## DOCUMENT CONTROL

| Author | H. Terese Parks  
|        | Heliograph Services Pty Ltd |
| Contributors | Paul Campbell, Director, Information Technology and Communication Services (ITCS)  
|        | Rona Brown  
|        | MIS Manager, Information Technology and Communication Services (ITCS)  
|        | Barbara Olde  
|        | Former Director, Information Technology and Communication Services (ITCS) |

| File Name |  |
| Last Edited | 26.04.07 |

### Record of Amendments

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Changed by</th>
<th>Description of Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2003</td>
<td>1.0</td>
<td>Helen Terese Parks</td>
<td>Initial draft of entire Handbook</td>
</tr>
<tr>
<td>September</td>
<td>1.1</td>
<td>Helen Terese Parks</td>
<td>- Inclusion of cost and benefit analysis methods</td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td>- Inclusion of IT&amp;T testing terms</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Elaboration of Project Charter instructions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Inclusion of changes arising from initial review of draft by Barbara Olde, Former Director, ITCS and Rona Brown, Manager, MIS, ACU</td>
</tr>
<tr>
<td>October 2003</td>
<td>1.2</td>
<td>Helen Terese Parks</td>
<td>Inclusion of summary overview at request of Barbara Olde, Former Director, ITCS</td>
</tr>
<tr>
<td>April 2007</td>
<td>1.3</td>
<td>Sean Connell</td>
<td>Inclusion of Communications Management section and template at request of Paul Campbell, Director, ITCS</td>
</tr>
</tbody>
</table>
# Table of Contents

1 Overview ........................................................................................................................................ 7
   1.1 Project Initiation .................................................................................................................. 8
   1.2 Project Establishment ........................................................................................................ 8
   1.3 Project Planning .................................................................................................................. 8
   1.4 Project Control .................................................................................................................. 9
   1.5 Project Completion ............................................................................................................. 9
2 Introduction .................................................................................................................................. 10
   What is a Project? ..................................................................................................................... 10
3 Project Management Phases ..................................................................................................... 11
   Project Scope .......................................................................................................................... 12
4 Role of the Project Manager ..................................................................................................... 13
5 User and project staff interrelationship .................................................................................. 13
6 Knowledge base ....................................................................................................................... 14
7 Project Charter ........................................................................................................................ 15
8 Business Process Mapping ..................................................................................................... 16
   9.1 Fact finding and recording techniques ............................................................................. 16
   9.2 Charting ............................................................................................................................. 17
      9.2.1 Types of Charts ........................................................................................................... 18
         9.2.1.1 Information Flow Charts .................................................................................... 18
         9.2.1.2 Special Purpose Charts ..................................................................................... 19
      9.2.1 Entity Relationship Diagram .................................................................................... 19
      9.2.3 Process Flow Chart ..................................................................................................... 20
      9.2.3 Analysis of Process Charts ....................................................................................... 21
9 Project Management Life Cycle ............................................................................................... 22
10 Project Initiation ..................................................................................................................... 23
   11 Cost and Benefit Analysis (CBA) ....................................................................................... 24
      11.1 Project scope .................................................................................................................. 24
      11.2 Project objectives .......................................................................................................... 24
      11.3 Net Present Value (NPV) ............................................................................................. 24
      11.3 Identify benefits ............................................................................................................. 25
      11.3.2 Identify costs .............................................................................................................. 25
      11.4 Return on Investment (ROI) ......................................................................................... 25
      11.5 Developing a cost/benefit analysis ............................................................................... 25
      11.3.1 Identify benefits ........................................................................................................ 25
11.3.3 Develop the project cash flow schedule ........................................................................................ ................................... 25
12 Project Planning ........................................................................................................................................................................... 26
12.1 Change Management Plan .......................................................................................................................................................... 27
13 Project organisation ........................................................................................................................................................................... 28
13.1 Executive Sponsor ....................................................................................................................................................................... 28
13.2 Project Sponsor ............................................................................................................................................................................. 29
13.3 Project Manager ........................................................................................................................................................................... 29
14 Scope Management ........................................................................................................................................................................... 30
14.1 Scope creep considerations: .......................................................................................................................................................... 31
14.1.1 Impact analysis ....................................................................................................................................................................... 31
14.1.2 Cost analysis ............................................................................................................................................................................. 31
14.1.3 Mandatory changes ................................................................................................................................................................. 31
15 Project Status Reporting .................................................................................................................................................................. 32
16 Issue Management ........................................................................................................................................................................... 33
17 Risk Management ........................................................................................................................................................................... 35
18 Communication Management ............................................................................................................................................................ 37
19 Project completion ........................................................................................................................................................................... 39
20 APPENDIX A –DATA MODELLING .................................................................................................................................................. 40
19.1 Conceptual data modelling .......................................................................................................................................................... 40
19.1.1 Entities.......................................................................................................................................................................................... 40
20.1.1.1 Defining ............................................................................................................................................................................... 40
20.1.1.2 Composite entities ............................................................................................................................................................... 40
20.1.1.3 Aggregates ............................................................................................................................................................................. 40
20.1.1.4 Sub-classification of entities .................................................................................................................................................. 41
20.1.1.5 Physical boundaries ............................................................................................................................................................ 41
20.1.1.6 Events .................................................................................................................................................................................. 41
20.1.1.7 Messages ............................................................................................................................................................................... 41
19.1.2 Attributes .................................................................................................................................................................................. 42
19.1.2.1 Attribute names ................................................................................................................................................................... 42
19.1.2.2 Domains ................................................................................................................................................................................. 42
19.1.2.3 Identifier attributes .............................................................................................................................................................. 42
19.1.2.4 Time-varying attributes ......................................................................................................................................................... 42
19.1.2.5 Optional attributes ............................................................................................................................................................. 42
19.1.3 Relationships .......................................................................................................................................................................... 42
19.1.3.1 Number and type of roles .................................................................................................................................................... 42
19.1.3.2 Degree .................................................................................................................................................................................. 43
19.1.3.3 Optionality ........................................................................................................................................................................... 44
Section 12 - References & Related Documents.......................................................................................... 67
27 APPENDIX H – Project Status Report format .......................................................................................... 68
28 APPENDIX I - Issue Log format ........................................................................................................... 70
29 APPENDIX J – Risk Management Schedule .......................................................................................... 71
30 APPENDIX K – Communication Plan Template ................................................................................... 79
   1. Communications Plan Executive Summary ............................................................................................ 81
   2. Marketing and Communication Strategies ............................................................................................ 81
      a. Communicating Major Risks, Issues and Changes ........................................................................... 81
   3. Stakeholder Communication ................................................................................................................ 82
   4. Training Strategies ............................................................................................................................... 82
31 APPENDIX L – Internal Rate of Return (IRR) ....................................................................................... 83
32 APPENDIX M – Net Present Value (NPV) ............................................................................................... 85
33 APPENDIX N – Return on Investment (ROI) ........................................................................................ 87
34 APPENDIX O – Weekly Project Review Meeting Minutes - Format ....................................................... 91
35 APPENDIX P – TESTING INFORMATION TECHNOLOGY APPLICATIONS .......................................... 92
   Terminology............................................................................................................................................ 92
36 BIBLIOGRAPHY...................................................................................................................................... 94
1 Overview

This Handbook provides a standard framework to guide project management at ACU National.

Because each Project is a self-contained related group of work activities with a specific predefined deliverable, it is not feasible to define every detail of work for every Project within a rigid template. However, this Handbook does define a set of documents that must be included in every Project. Hence, it provides a consistent framework within which to conduct all the work necessary for the success of each Project, notwithstanding that some of the tasks within the standard framework will vary according to the nature and complexity of the Project to which it is applied.

The ACU National Project Management methodology is comprised of five phases, each of which results in specific documentation (refer Section 3). Also note that communication should be a key consideration when drafting and disseminating project documentation.
1.1 Project Initiation

Project initiation has the following objectives:

- Identify and document the business need/objectives that the project will address
- Determine and evaluate alternative ways in which the business need can be met and recommend the best solution
- Assure and establish sponsorship of the project
- Define the objective, approach and controls of the project
- Estimate the project effort, duration and cost
- Ensure a clear and common understanding of the deliverables that will be produced
- Confirm all previous assumptions regarding skills required, number of project staff, effort and duration
- Confirm external contact requirements (identify the individuals who will be assigned according to the skill set)
- Confirm specific skill requirements, confirm that those resources are available (in-house or by external contract)
- Identify all necessary skills required and allocate budget to those codes
- Document work breakdown structure, including specific tasks, milestones and deliverables
- Document project team structure and define the role of stakeholders
- Establish the project team (allocate budget to those codes)
- Document the project team structure and define the role of stakeholders
- Establish project cost codes and allocate budget to those codes

Project initiation is completed upon sign-off of the final Business Case. The Business Case is a static document that is never to be changed after sign-off. The Business Case forms the baseline benchmark for the post-implementation evaluation of success, against which achievements will be measured.

1.2 Project Establishment

Project establishment has the following objectives:

- Allocate responsibility, assign the project manager, specify the project sponsor and establish an appropriate steering committee
- Identify project team members (according to skill needs identified in the Business Case), identify and define the role of stakeholders
- Document the project team structure
- Establish project cost codes and allocate budget to those codes
- Document the project team structure and define the role of stakeholders
- Identify project team members (according to skill needs identified in the Business Case), identify and define the role of stakeholders
- Establish the project team (allocate budget to those codes)

Project establishment is completed upon sign-off of the Project Charter. The Project Charter is a living document that is to be amended as and if any element of the initial Project Charter changes. However, version control is to be adhered to strictly, so that changes can be tracked in the quality assurance process and as input to the appropriate steering committee.

1.3 Project Planning

Project planning has the following objectives and deliverables:

- Confirm all previous assumptions regarding skills required, number of project staff, effort and duration
- Determine the type of skills that will be needed to complete the project
- Estimate how long it will take and what it will cost (once-off and ongoing/capital and operating)
- Estimate the type of skills that will be needed to produce the deliverables
- Specify what work needs to be completed in order to produce the deliverables
- Ensure a clear and common understanding of the deliverables that will be produced
- Define the project scope, effort, duration and cost
- Define the objectives and controls of the project
- Assess and establish sponsorship of the project
- Ensure a clear and common understanding of the deliverables that will be produced
- Identify and document the business need/objectives that the project will address

Project planning is completed upon sign-off of the Project Charter.

Project Charter is a living document that is to be amended as and if any element of the initial Project Charter changes. However, version control is to be adhered to strictly, so that changes can be tracked in the quality assurance process and as input to the appropriate steering committee.

Project Planning is completed upon sign-off of the Project Charter.

For the post-implementation evaluation of success, against which achievements will be measured.

Project Planning is completed upon sign-off of the Project Charter.

Project Planning is completed upon sign-off of the Project Charter.

Project Planning is completed upon sign-off of the Project Charter.

Project Planning is completed upon sign-off of the Project Charter.

Project Planning is completed upon sign-off of the Project Charter.
Determine external dependencies

Determine interface and interaction dependencies

Determine milestones that will represent quality assurance checkpoints and their completion dates

Schedule the work plan, inclusive of constraints

Prepare and review the project plan

Submit the initial project plan for approval by the relevant executive sponsor, project sponsor and steering committee

Schedule the work plan, inclusive of constraints

Determine milestones that will represent quality assurance checkpoints and their completion dates

Determine interface and interaction dependencies

Determine external dependencies

Project completion is a once-off activity. All stakeholders must sign-off their satisfaction with the project.

1.5 Project Completion

Review and update the original project charter as necessary

Review and update the project plan as necessary

Communicate progress of the project

Post actual costs against budgeted costs and explain variances

Review estimates of cost and time to complete

Analyze performance

Capture actual data and compare that data to the relevant project plan and budget to:

- Analyze performance
- Review estimates of cost and time to complete
- Post actual costs against budgeted costs and explain variances
- Communicate progress of the project
- Review and update the original project charter as necessary
- Review and update the project plan as necessary
- Review and update the original project charter as necessary
- Post actual costs against budgeted costs and explain variances
- Review estimates of cost and time to complete
- Analyze performance
- Capture actual data and compare that data to the relevant project plan and budget to:

Project control is ongoing throughout the duration of a project. Project status reports must be completed at intervals agreed in the project planning phase, but no less than monthly. Project control has the following objectives:

- Capture actual data and compare that data to the relevant project plan and budget to:
- Analyze performance
- Review estimates of cost and time to complete
- Post actual costs against budgeted costs and explain variances
- Communicate progress of the project
- Review and update the original project charter as necessary
- Review and update the project plan as necessary
- Review and update the original project charter as necessary
- Post actual costs against budgeted costs and explain variances
- Review estimates of cost and time to complete
- Analyze performance
- Capture actual data and compare that data to the relevant project plan and budget to:

1.4 Project Completion

Project completion is a once-off activity. All stakeholders must sign-off their satisfaction with the project deliverables before a project can be deemed to be complete.
2 Introduction

What is a Project?

2.1 What is a Project?

A project is any related group of work activities which, when completed, will achieve specific objectives.

A project has:

- A beginning and an end;
- A defined starting point, a defined end point, and defined work breakdown structure;
- A single project manager who is responsible for its success;
- Is undertaken within a well-defined organizational structure;
- Is defined by specific objectives (deliverables);
- Has a defined scope, deliverables, tasks, work steps, duration, and budget, as defined in a Project Charter;

The objectives of project management are to plan and control a project from start to end, with high levels of

Implementation

Project management is the process by which a project is initiated, controlled, and brought to a successful

Any project objectives, deliverables, and budget are not addressed until

Risks are inherent in all projects. A risk management plan is an essential element of any project charter.

Risks are inherent in all projects. A risk management plan is an essential element of any project charter.

Project milestones, comprised of specific deliverables, are developed to show tangible results of work

To be successful, a project must move forward in a controlled manner, from initiation to completion. A

A project:

- Has a defined starting point, a defined end point, and defined work breakdown structure;
- Has a single project manager who is responsible for its success;
- Is undertaken within a well-defined organizational structure;
- Is defined by specific objectives (deliverables);
- Has a defined scope, deliverables, tasks, work steps, duration, and budget, as defined in a Project

A project is any related group of work activities which, when completed, will achieve specific objectives.
3 Project Management Phases

**Initiation**
- Business Case
- Project Scope & Objectives defined and agreed
- Business need recognised
- Business Case documented

**Planning**
- Project Plan
- Project scope & objectives defined and agreed
- Business need recognised
- Proposal prepared
- Business Case developed
- Recommended solution documented
- Business Case approved by management and budget approved
- Business Case endorsed to applicable management
- Business Case approved and project initiation approved

**Establishment**
- Business Case developed
- Recommended solution documented
- Business Case approved by management and budget approved
- Business Case endorsed to applicable management
- Business Case approved and project initiation approved

**Control**
- Post Implementation Review
- Change (if applicable)
- Process Owner & Executive Sponsor sign-off

**Completion**
- Business Case
- Proposal prepared
- Business Case approved by management and budget approved
- Business Case endorsed to applicable management
- Business Case approved and project initiation approved

**Projects Management Phase**
- Business Case
- Proposal prepared
- Business Case approved by management and budget approved
- Business Case endorsed to applicable management
- Business Case approved and project initiation approved
4 Project Scope

The scope of any project should be derived from and be consistent with an overall enterprise model of business needs, priorities, strategies and infrastructure. Projects should be identified based on a number of complementary developments and prioritised according to prevailing business objectives. The scope of any project should be derived from and be consistent with an overall enterprise model of business needs, priorities, strategies and infrastructure. Projects should be identified based on a number of complementary developments and prioritised according to prevailing business objectives.
5 Role of the Project Manager

The project manager acts as a leader and a process manager. As a leader, the project manager is responsible for managing and communicating a clear vision of the project objectives, and motivating the project team to achieve them. As a process manager, the project manager must ensure that work efforts are sequenced to achieve the overall project schedule.

The project manager is in a key role and must have credibility with their project team and with the project sponsor. So it is essential that the project manager have, or acquire, some knowledge of the technical aspects of any project to which they are assigned.

Many projects fail because they lack credibility with the end users. This lack of credibility often arises from:

- Past failures to deliver on commitments; projects are often late, over budget and deliver less than expected.
- Poor communication; users are not listened to, project staff prefer to minimize interaction with end users, and assumptions are made without consulting them.
- Inadequate involvement of the project team.
- Business processes models need to be developed to ensure that the current procedures and proposed changes are understood by the users.

Business process models need to be developed to ensure that the current procedures and proposed changes are understood by the business users. Models developed by the project staff in isolation from the business knowledge base are insufficient to assure a common understanding.

When designing a project organisation structure, the roles of users as members of the project team, the management and control structure, and support groups need to be defined before the project begins. Users need to be involved in any project.

6 User and project staff interrelationship

Business users, not technology or external providers, should be the focus of every project. User involvement ultimately determines the quality of business systems. Past practices isolated users from the project process; it was, therefore, hard for users to commit to a process in which they had not participated or had not been afforded the opportunity to understand. This “them” and “us” approach inevitably militates against success of any project.

