of a model for the portfolio management process, there are recommendations that will aid in driving continuous improvement. These recommendations are discussed below.

6.5.1. Recommendation 1: Test the proposed portfolio management process

The effectiveness of the proposed model can only be determined by implementation. Hence, it is recommended that the proposed model be tested on a few baskets of projects to determine the effectiveness, as well as provide feedback on issues experienced. With the feedback provided from the testing, the model may be further enhanced, so as to eliminate any issues experienced.

6.5.2. Recommendation 2: Build on best practices and methods

Standards and specifications are constantly being updated. Hence, best practices and further methods may be documented. It is recommended that, research into additional SDLC's and best practices be conducted, and the selection criteria for SDLC's be further optimised. This information may be then integrated into the proposed portfolio management process.

6.5.3. Recommendation 3: Investigate the viability of a fully integrated portfolio and project management system.

In order to drive innovation and continuous improvement, it is recommended that the viability of a fully integrated portfolio and project management system, be investigated. The proposed portfolio management process should be programmed such that, for each step of the process, guidelines, best practices and templates for commonly used models, are generated. The users may then, with the use of the guidelines and methodology templates, complete each step electronically. Organisational goals, mission and strategies may be built into the programmed model. On completion of the portfolio management process, the system should be capable of populating a PMO database with the current and new organisational initiatives complete with the selected SDLC and project control points. Models for each SDLC, with corresponding step requirements, may be programmed into the PMO database system, so as to enhance the probability of successful initiative execution.

6.6. Conclusion

In today's growing international and domestic competitive environment, volatile economy, budgetary constraints and shrinking experienced workforce, optimal investment decisions coupled with, alignment of business strategies/objectives and effective project execution plans, are paramount in driving organisational success and sustainability (Walls 2004). Materialisation of business objectives and the organisational mission is usually accomplished by successful execution of organisational initiatives and efficient delivery of services/products of the highest quality. However, in many organisations, initiatives are run in parallel and across different functions and geographies, resulting in organisations struggling with "doing the right things" and "doing things right" (Ernst & Young 2012). Too often, organisations execute projects that are not in line with; the business objectives / strategies, customer needs and market requirements, resulting in, and not limited to; increased capital costs, decreased ROI, decreased market share and a weakened competitive edge (Kilford, Cansoti.com 2008),(Thornton 2013). As was stated in a research paper by OGC (Office of Government Commerce), *"In times of rapid change, budgetary constraints and high risk, it is shocking that some organisations continue to waste effort and resources by delivering the wrong Programmes and Projects"* (Kilford, Cansoti.com 2008)

Furthermore, as was highlighted in an International Journal of Scientific & Engineering Research paper, a larger number of projects fail, and billions are spent on failed projects. Lacks of poor selection process of system development life cycles, and project controls are the top reasons of such failure (Sharma 2011).

In order to drive optimal organizational initiative selection, while simultaneously minimizing the probability of the failures discussed above, it is evident that effective management strategies should be efficiently implemented and executed.

In Chapter 1 of this mini dissertation, the background to the research problem was highlighted. The research problem was developed based on personal experience of the researcher, and was further supported by various academic literatures. Based on the research problem, the questions the research aimed to answer was documented. Each of these questions, as well as the answers to the questions was discussed in Chapter 6 of this mini dissertation. Furthermore, the research objectives, as was stated in Chapter 1, was restated in Chapter 6, coupled with a discussion on how each objective was achieved.

Using the tools and techniques documented in the research process strategy, in Chapter 1, the foundation for best practices and commonly used models and method for portfolio management, system development life cycles and project controls, was documented in Chapter 2 and 3. The identified best practices, along with the various commonly used models and methods for each field were clearly specified in Chapter 6 of this mini dissertation.

Once the background, best practices and commonly used methods/models for portfolio management, SDLC's and project controls, were highlighted, the key findings from each field was documented in Chapter 5. To further highlight and support the discussions of the effects of poor portfolio and project management processes, two case studies were analysed. Based on the analysis of the case studies, it was found that projects / organisational initiatives failed, due to the fact that the initiatives were either; cancelled, delivered late, over budget and not up to the required quality standard. The root causes of these failures were attributed to the lack of best practices in portfolio and project management processes. Based on analysis of the case studies, as well as findings from Chapter 2 and 3, it could be seen that a formal process, incorporating best practices, for portfolio management is imperative in an organisation for project success.

In Chapter 5, Section 5.4, an optimised model for the portfolio management process was proposed. The proposed portfolio management model included the selection of SDLC's and prioritised project control points, as well as commonly used methods for certain steps. The proposed model uses the PMI portfolio management process as a backbone; however, with the proposed model, optimal SDLC's with prioritised project control points may now be; discussed amongst all key stakeholders, and selected. In this way, an optimal execution strategy for initiatives is established, further achieving alignment with the organisational strategy and mission. The aim of the proposed model is to create an optimised portfolio management process, so as to enhance the probability of project and organisational success.

It can be seen that, with the aid of the proposed model and research in this mini dissertation, the issues experienced by the organisations discussed in the case study, would be eliminated. Furthermore, with the aid of this mini dissertation, best practices and commonly used models and methods for portfolio management, SDLC's and critical project control points, may be understood, further driving efficient execution of the portfolio and project management process. These further addresses the problems specified in the original research problem statement.

Thus, based on the findings in this mini dissertation, it can be concluded that, the questions the research set out to answer, were clearly answered. Furthermore, each objective for this mini dissertation has been achieved. Using the information provided in this mini dissertation, the original problems specified in the research problem, may be resolved. It may be concluded that with the aid of a formal portfolio management process, coupled with best practices and optimal execution strategies, an optimised organisational portfolio may be established, enhancing the probability of project and organisational success.



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