Many projects fail because they lack credibility with the end users. This lack of credibility often arises from:

- Past failures to deliver on commitments; projects are often late, over budget and deliver less than expected.
- Poor communication; users are not listened to, project staff prefer to minimize interaction with end users, and assumptions are made without consulting them.
- Inadequate involvement of the project team.

Many projects fail because they lack credibility with the end users. This lack of credibility often arises from:

- Past failures to deliver on commitments; projects are often late, over budget and deliver less than expected.
- Poor communication; users are not listened to, project staff prefer to minimize interaction with end users, and assumptions are made without consulting them.
- Inadequate involvement of the project team.
Perceived lack of structure and process. Interviews and workshops will appear random unless the users receive timely and professionally structured feedback.

An over emphasis on technology, rather than the business need. Often, to the end users, a project can seem to be predicated on the project teams' desire to use technology, particularly topical technology, rather than to address the actual business need, which may be resolved without technology at all.

Knowledge base

A thorough knowledge base should underpin every project. A knowledge base is the set of all information documented during the planning, analysis, design, development and implementation phases of a project. The accumulated knowledge is essential to maintaining a rigorous structure in any project.

A central repository of the University’s accumulated knowledge relevant to the particular project.

A knowledge base should underpin every project. A knowledge base is the set of all information documented during the planning, analysis, design, development and implementation phases of a project. The accumulated knowledge is essential to maintaining a rigorous structure in any project.

Knowledge coordination is critical to ensure smooth translation of models between project phases.

Without technology at all.

An over emphasis on technology, rather than the business need. Often, to the end users, a project can seem to be predicated on the project teams' desire to use technology, particularly topical technology, rather than to address the actual business need, which may be resolved without technology at all.

A central repository of the University’s accumulated knowledge relevant to the particular project.

Knowledge coordination is critical to ensure smooth translation of models between project phases.

Knowledge base

A thorough knowledge base should underpin every project. A knowledge base is the set of all information documented during the planning, analysis, design, development and implementation phases of a project. The accumulated knowledge is essential to maintaining a rigorous structure in any project.

A central repository of the University’s accumulated knowledge relevant to the particular project.

Knowledge coordination is critical to ensure smooth translation of models between project phases.
The Project Charter is essential to ensure user involvement and understanding, particularly because the development will be a very iterative way of ensuring a clear understanding of the business requirements. It is at this point that any discrepancies between what the business needs and what the business system software can deliver will be identified. The Project Charter is the blueprint of a project; it constitutes the foundations upon which the project will proceed. If the Project Charter does not achieve the objectives stated above, then the project will most likely fail.

An effective Project Charter requires that the business needs be understood to the appropriate level of detail. The system design (base functionality and configuration in the case of packaged systems) does not end up reflecting the users’ functional requirements. The Project Charter is not a static document. It needs to be updated as and when the project scope changes, when stakeholders change, when budget variances occur, etc. The Project Manager must ensure that the project needs to be updated as and when the project scope changes, when stakeholders change, when budget variances occur, etc. The Project Charter is a live document. It must reflect the changing circumstances of the project and be updated accordingly.

Revisit Appendix B for the format of a Project Charter.

- Define the project roles and responsibilities.
- Provide a clear statement of the purpose of the project and what is to be delivered by it.
- Document the agreement between the Project Sponsor and the Project Manager.

The Project Charter must

Refer Appendix B for the format of a Project Charter.

1. Document the agreement between the project sponsor and the project manager.

The Project Charter is essential to ensure user involvement and understanding, particularly because the

Refer Appendix B for the format of a Project Charter.

1. Document the agreement between the project sponsor and the project manager.
To design and install cost-effective business systems that meet the needs of the user base, those needs must be completely and reliably met by functionally rich and robust solutions. In all instances, the end user must be provided with:

- A functional specification (needs analysis) of the business system to be developed (or purchased and installed). The functional specification represents the essential activities which must be performed, whether they can be computerised or not.

The functional specification should set out clearly the logical requirements of the business system, without including much information that is verifiable on a technical specification and becomes meaningless to the business users/process owners. It is essential that the functional specification be understandable to the business users/process owners, or designed to be understood by the end-user/process owner, so that he/she can:

- Agree, and sign off to the effect that the functional specification meets his/her needs, and what trade-offs may be required (or other than essential functions).

An effective functional specification can only be prepared on the basis of a clear understanding of the business processes that the business systems application is being developed (or installed and configured) to support. Business process mapping is, therefore, the first and most essential step in business systems development or re-design.

9 Business Process Mapping

9.1 Fact finding and Recording Techniques

It is essential in business systems analysis not to overlook sources of valuable background information relevant to the business process being analysed. What is relevant will be determined by how well the objectives of the analysis have been defined. A high level preliminary review, preceding detailed business process mapping, will often facilitate the information gathering exercise.

Normally useful background information can be obtained from:

- Organisational charts and Policy manuals
- Operating instructions and/or Procedural documentation
- Minutes of meetings, correspondence
- Previous reports, Minutes of meetings, correspondence
- Organisational charts and Policy manuals

An effective functional specification (needs analysis) of the business system to be designed must be provided, which:

- Takes account of the effect that the functional specification meets the needs of the end-user/process owner, so that he/she can:

- Agree, and sign off to the effect that the functional specification meets his/her needs, and what trade-offs may be required (or other than essential functions).

The functional specification should set out clearly the logical requirements of the business system, without including much information that is verifiable on a technical specification and becomes meaningless to the business users/process owners. It is essential that the functional specification be understandable to the business users/process owners, or designed to be understood by the end-user/process owner, so that he/she can:

- Agree, and sign off to the effect that the functional specification meets his/her needs, and what trade-offs may be required (or other than essential functions).

The functional specification should set out clearly the logical requirements of the business system, without including much information that is verifiable on a technical specification and becomes meaningless to the business users/process owners.

A functional specification (needs analysis) of the business system to be developed (or purchased and installed) must be provided.
Be aware of the person who may have been closely involved with the process under review in the past, who may now be in another department, school or faculty. Identify the key people who interact with the process or system being analysed, particularly indirect users.

By identifying and researching as much background information as practical within the time available, the person conducting the analysis of the business process:

- Will be sure of the information he/she requires, and from whom it can be obtained
- Can anticipate likely opposition and obstruction
- Can prepare well for interviews, deal with uncooperative people, and more readily distinguish facts from opinions
- Be able to complete interviews more quickly

Begin to understand the real motives for the study being undertaken:

- Why this process and not some other?
- What does senior/executive management expect to get from the analysis?

Charting is the principal documentation approach within business analysis. Charting has five main uses:

- Implementation
- Presentation
- Design
- Analysis
- Fact finding

In regard to fact finding, an effective and comprehensive chart of the process is the way in which the analyst will know and understand the existing process, including:

- Who
- What
- Where
- When
- Why
- How

The chart of the existing process (or system) will set the direction for further analysis and for

Similarly, charting of the design of the new (or possible alternative) process in the context of the chart of the existing process (or system) will reveal the complexity of the new (or possible alternative) system and, particularly, the extent to which it varies from the existing system.
Charts are very effective presentation tools ("a picture is worth a thousand words"), as they:

1. Obviate long narratives which may not make the flow of work obvious
2. Provide succinct and compact guidance as the functional flow of the process
3. Assist identification of controls which ensure accuracy, reliability, maintainability, timeliness, auditability, etc.
4. Support the change (and approve the costs of making the change)
5. Enable efficient comparison and analysis of gaps, bottlenecks, inefficiencies and opportunities for improvement
6. Accurate charts also form the basis for functional specifications of IT&T systems and for training of functional operatives and information technology system users
7. Provide succinct and compact guidance as the functional flow of the process

Effective business process mapping helps to identify:

9.2.1 Types of Charts

9.2.1.1 Information Flow Charts

- Charting must take account of:
  - The sub-processes and steps within the process being analyzed
  - The nature (e.g., mapping) of the business process
  - The type of process being analyzed
  - The level of detail required in the analysis
  - The purpose to which the chart is to be put
  - The purpose for which the business process exists (outputs)
  - The existence (or not) of controls that ensure accuracy, reliability, maintainability, timeliness, auditability, etc.
  - The resources required to achieve the purpose of the business process (inputs)
  - The level of detail contained in the analysis
  - The style of process being analyzed

- Charting must take account of:
  - Functional operations and information technology system users
  - Facilitate comparison between current and proposed processes
  - Assist identification and analysis of gaps, bottlenecks, inefficiencies and opportunities for improvement

- Effective business process mapping helps to identify:
  - The sub-processes and steps within the process being analyzed
  - The purpose for which the business process exists (outputs)
  - The resources required to achieve the purpose of the business process (inputs)
  - The existence (or not) of controls that ensure accuracy, reliability, maintainability, auditability, etc.
  - The interdependencies and interfaces of the business process being analyzed

9.2.1 Types of Charts

- Information Flow Charts
  - Operational/Procedural Flow Charts/maps
  - Schematic Flow Charts diagrams or maps
  - Form Flow Chart
  - Form Routing Charts
  - Computer Logic Charts
  - Event Chain Flow Charts
9.2.1.2 Special Purpose Charts

GANTT or BAR charts (Project Planning)
PERT charts: (sometimes called Network Charts or Logic Diagrams) are widely used project management diagrams, used for displaying project schedules depicting the dependencies between tasks.

FAST diagrams

DFD (data flow diagrams)

Students

Courses

Tutor

Enrols in

Taught by

9.2.1 Entity Relationship Diagram

This is a diagram used to show how various entities (elements of the process) are related to each other.

This diagram provides an example of an entity-relationship diagram in which the relationships will include many courses, but each course will have only one tutor (in this example).

The Gantt chart, devised as a planning method by Henry Gantt, is a visual display to represent scheduling which is based on time rather than quantity, volume or weight.

The relationship between student and course is many, because each student may attend many courses and each course will have many students.

The relationship between tutor and course is one to many, because each tutor will teach many courses, but each course will have only one tutor (in this example):
9.2.3 Process Flow Chart

Process Flow Charts are used at ACU National to map the business activities that support the University’s vision, mission, and operational plans.

A Process Flow Chart shows the information and/or activity flow represented by separate forms, records, or other media. It may be presented in either a horizontal or vertical flow, and is especially useful in

defining the functional requirements of an information technology application. The conventions and symbols applying to process flow charting are:

- Information or activity flow is from left to right or from top to bottom.
- Symbols apply to processes flow charting are:
  - Move: Indicating a transfer of a form physically from one point to another. The destination or origin of the move should be noted below the arrow.
  - Information is submitted to the computer application in which the information is entered. The process map should include a notation as to the computer application to which the information is submitted.
  - Information is being addressed. This is usually associated with a vertical line indicating the relationship between different forms or records. Where two forms are linked vertically through several operations, it indicates that the same forms are used in multiple operations.
  - Indicates a sorting or distribution of copies.
  - Activity involves the handling of information or activity involving the form or record. No information changes.

Basic symbols have the following meanings:

- Activity of something is done to or with the information on the form (or in the computer). The nature of the activity being performed needs to be explained on the chart.
- A new form or record is created.
- Information is being added. This is usually associated with a vertical line indicating the source from which the information being added is obtained.
- Indicates a sorting or distribution of copies.
- Indicates a sorting or distribution of copies.

Each horizontal line on the chart represents a discrete information flow (usually a separate paper).
9.2.3 Analysis of Process Charts

The business process chart provides the most effective means of eliminating unnecessary work and streamlining business processes because it provides a detailed description of a particular task or piece of work. There are five key questions that need to be answered to perform an effective analysis.

1. What is being done and why is it necessary?
   - Does each step serve a useful purpose? Does it actually contribute to the end result? An excuse for performing a step is often not a true reason for it being done, often, it will be found to be unnecessary.

2. What is being done and why should it be done there?
   - Can it be done more easily in some other step of the process, or in another department? Will a change to where and when it is being done save steps, time and effort?

3. Who is doing the job? Why should he/she do it? Would someone else do it better?
   - Is someone else better qualified or skilled to do the work? Who can do it most easily and most practically? Ensure that high-salaried time is used discriminately, and delegate tasks to lesser-paid employees wherever feasible.

4. When should this step or task be done? Why?
   - Is the process too complicated in its present form? Can it be done in an easier way? Will automation make it happen faster, more efficiently, with less cost? Should the whole process be done earlier, later or combined with other steps? Is it really in its proper sequence in the end-to-end process? By doing it at this time and at this juncture in the end-to-end process, is it really slowing down or holding up another business operation?

5. How is it being done? Why should it be done that way?
   - Should this step be done earlier, later or combined with some other step? Is it really in its proper sequence in the end-to-end process? If so, by doing it at this time and at this juncture in the end-to-end process, is it really slowing down or holding up another business operation?

For many activities there are explicit rules for how activities are done. Rules are of two types: constraints and operational guidance. Constraints define conditions under which an activity cannot be done or conditions under which an activity must be done. Operational guidance is the University's determination of how activities should be done. These can be analysed and changes recommended without reference to external authority.

Never overlook the people aspects and cultural issues that will need to be addressed, which include:

- Organisational structures: options, specialist/generalist, teams/individuals etc.
- Reward systems: performance measures and career paths
- Training and development
- Terms and conditions of employment
- Organisational culture
- Reward systems: performance measures and career paths
- Training and development
- Terms and conditions of employment
The Project Management Life Cycle is most usually referred to as the System/Software Development Life Cycle (SDLC). The processes shown in green shaded arrows related specifically to projects that are initiated to implement Information Technology & Telecommunications (IT&T) solutions. The other processes apply to all projects, whether IT&T based or not.

The Project Management Life Cycle is most usually referred to as the System/Software Development Life Cycle (SDLC). The processes shown in green shaded arrows relate specifically to projects that are initiated to implement Information Technology & Telecommunications (IT&T) solutions. The other processes apply to all projects, whether IT&T based or not.
11 Project Initiation

Project initiation has the following objectives:

- Identify and document the business need/objectives that the project will address.
- Determine and evaluate alternative ways in which the business need can be met and recommend the best solution.
- Assure and establish sponsorship of the project.
- Define the objective, approach and controls of the project.
- Estimate the project effort, duration and cost.
- Ensure a clear and common understanding of the deliverables that will be produced.
- Determine the type of skills that will be needed to complete the project.
- Estimate how long it will take and what it will cost (one-off and ongoing/capital and operating expenditure).
- Specify what will constitute completion of the project.
- Specify what will complete the completion of the project.
- Determine the type of skills that will be needed to complete the project.
- Define the project start, duration and cost.
- Ensure there is a clear and common understanding of the deliverables that will be produced.
- Determine the best solution.
- Identify and document the business need/objectives that the project will address.
- Denote and document the business need/objectives that the project will address.

If a project is part of a larger business program, the project charter for that program must be supported by a business case, signed off at the appropriate levels of the organization. If the University initiates a project, the project charter for that project must be supported by a business case, signed off at the appropriate levels of the organization.
11.1 Define Project Scope and Objectives

Failure to clearly define the scope and objectives of any project is the most common cause of project failure. The project scope represents an agreement on the work that needs to be performed and the outcome of the project. It must be clearly defined in order to manage expectations and ensure that all parties involved understand the project's objectives.

11.1.1 Project scope

The project scope should be expressed as a concise and accurate description of the end deliverables to be expected from the project and that meet specified requirements as agreed between the project's stakeholders. It is important to specify exclusions from scope, where misunderstandings are probable.

11.1.2 Project objectives

A project's objectives are synonymous with "goals." For clarity, define the scope and objectives of any project in the most common cause of project failure.
11.2.4 Return on Investment (ROI)

ROI is the yield that will manifest as a "profit" from expenditure. It is usually expressed as a percentage of the initial investment amount. Refer to Appendix M for details and examples of how to calculate ROI.

11.3 Developing a cost/benefit analysis

Before a realistic CBA can be developed, the following standards and guidelines need to be considered:

1. The cost of capital (discount rate) to be used.
2. The investment analysis time frame applicable to each of capital and operating expenditure.
3. The treatment of intangible (qualitative) benefits.
4. The treatment of taxes, depreciation, and consumer price index (CPI).
5. Full absorption cost of labour, by level and skill set, computer time usage, etc.

Identify benefits

• Full absorption cost of labour, by level and skill set, computer time usage, etc.
• Treatment of capital (discount rate) to be used.
• Cost and benefit categories.
• The cost of capital (discount rate), associated from Finance.
• The recommended investment analysis time frame applicable to each of capital and operating expenditure.

Identify costs

11.3.1 Identify benefits

Work with the project’s sponsor to identify benefits that will result from implementation of the project. It is not always clear whether a benefit is tangible or intangible. Tangible benefits, such as reduced staff (which can be quantified), are easier to track and audit than intangible benefits, such as better decision making support. Always ensure that all benefits can be quantified.

11.3.2 Identify costs

Determine the costs and the intervals at which those costs will be incurred over the life of the project.

11.3.3 Develop the project cash flow schedule

Allocate the anticipated costs and benefits monthly across the timeframe.
Project Planning

Project planning is an iterative and ongoing process. Detailed plans must be revised as necessary throughout the life of the project.

When planning a project, the project manager must confirm and build on the business case developed during project initiation to prepare an appropriately detailed project charter. The project manager is responsible to create the project plan. The detailed project plan is used to document the project strategy and objectives, the scope of the project, the project schedule, the project budget, the project team, and the project risks. The project plan is used to guide the project team, to evaluate project performance, and to communicate the project status to stakeholders.

The project plan must be reviewed regularly to identify any slippage from original delivery dates, to implement corrective measures and to evaluate the flow on effect on the project overall. The master project plan and all subsidiary plans must include milestones. Milestones will usually be the completion of project stages, the resource constraints, quality issues and project risks need to be factored into the milestone plan.

Each task within a project plan has a narrative description sufficient to communicate:
- What is to be achieved/achieved;
- The steps involved in achieving the deliverable;
- What is to be achieved/achieved;
- Task and resource scheduling;
- Task dependencies;

When preparing the detailed work plans, the project manager must ensure consideration of:
- A detailed budget addressing all aspects of the project and its management;
- A scope management plan;
- An issue management plan;
- A communications plan;
- A risk management plan;
- Quality management and review plans;
- Resource schedules;
- Task schedules, being project specific detailed work plans.

ACU uses Microsoft Project Plan software to create and maintain project plans.

There is some overlap between initiation, establishment and planning of a project. Generally, details from the business case created during project initiation will be carried forward into the project charter created during the establishment phase. The project charter may be modelled when detailed plans are created. When preparing the detailed work plans, the project manager must ensure consideration of:
- What is to be achieved/achieved;
- The steps involved in achieving the deliverable;
- What is to be achieved/achieved;
- Task and resource scheduling;
- Task dependencies;

Throughout the life of the project, project planning is iterative and ongoing process. Detailed plans must be reviewed as necessary.
During the planning process, it is essential to recognise that some or all of the project team, and potentially some of the extended stakeholder team, will need training. Determine the type and duration of training required and include that training in the detailed project plan.

The most common time-based techniques for displaying project plans are shown below; the Gantt Chart is the default display option within Microsoft Project, so is used most often at ACU National.

- CPA – Critical path analysis (Refer Appendix C)
- Gantt Chart – A Gantt chart is a horizontal bar chart developed as a production control tool in 1917 by Henry L. Gantt, an American engineer and social scientist. (Refer Appendix D)
- PERT – Program Evaluation and Review Technique (Refer Appendix D)
- Schedule, sequence and manage the activities of the project team (Refer Appendix D)

A project plan is brought together for a pre-determined period of time to achieve a specific set of objectives. A project team is brought together for a pre-determined period of time to achieve a specific set of objectives.

1.2 Change Management Plan

A change management plan must be prepared in conjunction with the project plan to ensure that the plan is brought together for a pre-determined period of time to achieve a specific set of objectives.

The first appointment within any project team will be the project manager. If more than six people need to report to the project manager, then consideration should be given to assigning team leaders for deliverable modules of the project, through whom other team members will report.

The first appointment within any project team will be the project manager. If more than six people need to report to the project manager, then consideration should be given to assigning team leaders for deliverable modules of the project, through whom other team members will report.

### 13 Project Organisation

A project plan has many uses, not only a schedule to manage the timeliness, sequence and interdependencies of tasks. The preparation of a project plan can also be used to communicate the project plan to other members of the project team. A project plan can also be used to communicate the project plan to other members of the project team.

A project plan is a tool for managing the timeliness, sequence and interdependencies of tasks. A project plan can also be used to communicate the project plan to other members of the project team. A project plan can also be used to communicate the project plan to other members of the project team.

- Report
- The active and visible support and sponsorship of most senior management and the project sponsor
- The geography and culture of the extended stakeholder team
- The characteristics and capabilities of the project team

Change management is the mechanism through which a change to a process or system in the University is implemented. Only when the change is assessed in relation to its overall impact on the University can an informed decision be made whether to implement the change or continue with the status quo.

A project plan is a tool for managing the timeliness, sequence and interdependencies of tasks. A project plan can also be used to communicate the project plan to other members of the project team. A project plan can also be used to communicate the project plan to other members of the project team.

1.2.1 Change Management Plan

The active and visible support and sponsorship of most senior management and the project sponsor

The reputation and credibility of the particular individuals assigned to the project team

The strength of the working and reporting relationships within the team

A project organisational chart must be approved by the definition and assignment of roles and responsibilities for each member of the team. It is essential that the project team be given sufficient authority to achieve the objectives of the project.

- The active and visible support and sponsorship of most senior management and the project sponsor
- The reputation and credibility of the particular individuals assigned to the project team
- The strength of the working and reporting relationships within the team

Change management is the mechanism through which a change to a process or system in the University is implemented. Only when the change is assessed in relation to its overall impact on the University can an informed decision be made whether to implement the change or continue with the status quo.

A project plan has many uses, not only a schedule to manage the timeliness, sequence and interdependencies of tasks. The preparation of a project plan can also be used to communicate the project plan to other members of the project team. A project plan can also be used to communicate the project plan to other members of the project team.
Roles in the overall project organisation will typically include:

13.1 Executive Sponsor
This is the person who has ultimate authority over the project and is ultimately accountable for its success. The executive sponsor:

- has control of the budget,
- resolves otherwise irreconcilable conflicts in the course of the project,
- provides high level direction,
- approves changes to project scope, including risk allocation,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
- determines and manages risks to the project,
- controls changes following approval,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- co-ordinates and directs the team,
- escapes otherwise irreconcilable conflicts in the course of the project,
13.3 Project Manager

- Be aware of the broader perspective and how it affects the project.
- Network effectively, negotiate well and influence people, broker relationships with stakeholders
- Identify, assess and manage project risks and ensure appropriate risk management practices are in place
- Manage project changes and ensure project plans are updated as required
- Ensure project resources are managed efficiently and effectively
- Establish and maintain effective communication with all stakeholders
- Ensure that project deliverables meet quality requirements
- Ensure that project documentation is produced and maintained
- Prepare and present project status reports
- Ensure project completion and closure

The Project Manager should be able to:

- Apply quality management principles and processes
- Build and sustain effective communications with other stakeholders
- Plan and manage the deployment of resources to meet project milestones
- Establish expert knowledge to meet specific circumstances
- Develop and maintain an agreed project plan and detailed stage plans
- Direct, manage and motivate the project team
- Report, record and review detailed results of the project's activities
- Assist the project manager in the resolution of problems
14 Scope Management

Any additional functionality, deleted functionality, modification of deliverables, etc., as detailed in the project charter, constitutes a change in the project's scope. Many projects fail to meet their schedules and their budgets because of "scope creep." It is essential that any and all changes to scope be managed closely. Such management requires that any request for change be documented, evaluated, and tabled and, if approved, scheduled into a revision of the project plan.

**Mandatory (M) changes** are those which are mandated by legislation or statutory reporting requirements. Acceptance of any change will require that the project charter, project plan, project budget and resource requirements be amended. Such changes must always be included into the original implementation schedule and, as such, requirements should have been identified during preparation of the project charter.

**Essential (E) changes** are changes that stakeholders advise would facilitate and optimise operations. They will always stand behind desirable changes. Most often, N2H are “in our dreams, but not in our lifetimes.”

**Desirable (D) changes** are changes that the University stakeholders consider it impossible to do business without. Again, manifestation of such will be as the result of a failure during the analysis and design leading to the functional specification. Such changes must always be included into the original implementation schedule and, instead of being deferred from initial scope, post-implementation enhancements will be scheduled as post-implementation production enhancements.

**Nice to Have (N2H) changes** are changes that stakeholders advise would marginally enhance the implemented solution. They will always be deferred from initial scope and, post-implementation, will always stand behind desirable changes. Most often, N2H are “in our dreams, but not in our lifetimes.”
Any stakeholder of the project may submit a change request. All change requests are to be assigned to the project manager in the first instance. The project manager will then assign one of his/her team members to analyse each request, including a high level cost/benefit analysis.

After this preliminary analysis, it is the responsibility of the project sponsor to decide whether the change will be included in the initial implementation, deferred to post-implementation, or rejected.

A good scope management process is essential to delivering the commitments documented in the project charter. When changes are rejected, the stakeholder who requested such change is going to need to understand the reasons for that rejection; no one likes to be told “no”.

14.1 Scope creep considerations:

14.1.1 Impact analysis:

The request for a change may arise at any time, so the change request process is ongoing throughout the project. A good scope management process is essential to delivering the commitments documented in the project charter. When changes are rejected, the stakeholder who requested such change is going to need to understand the reasons for that rejection; no one likes to be told “no”.

Consistent with the category, mandatory changes must be accepted and included in the project scope.

When mandatory changes are identified, the fact that they have been identified must be communicated throughout the immediate and extended project team.

Any stakeholder of the project may submit a change request, including a high level cost/benefit analysis.

14.1.2 Cost analysis:

Inevitably, the cost of including additional functionality within the project scope will be outside the original project budget. However, sufficient funds should be provided in the original project budget for resources to spend the time assessing the change request. Change analysis hours should be included in the project budget. However, sufficient funds should be provided in the original project budget for resources to spend the time assessing the change request. Change analysis hours should be included in the project budget.

14.1.3 Mandatory changes:

Mandatory changes must be accepted and included in the project scope. When mandatory changes are identified, the fact that they have been identified must be communicated throughout the immediate and extended project team.
The project status report communicates project progress against project plans. Refer to Appendix H for the format of a Project Status Report. Project Status Reports are distributed to the project sponsor, project team, project steering committee, where applicable, user community and other interested stakeholders. A Project Status Report must be produced no less frequently than monthly, on an agreed date that enables reporting of budget versus actual expenditure for the month to which the Status Report relates.

Preparation of a Project Status Report is essential to:
- Evaluate project controls in relation to fixed time and costs.
- Monitor progress to plan.
- Establish a forum for raising issues and seeking assistance through escalation, when and as necessary.
- Report issues to the appropriate stakeholders.
- Enable progress to be measured against milestones.
- Communicate performance progress, including changes to the project plan.
- Comply with contractual obligations.
- Ensure that actual expenditure is consistent with the project plan and budget.

The purpose of a Status Report is to keep stakeholders informed. The reports must be concise and honest. The level of detail in a report should be consistent with the audience to whom it is being directed. The reports should be produced on a regular basis, not less frequently than monthly. They should be reviewed by the project sponsor, where appropriate, for distribution to the project steering committee. A Project Status Report must be submitted to the sponsor in a timely manner, at least monthly, and according to the agreed schedule. The format of a Project Status Report, as explained in Appendix H, provides a clear and comprehensive overview of project progress.

15 Project Status Reporting

Australian Catholic University
The full functionality of Microsoft Project's variance analysis tools must be employed to ensure that the project is genuinely on track.

16 Issue Management

To avoid having to spend time on problem management, regular monitoring, beyond just the facts as represented in project status reports, needs to be undertaken by the project manager and team leaders. If the project manager is not proactive in monitoring the overall project, then urgent issues will overtake genuinely important ones and the "squeaking gates", within either the project team or the broader user community, will receive all the attention, while serious issues will arise from lack of attention in the early stages.

Maintenance of an up-to-date "to do list" is never more important than in the context of a time driven project. To do lists include items that don't warrant inclusion on the overall project plan, but which are the essence of effective time management in any work environment. A good project manager will track and manage use of his/her time very carefully, whether his/her time is charged or not. Maintenance of such records, by time intervals no less frequent than hourly per day, charged out or not, is an integral part of the manager's responsibility. The best way to do this is to interact with each member of the team daily. A comprehensive round of good mornings, in the context of genuinely meaning "how are things going", is a good discipline to adopt. Similarly, such daily contact is a way to ensure that the team is "in touch" with, and is aware of, all the issues that arise in the course of running a good project. A comprehensive round of good mornings, in the context of genuinely meaning "how are things going", is a good discipline to adopt. Similarly, such daily contact is a way to ensure that the team is "in touch" with, and is aware of, all the issues that arise in the course of running a good project.

Each week, the project manager should:

- Collect and collate project actual data, including:
  - All details required for project status report (refer Appendix H)
  - All tasks on project plan with scheduled completion dates for the ensuing week
  - Costs incurred during the proceeding week
- All tasks on project plan with past due scheduled completion dates
- All issues log
- Have prepared an individual status report
- Have prepared the project plan for their own assigned tasks

Each attendee is required to:

- Attend and complete project actual data, including:

Team meeting:

Costs incurred during the proceeding week
All issues log
All tasks on project plan with scheduled completion dates for the ensuing week
All tasks on project plan with past due scheduled completion dates
All details required for project status report (refer Appendix H)

A team meeting should be held every week, on the same day, at the same time, in the same venue.

A good project manager will track and manage use of his/her time very carefully, whether his/her time is charged out or not. Maintenance of such records, by time intervals no less frequent than hourly per day, charged out or not, is an integral part of the manager's responsibility. The best way to do this is to interact with each member of the team daily. A comprehensive round of good mornings, in the context of genuinely meaning "how are things going", is a good discipline to adopt. Similarly, such daily contact is a way to ensure that the team is "in touch" with, and is aware of, all the issues that arise in the course of running a good project.

Each week, the project manager should:

- Collect and collate project actual data, including:
  - All details required for project status report (refer Appendix H)
  - All tasks on project plan with scheduled completion dates for the ensuing week
  - Costs incurred during the proceeding week
  - Team meeting

Each attendee is required to:

- Attend and complete project actual data, including:

16 Issue Management

A good project manager will track and manage use of his/her time very carefully, whether his/her time is charged out or not. Maintenance of such records, by time intervals no less frequent than hourly per day, charged out or not, is an integral part of the manager's responsibility. The best way to do this is to interact with each member of the team daily. A comprehensive round of good mornings, in the context of genuinely meaning "how are things going", is a good discipline to adopt. Similarly, such daily contact is a way to ensure that the team is "in touch" with, and is aware of, all the issues that arise in the course of running a good project.

Each week, the project manager should:

- Collect and collate project actual data, including:
  - All details required for project status report (refer Appendix H)
  - All tasks on project plan with scheduled completion dates for the ensuing week
  - Costs incurred during the proceeding week

Each attendee is required to:

- Attend and complete project actual data, including:

A good project manager will track and manage use of his/her time very carefully, whether his/her time is charged out or not. Maintenance of such records, by time intervals no less frequent than hourly per day, charged out or not, is an integral part of the manager's responsibility. The best way to do this is to interact with each member of the team daily. A comprehensive round of good mornings, in the context of genuinely meaning "how are things going", is a good discipline to adopt. Similarly, such daily contact is a way to ensure that the team is "in touch" with, and is aware of, all the issues that arise in the course of running a good project.

Each week, the project manager should:

- Collect and collate project actual data, including:
  - All details required for project status report (refer Appendix H)
  - All tasks on project plan with scheduled completion dates for the ensuing week
  - Costs incurred during the proceeding week

Each attendee is required to:

- Attend and complete project actual data, including:

A good project manager will track and manage use of his/her time very carefully, whether his/her time is charged out or not. Maintenance of such records, by time intervals no less frequent than hourly per day, charged out or not, is an integral part of the manager's responsibility. The best way to do this is to interact with each member of the team daily. A comprehensive round of good mornings, in the context of genuinely meaning "how are things going", is a good discipline to adopt. Similarly, such daily contact is a way to ensure that the team is "in touch" with, and is aware of, all the issues that arise in the course of running a good project.
Where any scheduled deliverable has slipped, the project plan must be revised accordingly.

Formal Minutes of this weekly meeting must be kept. Usually, the role of Minute taker will rotate through attendees, excluding the project manager. Alternatively, if the project has been assigned an administrative support, the same person will take the Minutes each week.

Pursuant to the weekly team meeting, the project manager should meet with the project sponsor to discuss and update the status of open issues and any outstanding change requests.

Each month, prepare the comprehensive, collated and complete Project Status Report, in accordance with Appendix H:

- Update the project plan
- Update the budget
- Review and update the issues log
- Review and update the change request log
- Update the budget
- Summarise the actual expenditure compared to the budget for the month by each budget category (capital expenditure, operating expenditure) in the status report, but ensure that the variances are captured in the same format as the summary is created.
- Review and update the issues log
- Review and update the change request log

When an issue attains amber or red status, it may be considered a problem and requires corrective action. Depending on the impact of a problem, such action may need to be immediate or scheduled into the project plan. For a future date, any problem constitutes a risk to the success of the project.

When any scheduled deliverable has slipped, the project plan must be revised accordingly.
Risk Management

With reference to AS/NZS 4360:1999 "Risk Management", the magnitude of risk is assessed according to

The following matrix:

17 Risk Management

Australian Catholic University

+ National

12

Page 35 of 94
All project risks need to be put into the context of the three standard project measurables: cost, delivery, schedule and user satisfaction.
Effective communication within a project environment is the key to not only ensuring that all stakeholders are kept informed of the project’s progress but the appropriate opportunities are created for them to provide the necessary inputs into the process. Without appropriate channels of communication the project is susceptible to a number of significant risks including:

- Misunderstood objectives – leading to undesired project outcomes
- Incorrect emphasis on priorities with regards to budget, quality and scope management
- Resistance to change – leading to possible problems with regard to budget, quality and scope management
- Incompatible expectations of providers with regards to budget, quality and scope management
- Misunderstood objectives – leading to undesired project outcomes

To mitigate the risks associated with poor communication it is necessary to include a communication plan as part of the project plan or create a separate communications plan as an attachment outlining

The communication plan should include the following information:

- A strategy for the communication of major issues, risks and changes to the project’s scope
- A strategy for the management of stakeholder feedback
- A strategy for dealing with unscheduled communications
- A list of stakeholders and the selected methods of communication, the frequency and content for each
- Project status reports
- Stakeholder meetings
- Steering committee meetings
- Project team meetings
- Training sessions
- Newsletters
- User forums and discussion groups
- Conferencing and workshops

Communication during the project can be by various methods, including:

- Project status reports
- User forums and discussion groups
- Newsletters
- Training sessions
- Conferencing and workshops

Once this process is complete the methods and frequency of communication and interaction can be mapped to each stakeholder and incorporated into the communication plan.

The communication strategies that will be used during the course of the project:

- Increased momentum of selling – leading to increased new business
- Increased emphasis on priorities with regards to budget, quality and scope management
- Increased emphasis on priorities with regards to budget, quality and scope management
- Increased emphasis on priorities with regards to budget, quality and scope management
- Increased emphasis on priorities with regards to budget, quality and scope management

Communications within a project environment is key to not only ensuring that all stakeholders
A communication plan template has been included in this handbook (see Appendix K).

The process of developing plans and strategies the project is more likely to succeed.

Communication in a project environment is an ongoing process that is often overlooked. By going through

The communication schedule been adhered to?

Has the information being communicated meeting the needs of its intended audience?

Is the communication presenting the true status of the project?

Do all project team members and other stakeholders understand their role and responsibilities?

Has the communication schedule been reviewed and changed as needed throughout the project and a

number of questions should be asked:

The communication plan should be reviewed and changed as needed throughout the project and a

lessen the chances of them being overlooked.

Proposal communications are essential to the coordination of project tasks and events and as such should
A project will have been completed successfully when it has met all of the objectives and success criteria detailed in the project charter. A project may also be completed by virtue of being abandoned. Project completion is the point at which the project will be evaluated for addition to the cumulative knowledge base that will help assure the success of future projects. Project acceptance needs to be documented; the following is an example of an appropriate document for sign-off by the project owner/project sponsor and other identified key stakeholders.

**PROJECT COMPLETION APPROVAL AND ACCEPTANCE**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Project Manager:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion statement:</td>
<td>Date:</td>
</tr>
</tbody>
</table>

Additional comments:

**Approvals** (position/title/name/signature):
19.1 Conceptual data modelling

Conceptual data modelling is the first stage in the process of top-down functional analysis. The aim is to describe the information used by an organisation in a way which is not governed by implementation-level issues and details. It should make it easy to see the overall picture so that non-technical staff can readily understand it.

A common method of analysis involves identifying:

1. **Entities** (persons, places, things etc.) which the organisation has to deal with.
2. **Attributes** - the items of information which characterise and describe these entities.
3. **Relationships** - the ways in which they exist and must be taken into account when

For some applications, e.g. stock control of low-cost items, we are not concerned with individuals but with AGGREGATES - e.g. how many cans of baked beans are in the warehouse? It is easy to overlook the need to record individual units of these aggregates.

20.1.1 Entities

20.1.1.1 Defining

In a global data model for a hospital, for example, the entity names employee and patient are likely to occur. In some situations the same individual may play both an employee and an patient role in the same organisation. For example, a nurse may take a role in the relational structure. The name given to an entity should always be a singular noun descriptive of each item to be stored.

20.1.1.2 Composite entities

Sometimes an entity may be considered as a single entity or as multiple entities. For example, a firm may have a number of different premises for the delivery of goods or supply of services - multiple entities. But one head office for the payment of accounts - a single entity.

20.1.1.3 Aggregates

For some applications, e.g. stock control of low-cost items, we are not concerned with individuals but with aggregates - e.g. how many cans of baked beans are in the warehouse? But it is easy to overlook the fact that a definition refers not to an individual but to a type of object. The problem arises when we try to define the individual units of these aggregates.

Note: the name given to an entity should always be a singular noun descriptive of each item to be stored.

20.1.2 Definitions

In the relational structure, the name given to an entity should always be a singular noun descriptive of each item to be stored.

In a global data model for a hospital, for example, the entity names employee and patient are likely to take a role in the relational structure. The name given to an entity should always be a singular noun descriptive of each item to be stored.

20.1.3 Attributes

A common method of analysis involves identifying:

1. **Entities** (persons, places, things etc.) which the organisation has to deal with.
2. **Attributes** - the items of information which characterise and describe these entities.
3. **Relationships** - the ways in which they exist and must be taken into account when

A common method of analysis involves identifying:

19.1 Conceptual data modelling

20 Appendix A - DATA MODELING
20.1.1.4 Sub-classification of entities

The need for sub-classification of entities arises frequently. For example, a transport pool handles resources which in a global data model might be all classed as vehicles. Although certain attributes and relationships may be common to all vehicles, they are not inter-changeable and for practical purposes must be subdivided into vans, lorries, limousines, etc. each with their own particular characteristics.

20.1.1.5 Physical boundaries

It may be difficult to determine the physical boundaries of entities which are identified by geographical location. For example, a motorway is a road which continues indefinitely, whereas a road might begin and end.

20.1.1.6 Events

We have been talking about tangible objects; however, there are many more that are more abstract, for example, a sale or a birth. In terms of the overall model these are events which happen, and although certain attributes may be attached to them, such as date and amount, they are more difficult to deal with than the more tangible objects. However, these are many.

20.1.2 Attributes

Attributes are pieces of information about entities. The analysis must of course identify those which are included later. Although the need for sub-classification of entities is recognized, there may be even though in the business the attributes will give rise to recorded items of data in the system. It is necessary to consider the purpose for which the information is being collected, whether it will be useful search for some ultimate truth and a short-term expedient which will break down as soon as it is understood.

As these examples indicate, entities are not easy to pin down and compromise is required between a fruitless search for some ultimate truth and a short-term expedient which will break down as soon as it is understood. It is necessary to consider the purpose for which the information is being collected, what sort of questions are likely to be asked and how future developments may affect the initial requirements.

20.1.3 Messages

Similar difficulties occur with entities which exist only as messages within an existing clerical business network. As a piece of paper, a receipt is a tangible object, but in different technological situations its functions could equally well be performed by a notch on a stick or a series of pulses on an electronic document interchange (EDI) network.

The need for sub-classification of entities arises frequently. For example, a transport pool might be a road, a motorway might be a road, a river, a mountain, etc. Although certain attributes and relationships may be common to all vehicles, they are not inter-changeable and for practical purposes cannot be sub-classified. The need for sub-classification of entities arises frequently. For example, a transport pool might be a road, a motorway might be a road, a river, a mountain, etc. Although certain attributes and relationships may be common to all vehicles, they are not inter-changeable and for practical purposes cannot be sub-classified.
19.1.2.1 Attribute names.
Names should be explanatory words or phrases; coding and/or abbreviations should be postponed until
the implementation level. They should enable users of the data model to see what is being recorded, and
identify where the same piece of information occurs in different places (e.g. through a DATA
DICTIONARY.)

19.1.2.2 Domains
A DOMAIN is a set of values from which attribute values may be taken. Examples are: dates, sums of
money, temperatures, grid references, colours, gradings and nationalities. In one way the more definite
we can be here the better - it is more helpful to know that an attribute is a linear measurement than that it
is a number - but precise formatting specifications are not required. A date is a date, however its
format will be different. For example, the date name may come from the names of entities forming the relation.

19.1.2.3 Time-varying attributes.
It is important to know which attributes may change their values over time, as they will have to be updated
when the system is implemented. It may also be necessary to hold previous values somewhere for
AUDITING or the production of HISTORICAL REPORTS.

19.1.2.4 Optional attributes.
Entities may have attributes whose values will sometimes be unknown or irrelevant. This happens with
many applications and external events or processes may affect several related entities, rendering the
attribute values invalid; it may be necessary to record the invalid state, for example, invalid dates or
numbers.

19.1.3 Relationships
In many applications one external event or process may affect several related entities, requiring the
setting of LINKS from one part of the database to another. Important information to be recorded is:

19.1.3.1 Number and type of roles
The number of roles and the type of each role need to be recorded. Role names are different from the names
of entities: one entity may take on several roles; the same role may be played by different entities. Where a relationship is symmetric (e.g. roads intersecting) the names
are prefixed by different prefixes. Where a relationship is asymmetric (e.g. driver-owner) the same role
may take on many roles; the same role name is used.

19.1.3.2 Domains
Just as attributes have domains, so do relationships. The domain of a relationship may be a domain of entities,
relationships, numbers, dates, etc.

19.1.3.3 Time-varying attributes
Just as attributes may change over time, so may relationships. Important information to be recorded for
relationships is:

19.1.3.4 Optional attributes.
Just as attributes may be optional, so are relationships. Relationships may be optinal or mandatory.

A DOMAIN is a set of values from which attribute values may be taken. Examples are: dates, sums of
money, nationalities, grades, and so forth.
manufacturers, types of vehicle and garages. In such a model we may wish to represent the information specified by a TERNARY RELATIONSHIP e.g. \( g_{120} \) (Vehicle_Manufacturer, Vehicle_Type, Garage).

Vehicle_Manufacturer supplies Vehicle_Type to Garage.

This ternary relationship is not in general equivalent to the combination of the three binary relationships:

\( g_{120} \) Vehicle_Manufacturer SUPPLIES Vehicle_Type

\( g_{120} \) Garage SELLS Vehicle_Type

\( g_{120} \) Garage IS SUPPLIED BY Vehicle_Manufacturers

For example the information that:

1. Ford supplies cars to Hills

2. Ford supplies cars

3. Hills sells cars

4. Hills is supplied by Ford

tells us more than the combination:

1. Ford supplies cars to Hills

2. Ford supplies cars

3. Hills sells cars

4. Hills is supplied by Ford

One cannot validly infer (1) from (2), (3) and (4) e.g. it may be that Hills only sells Ford trucks, not cars.

The false inference (2, 3, 4) => (1) is sometimes called the connection trap.

19.1.3.2 Degree

Relationships may be:

- ONE-TO-ONE, e.g. Patient - Doctor,
- ONE-TO-MANY, e.g. Hospital - Patient,
- MANY-TO-MANY, e.g. Building - Location,
- RECURSIVE, e.g. Manager - Employee.

To decide the DEGREE of a relationship one must be clear about whether the individuals or types are involved. The relationship (vehicle_manufacturer, vehicle_type) is one-to-many if we are talking about an individual manufacturer, but many-to-many where (vehicle_manufacturer, vehicle_type) are types.

To understand the connection trap:

\[ \text{Ford supplies some type of vehicle to Hills.} \]
\[ \text{Hills sells cars supplied by some supplier} \]
\[ \text{Ford supplies cars to some garage(s).} \]
\[ \text{Ford supplies some type of vehicle to Hills.} \]
\[ \text{Hills sells cars supplied by some supplier} \]
\[ \text{Ford supplies cars to some garage(s).} \]

Relationships (2), (3) and (4) only tell us that:

4. Hills is supplied by Ford

3. Hills sells cars

2. Ford supplies cars

1. Ford supplies cars to Hills

For example the information that:

1. Garage IS SUPPLIED BY Vehicle_Manufacturers

2. Garage SELLS Vehicle_Type

3. Vehicle_Manufacturer SUPPLIES Vehicle_Type

This ternary relationship is not in general equivalent to the combination of the three binary relationships:

4. Vehicle_Manufacturer supplies Vehicle_Type to Garage.

(Vehicle_Manufacturer, Vehicle_Type, Garage) specified by a TERNARY RELATIONSHIP e.g. 9.
19.1.3.3 Optionality
A relationship may be required or optional for either participant, e.g. a piece of property must be owned by a person but not all persons need own a piece of property.

19.1.3.4 Permanence
A relationship may be defined as permanent (e.g. parenthood) or temporary (e.g. employment). If temporary but required by one of the participants (e.g. ownership) it must be transferable.

19.1.3.5 Dependencies
One relationship may necessarily exclude or imply another, or be excluded or implied by another. Membership of the City University Students Union necessarily implies membership of the University itself. Many of the above constraints will require consistency checks on incoming data. Some database management systems (DBMS) allow such checks to be declared as part of the logical data model so that they are applied automatically whenever the database is updated.

A relationship may be required or optional for either participant. A piece of property must be owned by a person.
Logical Data Modelling

Logical data modelling is a graphic-intensive technique that results in a data model representing the definition, characteristics, and relationships of data in a business, technical, or conceptual environment. Its purpose is to describe end-user data to systems and end-user staff.

Various methods of data modelling exist, each using a host of conventions and tools. The selected method of data modelling is a graphic-intensive technique that results in a data model.

19.2.1 Data Modelling Objects

- **Entities**
  - persons, places, or things about which an organization wishes to save information. Employees, States, Orders, and Time Sheets are examples of entities. (As a convention, I capitalize the first letter of entities.)

- **Attributes**
  - are the properties of entities. Attribute examples include Colour, Employment Date, Name, and Tax File Number.

- **Relationships**
  - verbs that describe how entities relate to each other. For example: "Customers Buy Products," "Employees File Time Sheets," "Salespeople Place Orders." A sentence in this entity-relationship-entity construct is called a relationship entity pair, which is a shorthand mechanism for representing relationships. Relationships aren't four cornered rectangles. A relationship is a verb that describes how entities relate to each other.

- **Entities**
  - are the properties of entities. Attribute examples include Colour.

19.2.2 Relationship diagrams

The conventional way to show relationships is shown in the following diagram:

![Diagram showing relationships between entities and attributes]

The relationship diagram shows:

- **Products**
  - are bought by **Customers**, and are bought by **Employees**.
- **Relationships**
  - are four cornered rectangles.
- **Entities**
  - are the properties of entities. Attribute examples include Colour.
- **Attributes**
  - are the properties of entities. Attribute examples include Colour.
Proper procedure is to label all relationships in both directions, as shown in the top figure (plumbers prepare pipes/pipes are prepared by plumbers). However, many modellers place the relationship in a diamond, as shown in the bottom figure (seamen sail ships/ships are sailed by seamen).

**19.2.3 Attribute diagrams**

Attributes are diagrammed in several different ways or not diagrammed at all. Some modellers place attributes in the entity box while others use ovals to hold attribute names. However, it is common practice not to place attributes on a diagram at all. Simple models, such as those above, are illustrative. In real analysis exercises, an entity may have so many attributes that a diagram becomes unreadable. A more practical approach is to keep attributes out of the data model and in the data dictionary.

**19.2.3.1 Type/Occurrence Distinction**

Before proceeding, the distinction between entity type and entity occurrence needs to be understood. "Occurrence" and "instance" being interchangeable.

An entity type represents the class of objects that share a distinguishing factor. An occurrence is a single case of an entity type. For example, "Detective" is an entity type, while "Sherlock Holmes," "Hercule Poirot," and "Ellery Queen" are entity instances. The distinction between entity type and entity occurrence is the same as the distinction between record type and record occurrence.

To say that entity type A relates to entity type B means that one or more occurrences of A, if any, relate to entity type B, means that one or more occurrences of A's and B's record occurrences.

"[Diagram of attribute diagrams]"
19.2.3.2 Membership Class (Connectivity Characteristics)

If entity 'A' relates to entity 'B,' knowing more about how the occurrences of 'A' relate to the occurrences of 'B' is important. One concern is the cardinality of the relationship. Cardinality is the specification of the number of occurrences of one entity type that can be related to the occurrences of another entity type. Cardinality is usually expressed in terms of one-to-many relationships, where an occurrence of one entity type relates to one or more occurrences of another entity type. Cardinality can be expressed as:

- One-to-one (1:1)--An occurrence of entity 'A' can relate to only one occurrence of entity 'B.'
- Many-to-many (M:N)--An occurrence of entity 'A' can relate to one or more occurrences of entity 'B,' and an occurrence of entity 'B' can relate to one or more occurrences of entity 'A.'
- One-to-many (1:N)--An occurrence of entity 'A' can relate to one occurrence of entity 'B.'
- Many-to-one (N:1)--An occurrence of entity 'B' can relate to one and only one occurrence of entity 'A.'

The most popular way to represent cardinality is to use a bar to express one and a trident (also called a "crow's foot" or "chicken foot") to express many.
However, several other approaches and diagramming conventions exist. Note that Chen and Reiner use a diamond to represent a relationship, whereas the Trident approach uses a line. (For a discussion of the Reiner technique, see Reiner et al., “The Data Base Design and Evaluation Workbench [DDEW] Project at CCA.” Database Engineering 7(4):10-15, 1985.) The diamond does a better job of representing certain types of relationships, but it is not as good at showing the bidirectional nature of relationships. The same is true in the other direction. Therefore, the line represents a modality of one, while a circle represents a modality of zero. The following diagram shows a relationship entity pair, “Artists Paint Pictures.” A bar expresses a modality of one, while a circle expresses a modality of zero. In the example of Invoice and Line Item entities: An Invoice occurrence can relate to many Line Items, but a Line Item can relate to only one Invoice. This tells you the cardinality. But is it possible to have a Line Item occurrence not related to an Invoice occurrence? The answer is no. For a line to exist, it must be linked to an invoice. Therefore, the inverse of this relationship is mandatory. In contrast to cardinality, the modality of a relationship indicates whether an entity occurrence is required or optional. The following example illustrates whether an entity occurrence is needed or optional. The use of squares and circles to denote modality is optional. The modality is not a requirement, and can be used at the discretion of the designer. The following diagram shows the relationship “Artists Paint Pictures.”
Any relationships are those involving more than two entity types, such as 'Customer buys a car from a dealer.'

The most common relationship is the binary relationship that links two entity types. Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.

The most common relationship is the binary relationship that links two entity types. Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.

Most data modellers use the term "optionality" instead of "modality." This is in awkward and confusing terms than optionality.

Contrary to the myth of a mandatory relationship, "modality" is a term from modal logic, which is used to distinguish necessary statements (in which truth is a necessity or mandatory) from contingent statements (in which truth is conditional or only a possibility). The term "modality" is often used in the context of modal logic, which is a branch of philosophy and computer science that deals with the notion of possibility and necessity. The term is derived from the Latin word "modalis," meaning "pertaining to" or ",conditioned by." In modal logic, there are two main types of modalities: necessity and possibility. Necessity is the property of something that must be true, and possibility is the property of something that could be true. The term is often used to describe the relationships between concepts or entities, such as the relationship between a parent and their child. The term "modality" is also used in other fields, such as linguistics and semiotics, to describe the relationships between words or symbols.

19.2.3.3 Degree

Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.

The most common relationship is the binary relationship that links two entity types. Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.

Most data modellers use the term "optionality" instead of "modality." This is in awkward and confusing terms than optionality.

Contrary to the myth of a mandatory relationship, "modality" is a term from modal logic, which is used to distinguish necessary statements (in which truth is a necessity or mandatory) from contingent statements (in which truth is conditional or only a possibility). The term "modality" is often used in the context of modal logic, which is a branch of philosophy and computer science that deals with the notion of possibility and necessity. The term is derived from the Latin word "modalis," meaning "pertaining to" or ",conditioned by." In modal logic, there are two main types of modalities: necessity and possibility. Necessity is the property of something that must be true, and possibility is the property of something that could be true. The term "modality" is also used in other fields, such as linguistics and semiotics, to describe the relationships between words or symbols.

19.2.3.3 Degree

Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.

The most common relationship is the binary relationship that links two entity types. Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.

Most data modellers use the term "optionality" instead of "modality." This is in awkward and confusing terms than optionality.

Contrary to the myth of a mandatory relationship, "modality" is a term from modal logic, which is used to distinguish necessary statements (in which truth is a necessity or mandatory) from contingent statements (in which truth is conditional or only a possibility). The term "modality" is often used in the context of modal logic, which is a branch of philosophy and computer science that deals with the notion of possibility and necessity. The term is derived from the Latin word "modalis," meaning "pertaining to" or ",conditioned by." In modal logic, there are two main types of modalities: necessity and possibility. Necessity is the property of something that must be true, and possibility is the property of something that could be true. The term "modality" is also used in other fields, such as linguistics and semiotics, to describe the relationships between words or symbols.

19.2.3.3 Degree

Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.

The most common relationship is the binary relationship that links two entity types. Relationships can have any number of entity types associated with them. When an entity type is related to another child through the relationship "Sibling," this is a unary or recursive relationship. That is, an entity type is related to itself.
All data modelling tools support binary relationships, and most support unary relationships, but only a few support n-ary relationships. The reason is that most database management systems support binary relationships only.

### 19.2.3.4 Attribute Values

As with entities and relationships, there are attribute types and attribute occurrences. An attribute value is an instance or occurrence of an attribute type. An attribute value is a characteristic of or fact about an entity occurrence. The fact might be that the entity's Colour is "blue" (the convention is to place attribute values in double quotes) or that the AUTHOR NAME is "Thomas Rowley."

Attribute values are what data processing is all about. They form the core of information management and represent the most tangible and least abstract aspects of all data.

### 19.2.3.5 Domains

A domain is the set of possible values an attribute type can have. Examples of domains include: dates, text, integers, real numbers, state abbreviations, and so on. However, while "July 1, 1983" is an acceptable value for Employment Date, "Curried Pancakes" is not.

19.2.3.5 Domains

Domains can be specific or generic. Generic domains, such as "integer," "text," or the ever-useful "string," are easier to work with but they are also the least meaningful.

Domains can also be nested. That is, the scope of one domain can incorporate another. The domain of "Dates" might be between 1/1/1970 and 12/31/94, or acceptable ZIP codes are more useful than "123 South Main Street." The results will be quite unpredictable.

19.2.3.5 Domains

Data types are programming language features that identify broad domain categories, such as integers, real numbers, text, and so on. These data types correspond to the entity types and relationship types, and allow us to encode and process the data in a meaningful way.
Ranges, such as dates between 1/1/1960 and 12/31/1967, non-negative values (for example, real numbers between 0 and 4.0), and last names beginning A to J, indicate which values between two end points are acceptable.

Acceptable values, such as street names, suburbs, post codes and State names are the most specific types of domains. They specify the only values an attribute can have.

Thus the acceptable values for the Gender attribute would be "Male" and "Female." In effect, a domain hierarchy is created with the data type at the highest level and each other.

The entity-relationship (ER) approach to logical data modeling does not end here. What has been set forth in this article is just a cursory view of some rather complex notions involved in data modeling. The following figure shows how the topics discussed in this appendix relate to each other.
19.3 Physical Data Model

19.3.1 Overview

This section describes the generation of the Data Archive Physical Data Model (PDM), as described by the Infrared Space Observatory (ISO) and should be used to aid further understanding of the detailed descriptions hereinafter.

A PDM represents the structure of the data as it will be implemented in the database. The ISO Data Archive PDM was originally generated from the ISO Data Archive Conceptual Data Model (CDM) taken into account the features and physical restrictions of the Data Base Management System (DBMS) which is used to implement the ISO Data Archive PDM.

19.3.2 Generating the Data Archive PDM

The ISO Data Archive PDM is generated from the ISO Data Archive CDM by translating conceptual objects into physical objects, as shown below:

<table>
<thead>
<tr>
<th>Object in a CDM</th>
<th>Generated object in a PDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attribute</td>
<td>Column</td>
</tr>
<tr>
<td>Entity</td>
<td>Table</td>
</tr>
<tr>
<td>Identifier</td>
<td>Primary or foreign key</td>
</tr>
<tr>
<td>Relationship</td>
<td>Reference</td>
</tr>
<tr>
<td></td>
<td>Primary of foreign key</td>
</tr>
<tr>
<td></td>
<td>Identifier of dependent</td>
</tr>
<tr>
<td></td>
<td>Table</td>
</tr>
<tr>
<td></td>
<td>Attribute</td>
</tr>
</tbody>
</table>

Generated object in a CDM

Conceptual objects in the ISO Data Archive Conceptual Data Model (CDM) were translated and physical restrictions of the Database Management System (DBMS) were taken into account.

The ISO Data Archive PDM was generated from the ISO Data Archive Conceptual Data Model (CDM) as shown below:

19.3.2 Generating the Data Archive PDM

Management System (DBMS) which is used to implement the ISO Data Archive PDM.

A PDM represents the structure of the data as it will be implemented in the database. The ISO Data Archive PDM was originally generated from the ISO Data Archive Conceptual Data Model (CDM) taken into account the features and physical restrictions of the database.

Understanding of the detailed descriptions hereinafter:

This section describes the generation of the Data Archive Physical Data Model (PDM), as shown below:

19.3.1 Overview

19.3 Physical Data Model
19.3.3 ISO Data Archive Physical Data Model – Example:
Substantial information required to be included in the project charter will be extracted directly from the business case upon which approval of the project was based. The project charter brings this information together with other information critical to the project's ability to achieve the benefits represented in the business case.

The statement of objectives specifies the outcomes sought to meet the business need described in Section 3. Ensure that the project's objectives are consistent with the objectives of the University as a whole. It is essential to define the objectives clearly, as their realization will determine the outcome of the evaluation of success in the post-implementation review. Objectives should follow the "SMART" approach:

- Specific
- Measurable
- Achievable
- Realistic
- Time-driven

The statement of objectives for the University project should be:

4. PROJECT OBJECTIVES

Explicit definition of the business need being addressed, expressed in terms of the functional area objectives that need to be met.

3. STATEMENT OF THE BUSINESS REQUIREMENT

The high-level summary of the project should be included in the business case description of the strategy that will be used to liaise with those stakeholders to ensure that their "buy-in" to the project is secure.

2. KEY STAKEHOLDERS

Name and position of stakeholders in the project:

EXECUTIVE SUMMARY

III. ENDORSEMENTS AND APPROVALS

II. DISTRIBUTION LIST

I. DOCUMENT CONTROL DETAILS

Section Contents

The project is a detailed document for reference in the post-implementation review to evaluate the success of the project. It is therefore important that it is clearly defined and consistent with the objectives of the University as a whole. The benefits represented in the business case are brought together with other information critical to the project's ability to achieve the desired outcomes. Information required to be included in the project charter will be extracted directly from the business case upon which approval of the project was based. The project charter should be consistent with the objectives of the University as a whole, and it should be clear that the objectives are defined clearly, as their realization will determine the outcome of the evaluation of success in the post-implementation review.
5. PROJECT SCOPE

The scope of the project specifies the activities and defines the boundaries of the work to be done. It identifies the deliverables required to meet the project objectives. This guides the further design of the system and the use of resources in its implementation and operation.

The project scope needs to be very specific in describing what will be produced, how long it will take to deliver the specific outcomes, and how much will be delivered. This includes the total cost and schedule costs. The project scope needs to be very specific in describing what will be delivered. This includes the total cost and schedule costs.

Time, cost, and deliverables are key project deliverables. Any omission will adversely impact the project, and the project will fail. If the project scope cannot deliver the cost, then it is not achievable with current resources. If any project sponsor does not agree on any one of these, then the project cannot be implemented. If the project cannot be delivered, then it is not achievable with current resources. If any project sponsor does not agree on any one of these, then the project cannot be implemented. If the project cannot be delivered, then it is not achievable with current resources.

A detailed project plan will not be developed until the project manager begins work in earnest. This section of the project charter must include a high-level summary of the subsequent detailed plan. A detailed project plan will not be developed until the project manager begins work in earnest. This section of the project charter must include a high-level summary of the subsequent detailed plan.

6. KEY DELIVERABLES

- Defining the project's scope
- Defining the project's objectives and key performance indicators
- Defining the project's deliverables
- Defining the project's milestones and dependencies

Time to deliver these objectives. This can be achieved by any one of:

- Changing the project scope
- Changing the project's objectives and key performance indicators
- Changing the project's deliverables
- Changing the project's milestones and dependencies

If the project sponsor does not agree on any one of these, then the project cannot be implemented. If the project cannot be delivered, then it is not achievable with current resources. If any project sponsor does not agree on any one of these, then the project cannot be implemented. If the project cannot be delivered, then it is not achievable with current resources. If any project sponsor does not agree on any one of these, then the project cannot be implemented. If the project cannot be delivered, then it is not achievable with current resources.
INFORMATION AND PERFORMANCE REQUIREMENTS

This section details the proposed system's requirements, in terms of functionality, accuracy, timeliness, frequency, criticality, etc., that support the project's scope and objectives. Management information requirements, including security needs, are stated separately from operational information needs. When requirements have been defined fully in the mapping and analysis of the business processes, identify those which are most appropriately handled by a computer application and those that are more effectively and efficiently kept as, or created as, manual systems. Based on analysis of the information gathered, the use to which the information is put needs to be determined, including an analysis of the data, the systems objectives for the end-user, the use to which the data will be used to give the required information to the end-user. The objective is to define what the system, whether computer based or manual, is required to do to support the business (i.e. specify its functionality).

Detailed requirements:

1. Essential to ensure all functionalities are provided, which will assist in the business processes. The business processes must be described accurately, so that the systems objectives can be achieved.

2. When requirements have been defined, the information system architecture needs to be determined, including the mapping of the data and its use.

3. Identify all interfaces to the new system, the current system to see whether any of its components warrant retention or replacement. If the requirement is for a totally new computer application, then analyse the business processes and business rules that are used to achieve the objectives. Gather relevant information about the business processes, including the data and activities that are needed.

4. The objective is to define what the system, whether computer based or manual, is required to do to support the business (i.e. specify its functionality).
The critical path is the longest path through the project from start to end. If tasks that are on the critical path are delayed and fail to meet their scheduled delivery date, the end of the project will similarly be delayed.

Dupont and Remington Rand devised the Critical Path Analysis technique in the 1950’s, to standardise the presentation of large projects. It is sometimes also called “critical path method” (CPM), or just “arrow network”.

Critical Path Analysis (CPA) is a mathematical model that calculates the earliest possible start and finish dates for each task, and identifies the critical path, which is the longest sequence of tasks that must be completed on time for the project to be completed on time.

Once the CPA calculation is finished, the contingency margin in non-critical tasks can be determined. The contingency margin is the amount of time that a task can slip before it affects the end of the project.

Calculating the critical path:

The following example shows a project with two distinct paths, A-B-C-E-F and A-B-D-E-F:

Once a project is completed, the project manager needs to determine the critical path, which is the longest sequence of tasks that must be completed on time. This is done by identifying the tasks that have no slack time, which is the amount of time a task can be delayed without delaying the project. The tasks with zero slack time are on the critical path.

In the example project, tasks A, B, and E have zero slack time and are therefore on the critical path. If any of these tasks are delayed, the entire project will be delayed.
The second calculation is the Backward Pass, which determines, firstly, the Late Start (LS), then the Late Finish (LF) for each task. The critical path can be determined. The critical margin is shown above in the shaded circles (A-B-D-E-F). The critical tasks are those where the early and late dates are the same. The contingency margin available is calculated as:

\[
\text{Contingency Margin} = \text{Late Finish} - \text{Early Finish}
\]

Upon completion of the forward and backward passes, the critical path, and the contingency margin/s, can be determined. The critical path is shown above in the shaded circles (A-B-D-E-F). The critical tasks are those where the early and late dates are the same. The contingency margin available is calculated as:

\[
\text{Contingency Margin} = \text{Late Finish} - \text{Early Finish}
\]
The PERT chart graphically displays tasks as boxes, with lines joining them to show dependencies. The methodology represents project timelines graphically according to the following disciplines:

- **Finish to Start**
- **Start to Start**
- **Finish to Finish**
- **Start to Finish**

A traditional PERT chart will also show task relationships accurately by the way the line joins each node/box.

The PERT scheduling method was developed by Lockheed in 1958, for the Special Projects Office of the United States Navy.

The PERT method calculates the estimated duration for a task. The main difference is in how the PERT chart is sometimes confused with a Critical Path Analysis (CPA).
A PERT chart will appear as follows (in this instance specifically in Microsoft Project):
Henry Gantt developed a bar chart, now called a Gantt Chart, during the First World War. The Gantt Chart is effective because it is simple. An example of a Gantt Chart is:

The chart is effective because it is simple. This advantage will be lost if project managers try to put too much detail. An example of a Gantt Chart is:

The Gantt Chart is used to display tasks and durations as bars plotted against a timescale. The Gantt Chart is effective because it is simple. An example of a Gantt Chart is:
The WBS is based on the deliverables that the work needs to produce. Since it includes only the tasks that are directed toward the output of deliverables, the overall project work plan should be comprised of tasks. The overall project work plan produces, and should take no more than 40 work hours of effort to produce, a part of a work product such as a knowledge base object. A task can specifically be assigned to one individual, or to a team leader, and should take no more than 40 work hours of effort to complete a part of a work product, such as a knowledge base object. A task can specifically be assigned to one individual, or to a team leader, and should take no more than 40 work hours of effort to complete a part of a work product, such as a knowledge base object.

24.1 Phase

The highest level of the work breakdown structure (WBS) is a phase. A phase generally produces a draft deliverable, or a part of a deliverable. Phases provide the project manager with formal checkpoints for performing his/her own project quality assurance (QA) reviews. The lowest level of the work breakdown structure (WBS) is a task. A task generally produces a part of a work product, such as a knowledge base object. Tasks can typically be assigned to one individual, or to a team leader, and should take no more than 40 work hours of effort to complete a part of a work product, such as a knowledge base object. A task can specifically be assigned to one individual, or to a team leader, and should take no more than 40 work hours of effort to complete a part of a work product, such as a knowledge base object.

24.2 Stage

Stages are a set of related work that is managed as a single logical unit of work. A stage is the largest logical unit of work within a phase. A stage generally provides a draft deliverable, or a part of a deliverable. Stages provide the project manager with formal checkpoints for performing his/her own project quality assurance (QA) reviews. Stages are the best points to designate as project milestones for peer/third party quality assurance (QA) reviews.

24.3 Activity

Activities provide the project manager with formal checkpoints for performing his/her own project quality assurance (QA) reviews. Activities provide the project manager with formal checkpoints for performing his/her own project quality assurance (QA) reviews. Activities provide the project manager with formal checkpoints for performing his/her own project quality assurance (QA) reviews. Activities provide the project manager with formal checkpoints for performing his/her own project quality assurance (QA) reviews. Activities provide the project manager with formal checkpoints for performing his/her own project quality assurance (QA) reviews.
TABLE OF CONTENTS

Section 1 – Executive Summary
To be completed last

Section 2 – Statement of the business issue
What is the business issue that has resulted in the need to initiate a project?

Section 3 – Background and Business Drivers
What is the business issue that has resulted in the need to initiate a project?

Section 4 – Project Scope and Objectives

Section 5 – Evaluation of Alternative Solutions

5.1 Option 1 – Do nothing

5.2 Option 2

5.3 Option 3

5.4 Option 4

Using the information gathered in the previous sections, it should be possible to develop a number of alternative solutions.

The solution, including incremental improvement projects. Alternatives should include selected sub-sets of levels of effectiveness and cost. Describe the do-nothing scenario, and other alternatives that would meet the business need, to varying degrees of effectiveness.

This section addresses alternative solutions that would meet the business need, to varying degrees of effectiveness.

Section 2 – Statement of the business issue

What has led to the identification of the current business issue? What are the adverse consequences of continuing with the present processes?

Section 3 – Background and Business Drivers

What is the business issue that has resulted in the need to initiate a project?

Section 1 – Executive Summary

TABLE OF CONTENTS
Specific evaluation criteria should be developed to cover functional, technical and economic aspects of each alternative solution, in relation to the specific objectives of the project, as they relate to meeting the business need.

**Recommendation**

After applying the evaluation criteria to each alternative, a recommendation should be made to select the best functional, technical, economic and timely solution. The recommendation should be substantiated by the evaluation criteria applied to each alternative.

**Evaluation Matrix**

List all 'once-off' costs associated with training, systems development (if applicable), initial system setup and project management.

**Implementation costs**

Recommended solution:

This section of the business case describes the costs associated with implementing the

Refer Appendices K, L and M.

**Cost/Benefit analysis (CBA) and budgeted cash flow analysis**

**Section 7 – Economic Justification**

This section should refer to the performance requirements previously described at Section 6.

**Performance Objectives**

- Identification of any existing policies that may be impacted or changes that may affect organisational structures and/or functional areas responsibilities.

**Organisational Impact**

Identification of any interfaces, whether manual or automated, with any other existing or proposed systems.

**System Interfaces**

Including dependencies.

A description of any specific technical infrastructure or software needs, as applicable.

**Technology Requirements**

With any current system that it seeks to replace, supplemented by high-level flow charts. If applicable, the proposed system should be compared with the existing alternative system.

**Section 6 – Proposed System Description**

After applying the evaluation criteria to each alternative, a recommendation should be made to select the best functional, technical, economic and timely solution. They relate to meeting the business need.

**Specific objectives**

Of each alternative solution, in relation to the specific objectives of the project, as they relate to meeting the business need.
change management, capital equipment (both new, and “sunk cost” of any capital equipment displaced if not fully depreciated), premises, consultancy or contract support, etc.

Recurring costs
Describe and quantify any and all costs that will recur year after year to maintain the recommended solution over the projected life of the new system.

Benefits
This section describes the quantitative benefits associated with the recommended solution. It is important that the benefits link back to the situational assessment and the key business drivers that led to the project being initiated.

Operational savings
This section describes all cost savings, or costs avoided, associated with the recommended solution. It is important that the benefits link back to the situational assessment and the key business drivers that led to the project being initiated.

Benefits
This section describes the quantitative benefits associated with the recommended solution over the projected life of the new system. Benefits and quantify any and all costs that will recur year after year to maintain the system.

Section 9 – Structure
This section provides information about any assumptions or constraints that are critical to the project and its implementation. It also provides the framework for more detailed specifications in the project plan and also some information on resource requirements for those to be involved in the project.

Section 8 – Implementation timeline
This section describes the high level project timeline with key milestones and project checkpoints. The project timeline should reflect key steps in the approach and include major decision making milestones.

Section 10 – Critical Assumptions and Risk Assessment
This section provides information about any pending or proposed projects, or any changes to pending or proposed projects, that are critical to the recommended solution. It also provides the framework for more detailed specifications in the project plan and also some information on resource requirements for those to be involved in the project.

Functional Risk
The impact of, or on, any pending or proposed projects, or any changes to pending or proposed projects, that are critical to the recommended solution.

Operational risks
Any risks that can be foreseen as possible with the project’s progress and implementation.

Section 10 – Critical Assumptions and Risk Assessment
This section provides information about any assumptions or constraints that are critical to the project and its implementation. It also provides the framework for more detailed specifications in the project plan and also some information on resource requirements for those to be involved in the project.

Section 8 – Implementation timeline
This section describes the high level project timeline with key milestones and project checkpoints. The project timeline should reflect key steps in the approach and include major decision making milestones.

Section 9 – Structure
This section provides information about any assumptions or constraints that are critical to the project and its implementation. It also provides the framework for more detailed specifications in the project plan and also some information on resource requirements for those to be involved in the project.

Critical Assumptions and Risk Assessment
This section provides information about any assumptions or constraints that are critical to the project and its implementation. It also provides the framework for more detailed specifications in the project plan and also some information on resource requirements for those to be involved in the project.
Section 11 - Conclusions and Recommendations

State the conclusions the reader should draw from the business case, and recommendations.

Section 12 - References & Related Documents

Execute summary and closing.

For the next steps, list key themes from each major section of the case as part of the conclusion of the reader should draw from the business case, and recommendations.
**ACTIVITIES DURING THIS PERIOD**

**PROPOSED WORK FOR NEXT MONTH**

**Matters Requiring Action**

**Progress against Project milestones**

**Progress against Budget** – Month to nn/nn 200x

<table>
<thead>
<tr>
<th>Project completion date</th>
<th>Revised completion date</th>
<th>Actual completion date</th>
<th>Task</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Contract Resource</th>
<th># DAYS</th>
<th>Daily Rate</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Progress against Budget – Month to nn/nn 200x</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>Action required by (person)</th>
<th>Action required by (date)</th>
<th>Status at date</th>
<th>Action required by (person)</th>
<th>Action required by (date)</th>
<th>Status at date</th>
<th>Action required by (person)</th>
<th>Action required by (date)</th>
<th>Status at date</th>
</tr>
</thead>
</table>

**Distribution (position titles)**
### ISSUE LOG

<table>
<thead>
<tr>
<th>Participant</th>
<th>Priority</th>
<th>Issue</th>
<th>Status / Actions</th>
<th>By Whom</th>
<th>By When</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Priority categories:

- **RED**
  - Roadblock, potential to stop/severely hinder progress

- **AMBER**
  - Significant/potential problems – needs addressing now

- **GREEN**
  - Not critical yet – raised for awareness, to ensure covered

### RESOURCE CONSTRAINTS

<table>
<thead>
<tr>
<th>Resource</th>
<th>Absence</th>
<th>Reason for absence</th>
<th>Project Impact</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX I - Issue Log format

<table>
<thead>
<tr>
<th>Issue No</th>
<th>Sub-project element</th>
<th>Summary description of issue</th>
<th>Priority</th>
<th>Assigned To</th>
<th>Status</th>
<th>Scheduled completion date</th>
<th>Actual completion date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7 Mandatory, Essential, Desirable or Nice to Have (N2H)
8 Member of project team
9 Open, Active, Deferred, Closed
### Risk Management Schedule

<table>
<thead>
<tr>
<th>Risk</th>
<th>Impact</th>
<th>L</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delays in delivery of project deliverables due to support needed for remedial and resolution consultancies</td>
<td>C1</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Performance of the project or their experience or proposed candidates on the basis of the historical pitfalls</td>
<td>C2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Insufficient resources assigned to make timely implementation possible</td>
<td>C1</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Conflicting priorities for project team resources</td>
<td>C2</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**Mitigation Strategy**

- Develop detailed project plan as necessary.
- Ensure that a strategy is in place to support remedial and resolution consultancies.
- Develop a detailed project plan as necessary.
- Perform quality assurance reviews at all milestones.
- Document specific success criteria and have them signed off, particularly by the project sponsor.
- Ensure that no change is made to the project plan without the consent of the project sponsor.
- Maintain the change log scrupulously.

**Backfilling of Key Business Users**

- Develop a detailed project plan as necessary.
- Ensure that a strategy is in place to support remedial and resolution consultancies.
- Develop a detailed project plan as necessary.
- Ensure that no change is made to the project plan without the consent of the project sponsor.
- Maintain the change log scrupulously.

---

**Notes**

- L = Likelihood
- C = Consequence
- The project will be delayed if the project sponsor, key stakeholders, and the project management structure are not clearly defined and agreed.
- Vendor consultants do not have the necessary experience to add value to the project.
- Will impact the implementation date and potentially could have serious ramifications if inappropriate configuration settings are defined.

---

**Functional Specifications**

- Not clearly stated.
- Quality assurance implemented upon completion of the project.
- Document specific success criteria and have them signed off, particularly by the project sponsor.
- Ensure that no change is made to the project plan without the consent of the project sponsor.
- Maintain the change log scrupulously.

---

**Quality Assurance Reviews**

- Quality assurance reviews will monitor.
- Document specific success criteria and have them signed off, particularly by the project sponsor.
- Ensure that no change is made to the project plan without the consent of the project sponsor.
- Maintain the change log scrupulously.
<table>
<thead>
<tr>
<th>Risk</th>
<th>Impact</th>
<th>Mitigation Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A third party package implemented without the support of business groups.</td>
<td>Tens of millions in any structured documentation not available to support the project team.</td>
<td>Ensure that a defined nomenclature is used to categorise documents. Establish a reference group as one element of a communication strategy that will enable the affected functional units to be informed of the progress of the project.</td>
</tr>
<tr>
<td>Lacks of facilities to support the project team.</td>
<td>The critical path through the project is delayed.</td>
<td>Ensure that accommodation and support services, including telephones and desktop computers, are available for the project team.</td>
</tr>
<tr>
<td>Documentation not managed in any structured fashion.</td>
<td>Decision making process is not clear.</td>
<td>Set up a documentation structure that provides for simple shared access. Ensure that all critical decisions are resolved in a timely manner and recorded in a manner that is accessible to all project team members.</td>
</tr>
<tr>
<td>Technology infrastructure is not available to support a particular phase of the project.</td>
<td>Project is delayed at the start.</td>
<td>Ensure that all required elements of the infrastructure environment are acquired/established early in the project and that the production environment is available for acceptance testing of the design.</td>
</tr>
<tr>
<td>Key business stakeholders not identified.</td>
<td>The project will have negligible support from the end-users, causing difficulties in operational deployment due to lack of involvement of the primary user.</td>
<td>Identify the project team that will have responsibility for each business process. Ensure that all business stakeholders are identified and engaged, including the end-users.</td>
</tr>
<tr>
<td>Many part-time employees assigned to the project team.</td>
<td>Tasks can not be completed in time due to conflicting priorities.</td>
<td>Try to avoid any and all part-time assignments to the project team.</td>
</tr>
<tr>
<td>Information easily managed in any structured documentation not available for the project team.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Impact</td>
<td>Migration Strategy</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Substantial new reporting is identified to support current business processing.</td>
<td>Project is unable to deliver the required reporting by the implementation date and the cost of report development has an adverse effect on the project budget.</td>
<td></td>
</tr>
<tr>
<td>Business processes are not explored.</td>
<td>Ensure that key business tasks and the project process are completed to the project through the following.</td>
<td></td>
</tr>
<tr>
<td>Business environment is substandard.</td>
<td>Get stakeholders commitment to the BPR processes. Implement, if possible, parts of the revised business process before the implementation of the package.</td>
<td></td>
</tr>
<tr>
<td>Lack of available skilled business resources in the project.</td>
<td>The quality of the design is over complex.</td>
<td></td>
</tr>
<tr>
<td>New business environment, design new business processes in the new package environment.</td>
<td>Design is overly complex.</td>
<td></td>
</tr>
<tr>
<td>The quality of the design suffers. Existing business processes are not well understood and the capacity to implement changed practices not explored.</td>
<td>Design is overly complex.</td>
<td></td>
</tr>
<tr>
<td>Issues are hard to uncover and end-to-end testing is complex putting pressure on achieving the implementation date.</td>
<td>Evaluation of the package to ensure that the user acceptance team can understand the user acceptance process to the points of possible user resistance to the change.</td>
<td></td>
</tr>
<tr>
<td>Business environment is to be impacted with the package adopted without reference to the business environment.</td>
<td>Implement, if possible, parts of the revised business process before the implementation of the package.</td>
<td></td>
</tr>
<tr>
<td>Substantial business process re-engineering is adopted without reference to the impact within the business environment.</td>
<td>Ensure that the business is committed to the project through the charter process and that the project is a key priority of the key business resource.</td>
<td></td>
</tr>
<tr>
<td>When the application goes into production there is significant user resistance to the package.</td>
<td>Get stakeholders commitment to the BPR processes. Implement, if possible, parts of the revised business process prior to the implementation of the package.</td>
<td></td>
</tr>
<tr>
<td>The quality of the design is not explored.</td>
<td>Ensure that key business users (and champions of the application within the business) are part of the user acceptance team.</td>
<td></td>
</tr>
<tr>
<td>Executive management is supporting the project to give the business processes in the new package to be implemented.</td>
<td>Work with the business teams to develop a business process that gives the business processes in the new package to be implemented.</td>
<td></td>
</tr>
<tr>
<td>Executive management is supporting the project to give the business processes in the new package to be implemented.</td>
<td>Work with the business teams to develop a business process that gives the business processes in the new package to be implemented.</td>
<td></td>
</tr>
<tr>
<td>Executive management is supporting the project to give the business processes in the new package to be implemented.</td>
<td>Work with the business teams to develop a business process that gives the business processes in the new package to be implemented.</td>
<td></td>
</tr>
<tr>
<td>Executive management is supporting the project to give the business processes in the new package to be implemented.</td>
<td>Work with the business teams to develop a business process that gives the business processes in the new package to be implemented.</td>
<td></td>
</tr>
<tr>
<td>Executive management is supporting the project to give the business processes in the new package to be implemented.</td>
<td>Work with the business teams to develop a business process that gives the business processes in the new package to be implemented.</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Impact</td>
<td>Mitigation strategy</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Design does not reflect business requirements</td>
<td>May impact the ability to achieve the project's objectives and may lead to delays</td>
<td>Consider a phased approach. Key issues need to be addressed early.</td>
</tr>
<tr>
<td>Implementation date not met</td>
<td>May impact the ability to make timely decisions and decisions may need to be made later</td>
<td>Ensure that the application design process produces a design that is transferable to deployable in line.</td>
</tr>
<tr>
<td>Project team spends excessive time on non-critical business processes</td>
<td>Some key business processes may not be supported at implementation time, causing problems</td>
<td>Prioritize the functionality to be provided in the application. Identify those 'must have' items and ensure the project plan delivers those for the implementation date.</td>
</tr>
<tr>
<td>Pre-printed stationery not available in time for “go-live”</td>
<td>Unable to produce anything requiring pre-printed stationery</td>
<td>Agree on all output formats in the design process; wherever possible, include stationery formats in actual documents produced by the system.</td>
</tr>
<tr>
<td>Design does not pay sufficient attention to the complete business process</td>
<td>Although the business process works in theory, it breaks down when tested in the field.</td>
<td>Ensure that a walkthrough of the end-to-end business process is undertaken with the specialist staff. Map data capture from input to output as part of the functional design.</td>
</tr>
<tr>
<td>Size of the task is underestimated</td>
<td>Potential to delay the implementation date if key data cannot be transferred in time.</td>
<td>Identify all data sources required to support the new environment. In the case of multiple data sources estimate the degree of data cleaning and consolidation required. Ensure that data migration tasks are started as soon as possible in the project.</td>
</tr>
<tr>
<td>Quality of the data is poor</td>
<td>More data cleaning and decision making is required to ensure project timelines are met</td>
<td>Identify data quality issues as soon as possible after the commencement of the project and raise these through the Faculty reference group.</td>
</tr>
<tr>
<td>Volume of data</td>
<td>May impact the ability to achieve the project's objectives and may lead to delays</td>
<td>Identify data sources required to support the new environment. In the case of multiple data sources estimate the degree of data cleaning and consolidation required. Ensure that data migration tasks are started as soon as possible in the project.</td>
</tr>
<tr>
<td>Business process design changes the dynamics of data capture and processing</td>
<td>Some business areas will not feel that they have adequate resources to support the change in business practice</td>
<td>Identify issues of concern and raise these through the Faculty reference group.</td>
</tr>
<tr>
<td>Pre-printed stationery not available in time for “go-live”</td>
<td>Unable to produce anything requiring pre-printed stationery</td>
<td>Agree on all output formats in the design process; wherever possible, include stationery formats in actual documents produced by the system.</td>
</tr>
<tr>
<td>Design does not pay sufficient attention to the complete business process</td>
<td>Although the business process works in theory, it breaks down when tested in the field.</td>
<td>Ensure that a walkthrough of the end-to-end business process is undertaken with the specialist staff. Map data capture from input to output as part of the functional design.</td>
</tr>
<tr>
<td>Risk</td>
<td>Impact</td>
<td>Mitigation Strategy</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Dependability of the development environment is poor</td>
<td>Significant impact on the project. Consequence could have a negative effect on the project. The team must ensure that the project is kept on track.</td>
<td>Set up the development environment as soon as possible. If delays occur due to the environment, the project should be dealt with as soon as possible.</td>
</tr>
<tr>
<td>Potential data entry errors will not be detected in the acceptance phase.</td>
<td>Delays the project. Frustrates the project team.</td>
<td>Set up the development environment as soon as possible. Ensure there is adequate support for the development environment.</td>
</tr>
<tr>
<td>Poor management control of the various application environments</td>
<td>Loss of progress due to having to recover previous environments.</td>
<td>Develop and maintain an issue log.</td>
</tr>
<tr>
<td>Vendor experiences package problems</td>
<td>If the problems are severe, it may impact the implementation date.</td>
<td>Develop and maintain an issue log.</td>
</tr>
<tr>
<td>Not all interfaces are identified</td>
<td>Functionality will be impaired and systems to which interfaces are required (in or out) will cease to provide correct results.</td>
<td>Develop and maintain an interface map to depict all interfaces that are required. Develop a set of acceptance criteria that cover the interface map.</td>
</tr>
<tr>
<td>Testing of interfaces can be difficult and time consuming</td>
<td>Potential data entry errors will not be detected in the acceptance phase.</td>
<td>Set up the development environment as soon as possible. Ensure there is adequate support for the development environment.</td>
</tr>
</tbody>
</table>

Legend:
- L10: Critical
- C11: Important
- D: Difficult and time consuming
<table>
<thead>
<tr>
<th>Risk</th>
<th>Impact</th>
<th>Mitigation Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient training provided to project team and/or users</td>
<td>Users unable to use the system as expected.</td>
<td></td>
</tr>
<tr>
<td>― Insufficient training provided to project team and/or users</td>
<td>Users unable to use the system as expected.</td>
<td>Develop an appropriate training strategy that covers the project team and their requirements to be trained in the package functionality. User training needs to consider a 'train the trainer' approach or direct training of the end user in key business functions. As part of the marketing and training activities, identify process champions within the business areas.</td>
</tr>
<tr>
<td>Application is implemented but key business problems have not been identified.</td>
<td>Application implementation is not complete.</td>
<td>Ensure that acceptance testing is included in the project plan. The testing strategy must contain the tests to be conducted with the expected results. Acceptance testing must be performed in an environment that mirrors the expected production environment. The user acceptance environment should be able to become the production environment once the final data migration is undertaken.</td>
</tr>
<tr>
<td>Application performs most functions correctly, but accuracy of data has not been sufficiently verified.</td>
<td>Application is not performing its intended role adequately.</td>
<td>Although application testing is performed in the expected environment, compare the results to the expected environment. Ensure the test environment is realistic to the end-user environment. Establish a realistic moment of failure. Identify the process champions within the business areas. The business areas need to understand the needs of the end user in key business functions. Approaches to direct training of the user that cover their needs and their requirements to be trained in the package functionality. Develop an appropriate training strategy.</td>
</tr>
<tr>
<td>Acceptance testing is performed with user profiles that have global privileges.</td>
<td>Problems can arise at package implementation.</td>
<td>Acceptance testing must be conducted in an environment that mirrors the expected production environment. The user acceptance environment should be able to become the production environment once the final data migration is undertaken.</td>
</tr>
<tr>
<td>Transaction response times do not meet objectives.</td>
<td>Projects are not meeting objectives.</td>
<td>Monitor the situation, particularly through the user acceptance phase. Identify the need for infrastructure upgrades. Ensure that the expected results are obtained in the expected time.</td>
</tr>
<tr>
<td>Organisation does not handle the change process well.</td>
<td>Perceptions within the user base that they have received little benefit from the introduction of the application.</td>
<td>Ensure that appropriate training is provided throughout the implementation phase of the product. Provide regular updates. Ensure communication is ongoing throughout the project.</td>
</tr>
<tr>
<td>Risk</td>
<td>Impact</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Limited skills transfer has occurred to end-user staff</td>
<td>Error-prone team, both core and extended project team worked extensively over time.</td>
<td></td>
</tr>
<tr>
<td>Providing a consistent service is difficult and requires the ongoing support of external staff or project team members.</td>
<td>Deficient and inflexible leadership will result in the quality of work will deteriorate.</td>
<td></td>
</tr>
<tr>
<td>The production environment is not stable</td>
<td>Capacity is exceeded soon</td>
<td></td>
</tr>
<tr>
<td>Users lose confidence in the new application</td>
<td>Project schedule is underestimated</td>
<td></td>
</tr>
<tr>
<td>Number of functional requirements exceeded</td>
<td>Project budget is underestimated</td>
<td></td>
</tr>
<tr>
<td>Close monitoring the usage of volumes</td>
<td>Problems will arise</td>
<td></td>
</tr>
<tr>
<td>Configuration to support expected volumes</td>
<td>Excessive overtime worked</td>
<td></td>
</tr>
<tr>
<td>Environmental issues will support a high availability and sovereignty</td>
<td>Lack of teamwork within the project team</td>
<td></td>
</tr>
<tr>
<td>Inappropriate environmental features</td>
<td>&quot;C&quot;</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>Impact</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Failure to reach agreement between the project manager and the project sponsor.</td>
<td>The project deliverables will never meet the mercurial expectations of the project sponsor. The project deliverables will change dramatically and the project team will lose focus. Do not allow personal issues to cloud the project's objectives. Ensure that the process owner is kept informed.</td>
<td></td>
</tr>
</tbody>
</table>

**Mitigation strategy**

- Do not allow personal issues to cloud the project's objectives.
- Ensure that the process owner is kept informed.
<table>
<thead>
<tr>
<th>Principal Stakeholder</th>
<th>Name</th>
<th>Role</th>
<th>Position @ ACU</th>
<th>Contact</th>
<th>Details</th>
</tr>
</thead>
</table>

**Project Details**

**Communications Plan**

**Document Version Control**

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Details</th>
</tr>
</thead>
</table>

**Prepared by:**
**Project Owner:**
**Date:**
**Project Name:**
| 1. Communications Plan Executive Summary | 1 |
| 2. Marketing and Communication Strategies | 2 |
| 3. Stakeholder Communications Strategies | 2 |
| 4. Training Strategies | 2 |

**TABLE OF CONTENTS**
1. Communications Plan Executive Summary

2. Marketing and Communication Strategies
   a. Communicating Major Risks, Issues and Changes
3. Stakeholder Communication

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Method</th>
<th>Message</th>
<th>Timing</th>
<th>Frequency</th>
<th>Communicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Training Strategies

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Training Required</th>
<th>Format</th>
<th>Timing</th>
<th>Frequency</th>
<th>Trainer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholder1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stakeholder3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The internal rate of return (IRR) is the discount rate that results in a net present value of zero for a series of future cash flows. Avoid a project if the IRR is less than the cost of capital or minimum desired rate of return.

The IRR provides a simple hurdle rate for investment decision-making. But IRR is not as easy to compute as NPV, especially when there are many cash flows. A company evaluating this investment using cash flows discounted at 10% would compute an NPV of $137,000. A company evaluating this investment using cash flows discounted at 15% would compute an NPV of $1,770.

A company evaluating this investment using cash flows discounted at 20% would compute an NPV of $50,000.

Consider the three scenarios shown below (see Table 3.1). Each involves an initial investment of $1 million. The investment returns $300,000 (undiscounted) per year in each of the five years after the initial investment. The IRR, on the other hand, computes a break-even rate of return. It shows the discount rate below which an investment results in a positive NPV (and should be made) and above which an investment results in a negative NPV (and should be avoided).

### Initial Investment

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow (Undiscounted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-1,000,000</td>
</tr>
<tr>
<td>1</td>
<td>300,000</td>
</tr>
<tr>
<td>2</td>
<td>300,000</td>
</tr>
<tr>
<td>3</td>
<td>300,000</td>
</tr>
<tr>
<td>4</td>
<td>300,000</td>
</tr>
<tr>
<td>5</td>
<td>300,000</td>
</tr>
</tbody>
</table>

### IRR Calculation

Initial Investment: $1,000,000
Cash Flow: $300,000 per year for 5 years

**Initial Investment (NPV):**

NPV = \( \sum \frac{CF_t}{(1 + r)^t} \)

where:
- \( CF_t \) = cash flow at time \( t \)
- \( r \) = discount rate
- \( t \) = time period

**Initial Investment (IRR):**

IRR is the discount rate that makes the NPV equal to zero.

**Initial Investment (IRR) Calculation:**

Initial Investment (NPV) = Initial Investment (IRR) - Initial Investment (NPV)

**Initial Investment (IRR) Result:**

Initial Investment (IRR) = \( \sum \frac{CF_t}{(1 + r)^t} \)

where:
- \( CF_t \) = cash flow at time \( t \)
- \( r \) = discount rate
- \( t \) = time period

**Initial Investment (IRR) Result:**

Initial Investment (IRR) = 10%
The Internal Rate of Return (IRR) is a crucial concept in investment analysis. It represents the discount rate at which the Net Present Value (NPV) of an investment's cash flows equals zero. In other words, it is the rate at which the investment is 'self-financing,' meaning the cash inflows exactly offset the cash outflows at that rate.

The IRR is a key component in determining the profitability of investments. A higher IRR indicates a more attractive investment, assuming all other factors are equal. However, it's important to note that IRR can sometimes yield multiple rates for a given set of cash flows, which can lead to interpretative complexities.

The IRR formula involves solving the equation for NPV = 0, where NPV is the Net Present Value of the cash flows at a given discount rate. The equation typically includes a series of cash inflows and outflows, each discounted back to its present value using the discount rate.

In the example provided, the IRR is calculated to be slightly more than 15%, indicating a positive NPV at this rate, suggesting the investment is profitable. Below is a table summarizing the cash flows and their NPVs at different discount rates:

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
<th>Factor</th>
<th>Amount</th>
<th>Factor</th>
<th>Amount</th>
<th>Factor</th>
<th>Amount</th>
<th>Factor</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-1 million</td>
<td>1.000</td>
<td>0</td>
<td>1.000</td>
<td>0</td>
<td>1.000</td>
<td>0</td>
<td>1.000</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>300,000</td>
<td>0.909</td>
<td>273,000</td>
<td>0.870</td>
<td>261,000</td>
<td>0.833</td>
<td>250,000</td>
<td>0.800</td>
<td>240,000</td>
</tr>
<tr>
<td>2</td>
<td>300,000</td>
<td>0.826</td>
<td>248,000</td>
<td>0.794</td>
<td>237,000</td>
<td>0.762</td>
<td>227,000</td>
<td>0.731</td>
<td>217,000</td>
</tr>
<tr>
<td>3</td>
<td>300,000</td>
<td>0.751</td>
<td>225,000</td>
<td>0.730</td>
<td>216,000</td>
<td>0.701</td>
<td>207,000</td>
<td>0.672</td>
<td>198,000</td>
</tr>
<tr>
<td>4</td>
<td>300,000</td>
<td>0.683</td>
<td>205,000</td>
<td>0.655</td>
<td>195,000</td>
<td>0.627</td>
<td>186,000</td>
<td>0.600</td>
<td>178,000</td>
</tr>
<tr>
<td>5</td>
<td>300,000</td>
<td>0.621</td>
<td>186,000</td>
<td>0.594</td>
<td>176,000</td>
<td>0.569</td>
<td>167,000</td>
<td>0.545</td>
<td>158,000</td>
</tr>
</tbody>
</table>

The total NPV at a discount rate of 15% is +$5,000, while at 10% it is +$137,000, and at 20% it is -$102,000. This indicates that the IRR of this investment is slightly more than 15%.

IRR is often used as a hurdle rate, a sort of go/no-go investment threshold. In this example, the NPV of the $1 million outlay depends on the discount rate, or cost of capital, used to evaluate the investment. The NPV of the $1 million return at a net undiscounted return of $500,000. The NPV of the $1 million investment is zero at the IRR, which is here a fraction of a percentage point above 15%.

Source: Computerworld
The net present value (NPV) of an investment is the present (discounted) value of future cash inflows minus the present value of the investment and any associated future cash outflows. It's the net result of a multiyear project, and is expressed in today's dollars. NPV = \[ (\text{Net Present Value}) = \text{Present Value of Inflows} - \text{Present Value of Outflows} \]

This formula is used to evaluate the profitability of a project by considering the time value of money. NPV is higher for projects where the present value of inflows is greater than the present value of outflows. NPV is generally preferred over other metrics like payback period because it takes into account the time value of money.

### Calculating NPV

1. **Discount Rate**: This is the minimum desired rate of return. It could be your company's average weighted cost of capital (debt and equity) as computed by your finance department. If capital costs your company 10%, you aren't likely to invest that capital for an 8% return.
2. **Discount Factor**: This is used to convert future cash flows to their present value. The discount factor can be calculated as \[ \text{Discount Factor} = \frac{1}{(1+i)^n} \]
where \(i\) is the target rate of return and \(n\) is the number of years.

### Example

Consider a project with initial outflows of $1 million and a minimum desired rate of return of 10%. The present value of the cash inflow is $1.1 million. The NPV can be calculated as:

\[ \text{NPV} = \text{Present Value of Inflows} - \text{Present Value of Outflows} = (1.1 \text{ million}) - (1 \text{ million}) = 0.1 \text{ million} \]

### Advantages of NPV

- **Considers Time Value of Money**: NPV takes into account the time value of money, which means that receiving $1 today is better than receiving $1 a year from now.
- **No Arbitrary Life Span**: Unlike the payback period, NPV doesn't require a specific time frame for analysis.
- **More Accurate**: NPV provides a more accurate measure of the profitability of an investment than other metrics.

### Disadvantages of NPV

- **Sensitivity to Discount Rate**: NPV is highly sensitive to the discount rate used.
- **Not Applicable for Projects with Non-Constant Flows**: NPV cannot be applied to projects with non-constant cash flows.
- **Difficulty in Valuing Intangible Assets**: It's challenging to value intangible assets like brand loyalty, customer relationships, etc.

Using NPV, investors can make informed decisions about whether to invest in a project or not.
NPV considers the time value of money. In this example, we compare two $1 million projects with a minimum desired rate of return of 10%. On the basis of simple cash flow, the ATM installation looks better because it generates $250,000 more over the life of the investment. But when the time value of money is considered, the server consolidation project looks slightly better, with an NPV higher by $9,000, because the returns occur earlier in the project's life. The server consolidation project looks better because it generates $250,000 more over the life of the investment.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
<th>Present Value of Cash Flow</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-$1 million</td>
<td>-$1 million</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>$500,000</td>
<td>-$413,000</td>
<td>-$10,914,000</td>
</tr>
<tr>
<td>2</td>
<td>$500,000</td>
<td>-$375,500</td>
<td>-$10,514,500</td>
</tr>
<tr>
<td>3</td>
<td>$500,000</td>
<td>-$341,500</td>
<td>-$10,361,500</td>
</tr>
<tr>
<td>4</td>
<td>$500,000</td>
<td>-$310,500</td>
<td>-$10,170,500</td>
</tr>
<tr>
<td>5</td>
<td>$500,000</td>
<td>-$282,900</td>
<td>-$10,052,900</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Discount Factor</th>
<th>Cash Flow</th>
<th>Present Value of Cash Flow</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.000</td>
<td>-$1 million</td>
<td>-$1 million</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.909</td>
<td>$500,000</td>
<td>-$454,500</td>
<td>-$10,914,000</td>
</tr>
<tr>
<td>2</td>
<td>0.826</td>
<td>$500,000</td>
<td>-$413,000</td>
<td>-$10,514,500</td>
</tr>
<tr>
<td>3</td>
<td>0.751</td>
<td>$500,000</td>
<td>-$375,500</td>
<td>-$10,361,500</td>
</tr>
<tr>
<td>4</td>
<td>0.683</td>
<td>$500,000</td>
<td>-$341,500</td>
<td>-$10,170,500</td>
</tr>
<tr>
<td>5</td>
<td>0.621</td>
<td>$500,000</td>
<td>-$310,500</td>
<td>-$10,052,900</td>
</tr>
</tbody>
</table>

NPV is calculated as follows:

\[
NPV = \sum_{t=0}^{n} \frac{C_t}{(1+r)^t} - Initial\ Investment
\]

For the ATM installation:

\[
NPV = \frac{-1,000,000}{(1.10)^0} + \frac{500,000}{(1.10)^1} + \frac{500,000}{(1.10)^2} + \frac{500,000}{(1.10)^3} + \frac{500,000}{(1.10)^4} = 0.909 + 0.826 + 0.751 + 0.683 + 0.621 = -10,914,000
\]

For the server consolidation:

\[
NPV = \frac{-1,000,000}{(1.10)^0} + \frac{500,000}{(1.10)^1} + \frac{500,000}{(1.10)^2} + \frac{500,000}{(1.10)^3} + \frac{500,000}{(1.10)^4} = 0.909 + 0.826 + 0.751 + 0.683 + 0.621 = -10,514,500
\]

ATM installation looks better because it generates $250,000 more over the life of the investment."
33 APPENDIX N  RETURN ON INVESTMENT (ROI)

The following elaboration of ROI, and example calculation, relates to a proposal for eLearning (electronic learning). However, the methods are identical for all proposals, whether technology is involved or not.

21.1 Introduction

Building a business case that is centred around a quantifiable, reliable, and compelling estimate of the Return on Investment (ROI), is an essential element of any value proposition. The key to building a business case that is centred around a quantifiable, reliable, and compelling estimate of the Return on Investment (ROI), is accurate cost and income impact estimates. This article provides guidelines for quantifying the hard (quantifiable) benefits and soft (qualitative) benefits that are important in developing a complete picture of the total return on investment.

In this example, the eLearning solution is expected to deliver a minimum ROI of 400% in the first twelve months versus traditional education and training approaches, when the full business impact is measured. Any ROI analysis should include the following four categories of potential benefits:

- Quantitative cost savings vs. alternative solutions
- Quantitative revenue/income impacts vs. alternative solutions
- Qualitative benefits vs. alternative solutions
- Qualitative cost savings vs. alternative solutions

This paper defines these benefit categories and provides a primer on the mathematics of the ROI calculation.

21.2 Quantitative ("hard") Cost Savings

Quantitative cost savings can always be expressed in financial value terms and can be easily estimated or measured. When calculating the total quantifiable cost savings, consider the following factors:

- Travel: Traditional instructor-led training (ILT) requires personnel to travel to one central location. The hard travel savings are easy to calculate. Take the sum of all travel, hotel, meals, and other travel-related expenses and multiply by the headcount number. In many cases, this alone yields a 400% ROI.
- Facilities (cost of renting premises to conduct training, etc.)
- Instructor fees
- Printing, distribution and storage costs
- Repeated training for new staff, refresher courses, content updates, etc.
- Reduction of customer support costs (the average cost per minute for support calls)
- Reduction of telephone handsets avoided, telephone call charges, PABX capacity needs, etc.
- Productivity gains from training, etc.

In this example, the eLearning solution is expected to deliver a minimum ROI of 400% in the first twelve months versus traditional education and training approaches, when the full business impact is measured. Any ROI analysis should include the following four categories of potential benefits:

- Quantitative cost savings vs. alternative solutions
- Quantitative revenue/income impacts vs. alternative solutions
- Qualitative benefits vs. alternative solutions
- Qualitative cost savings vs. alternative solutions

In this example, the eLearning solution is expected to deliver a minimum ROI of 400% in the first twelve months versus traditional education and training approaches, when the full business impact is measured. Any ROI analysis should include the following four categories of potential benefits:

- Quantitative cost savings vs. alternative solutions
- Quantitative revenue/income impacts vs. alternative solutions
- Qualitative benefits vs. alternative solutions
- Qualitative cost savings vs. alternative solutions

In this example, the eLearning solution is expected to deliver a minimum ROI of 400% in the first twelve months versus traditional education and training approaches, when the full business impact is measured.
21.3 Quantitative ("hard") Income/Revenue Impact

Quantitative revenue impact is the total revenue dollar value of the solution that can be estimated or measured. When rolling up hard revenue impact, consider the following factors:

- Increased productivity
  - More income-producing days per instructor or other customer-facing personnel, such as support staff.
- Shorter time to course deployment
  - Reduced time to course development
- Increased revenue opportunities
  - More revenue-producing days per instructor or other customer-facing personnel, such as support staff.
- Increased productivity
  - Web-based eLearning is a cost-effective medium for certifying knowledge on a large scale.
- Pedagogical benefits and certification, allowing more consistent and human interaction, which can vary from trainer to trainer and instance to instance. 

21.4 Qualitative ("soft") Benefits

Qualitative benefits are difficult and sometimes impossible to quantify and measure. Typically, they will be the weighing consideration in an otherwise marginal business case. Qualitative benefits should not be the primary reason for proceeding with a project proposal. Often, qualitative benefits are critical and can be as compelling as quantitative cost savings and revenue impact. The qualitative benefits are often layered on top of the business case to provide a more complete view of the total return. When developing qualitative benefits, consider the following values:

- Immediate
  - Since education is treated as an ongoing process and not an event, knowledge transfer is always only a web browser away.
- Consistency
  - Automated, technology-based approaches to large-scale knowledge transfer are inherently more consistent in their delivery than human interaction, which can vary from trainer to trainer and instance to instance.
- Certification
  - Web-based eLearning is a cost-effective medium for certifying knowledge on a large scale.
- Closed loop
  - Course improvement with each iteration

Following values:

- More revenue-producing courses to more students
- Decreasing the time taken to develop and deliver a course expands the duration of this revenue stream.
- More income-producing days per instructor or other customer-facing personnel, such as support staff.
Increased morale gained from simultaneous training: "We're no longer last on the up here in Malaysia."

Individual Values:
Individual values are benefits that are experienced at the individual learner level. They represent an additional category of soft benefits that should not be ignored in understanding the complete business impact of an eLearning solution. Individually experienced benefits that are experienced at the individual learner level.

21.5 Calculation of Return on Investment (ROI)

Three data points are required:

1. Return:
   - The return is the total of the cost savings and revenue enhancements known, or reasonably estimated, to be gained from the proposed solution.

2. The investment is the total of all costs directly attributable to the proposed solution and allocation of appropriate percentages of indirect costs.

3. The time period over which the ROI is to be calculated (typically one year).

There are three ways to calculate the ROI:

1. As a Percentage:
   ROI = [(Payback - Investment)/Investment] * 100%  
   - In this example:
     ROI = [($1,000,000-$250,000)/$250,000] * 100% = 300%

2. As a Ratio:
   - Divide the return by the investment.
   - $1,000,000/$250,000 = 4:1

3. As a Time to Break-even:
   - Determine the number of days, weeks, or months it will take to break even on the investment.
   - Time period to break-even = (Investment/Return) / Time Period

We're no longer last on the up here in Malaysia.
21.6 Conclusion

ROI analysis needs to be used in context of a broader evaluation framework because it is just one

- Enforcing an understanding of the top/bottom line business impact of the investment since it

- Justification:
  
  - Impact claims by taking a more methodical and quantifiable approach to business
  
  - Improving some discipline on the part of vendors and decision-makers to support business

- Setting investment screening thresholds (e.g., consider only projects that deliver an ROI of

- Formalizing investment prioritization by making hard number comparisons between

- Facilitating investment prioritization by making hard number comparisons between

- ROI is particularly effective at

- For intangible rewards:

  - Limitations of ROI metrics, for example, ROI does not factor in risk and does a poor job accounting

  - Key may want to complement your ROI financial measures with other methods that address the key

  - Of several financial measurement tools that can be used to support an investment decision. You

  - ROI analysis needs to be used in context of a broader evaluation framework because it is just one

  - Conclusion
### NEW BUSINESS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Review the Acme Project Plan Protocol.</td>
</tr>
<tr>
<td>2</td>
<td>Prepare for the next meeting.</td>
</tr>
<tr>
<td>3</td>
<td>Decide on changes to the project plan.</td>
</tr>
</tbody>
</table>

### OUTSTANDING ACTION ITEMS

#### Weekly Meeting Minutes - Format

<table>
<thead>
<tr>
<th>Meeting Date</th>
<th>Purpose of Meeting</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Review the Acme Project Plan Protocol.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prepare for the next meeting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decide on changes to the project plan.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Update Session Date</th>
<th>Issue</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/09/99</td>
<td>1</td>
<td>To develop a naming convention document.</td>
</tr>
<tr>
<td>02/10/99</td>
<td>2</td>
<td>To ensure that all action items are addressed.</td>
</tr>
<tr>
<td>07/10/99</td>
<td>3</td>
<td>To make sure that the minutes are accurate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scheduled Date</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>23/09/99</td>
<td>1</td>
<td>Review supplier issues regularly with relevant provider and present findings at next week’s meeting.</td>
</tr>
<tr>
<td>23/09/99</td>
<td>2</td>
<td>Follow up on screen format.</td>
</tr>
<tr>
<td>07/10/99</td>
<td>3</td>
<td>Build product releases and upgrades into schedule.</td>
</tr>
<tr>
<td>23/09/99</td>
<td>4</td>
<td>Follow up on screen format.</td>
</tr>
<tr>
<td>07/10/99</td>
<td>5</td>
<td>Ensure that installation and configuration process is documented fully, so that it becomes a repeatable and easily manageable procedure.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actual Date</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/10/99</td>
<td>1</td>
<td>To develop a naming convention document.</td>
</tr>
<tr>
<td>07/10/99</td>
<td>2</td>
<td>To ensure that all action items are addressed.</td>
</tr>
<tr>
<td>07/10/99</td>
<td>3</td>
<td>To make sure that the minutes are accurate.</td>
</tr>
</tbody>
</table>

### CLOSED ACTION ITEMS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Review supplier issues regularly with relevant provider and present findings at next week’s meeting.</td>
</tr>
<tr>
<td>2</td>
<td>Follow up on screen format.</td>
</tr>
<tr>
<td>3</td>
<td>Build product releases and upgrades into schedule.</td>
</tr>
<tr>
<td>4</td>
<td>Follow up on screen format.</td>
</tr>
<tr>
<td>5</td>
<td>Ensure that installation and configuration process is documented fully, so that it becomes a repeatable and easily manageable procedure.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actual Date</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/10/99</td>
<td>1</td>
<td>To develop a naming convention document.</td>
</tr>
<tr>
<td>07/10/99</td>
<td>2</td>
<td>To ensure that all action items are addressed.</td>
</tr>
<tr>
<td>07/10/99</td>
<td>3</td>
<td>To make sure that the minutes are accurate.</td>
</tr>
</tbody>
</table>

### NEW BUSINESS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Review the Acme Project Plan Protocol.</td>
</tr>
<tr>
<td>2</td>
<td>Prepare for the next meeting.</td>
</tr>
<tr>
<td>3</td>
<td>Decide on changes to the project plan.</td>
</tr>
</tbody>
</table>
Terminology

In IT&T projects, a test is an activity in which a system or component is executed under specified conditions, the results are observed or recorded and an evaluation is made of some aspect of the system or component. The term "testability" is used to describe:

1. The degree to which a system or component facilitates the establishment of test criteria and the performance of tests to determine whether those criteria have been met.
2. The degree to which a requirement is stated in terms that enable establishment of test criteria and performance tests to determine whether those criteria have been met (see measurable).

Testing terms and their meanings are contained in the following table:

<table>
<thead>
<tr>
<th>TERM</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-box testing</td>
<td>See functional testing.</td>
</tr>
<tr>
<td>Boundary value analysis</td>
<td>A test data selection technique in which values are chosen to lie along data extremes. Boundary values include maximum, minimum, just inside/outside boundaries, typical values, and error values. The hope is that, if a system works correctly for these special values then it will work correctly for all values in between.</td>
</tr>
<tr>
<td>Cause effect graphing</td>
<td>A testing technique that aids in selecting, in a systematic way, a high-yield set of test cases. It is a method of systematic selection of test cases in which a logical relationship exists between a set of test cases. It has a beneficial side effect in pointing out incompleteness and ambiguity in specifications.</td>
</tr>
<tr>
<td>Closed-box testing</td>
<td>See functional testing.</td>
</tr>
<tr>
<td>Equivalence class partitioning</td>
<td>A software testing technique that involves identifying a small set of representative input values that invoke as many different input conditions as possible.</td>
</tr>
<tr>
<td>Error based testing</td>
<td>Testing where the knowledge about program structure, style, and other programming language constructs is applied to select test data.</td>
</tr>
<tr>
<td>Failure directed testing</td>
<td>Software testing based on the knowledge of the types of errors made in similar projects, the defects are observed, recorded, and an evaluation is made of some aspect of the conditions the testability is used to describe.</td>
</tr>
<tr>
<td>Functional testing</td>
<td>The application of test data derived from the functional requirements without regard to the final program structure. Synonymous with “black-box testing” and “closed-box testing.”</td>
</tr>
<tr>
<td>Penultimate testing</td>
<td>Software testing based on the knowledge of the types of errors made in similar projects.</td>
</tr>
<tr>
<td>Practical testing</td>
<td>The test that are likely for the system under test. Synonymous with “feasible testing.”</td>
</tr>
<tr>
<td>Preventive testing</td>
<td>Software testing based on the knowledge of the types of errors made in similar projects.</td>
</tr>
<tr>
<td>Purposeful testing</td>
<td>The test that are likely for the system under test. Synonymous with “feasible testing.”</td>
</tr>
<tr>
<td>Synthetic testing</td>
<td>The application of test data derived from the functional requirements without regard to the final program structure. Synonymous with “black-box testing” and “closed-box testing.”</td>
</tr>
</tbody>
</table>

15 Source = IEEE (Institute of Electrical and Electronics Engineers)
<table>
<thead>
<tr>
<th>Heuristics testing</th>
<th>Validation protocol provides the best tests and specific guidelines to design and validation protocol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test case</td>
<td>Documentation that specifies inputs, predicted results, and a set of execution conditions for a test item. Synonymous with test case specification. See also test procedure.</td>
</tr>
<tr>
<td>Test case generator</td>
<td>A software tool that accepts as input source code, test criteria, specifications, or data structure definitions and uses those inputs to generate test input data and, sometimes, determine expected results. Synonymous with test data generator and test generator.</td>
</tr>
<tr>
<td>Test design</td>
<td>Documentation that specifies the details of the test approach for a software feature or combination of software features and identifies the associated tests. Refer also: Boundary value analysis, equivalence class partitioning, cause and effect graphing, functional testing, error based testing, equivalence class partitioning, cause and effect graphing, boundary value analysis, test case generator. Test design is also referred to as test planning.</td>
</tr>
<tr>
<td>Test documentation</td>
<td>Documentation that describes plans for, or results of, the testing of a system or component. Types include test case specification, test incident report, test log, test plan, test procedure and test report.</td>
</tr>
<tr>
<td>Test driver</td>
<td>A software module used to invoke a module under test and provide test inputs, control the execution, and report test results. Synonymous with test harness.</td>
</tr>
<tr>
<td>Test harness</td>
<td>See test driver.</td>
</tr>
<tr>
<td>Test incident report</td>
<td>A document that reports on any event that occurs during testing that requires further investigation. See also failure directed testing.</td>
</tr>
<tr>
<td>Test log</td>
<td>A chronological record of all relevant details about the execution of a test.</td>
</tr>
<tr>
<td>Test phase</td>
<td>The period of time in the software development life cycle (SDL) in which the components of the software (developed or purchased) are evaluated and integrated, and the software is evaluated to determine whether or not requirements have been satisfied, and if the software is evaluated to determine whether or not it meets the requirements of the software (developed or purchased) and the software is evaluated to determine whether or not it meets the requirements of the software (developed or purchased). Test phase is also referred to as test planning.</td>
</tr>
<tr>
<td>Test plan</td>
<td>Documentation that specifies the scope, approach, resources and schedule of intended testing activities. A test plan identifies test items, the schedule of intended testing activities, resources, and risks, and the approach to address these risks. Test plan is also referred to as test design.</td>
</tr>
<tr>
<td>Test documentation</td>
<td>Validation protocol provides the best tests and specific guidelines to design and validation protocol.</td>
</tr>
<tr>
<td>Test case generator</td>
<td>A software tool that accepts as input source code, test criteria, specifications, or data structure definitions and uses those inputs to generate test input data and, sometimes, determine expected results. Synonymous with test data generator and test generator.</td>
</tr>
<tr>
<td>Test case</td>
<td>Execution conditions for a test item. Synonymous with test case specification. Test case documentation describes the details of the test approach for a software feature or combination of software features and identifies the associated tests.</td>
</tr>
<tr>
<td>Test documentation</td>
<td>See test case documentation.</td>
</tr>
<tr>
<td>Test case generator</td>
<td>See test case generator.</td>
</tr>
<tr>
<td>Test case</td>
<td>See failure directed testing.</td>
</tr>
</tbody>
</table>
# BIBLIOGRAPHY

| The Office of Government Commerce, United Kingdom | [http://www.ogc.gov.uk/sdtoolkit](http://www.ogc.gov.uk/sdtoolkit) |
| Computer World periodical publications |
| Intelligent Enterprise periodical publications |
| U.S. Department of Transportation - Volpe Center Logical Data Modelling |
| Infrared Space Observatory | [http://www.iso.vilspa.esa.es](http://www.iso.vilspa.esa.es) |