**MBA 815**

**Overview of Systems Development Life Cycle (SDLC)**

Many organizations spend millions of dollars each year on the acquisition, design, development, implementation, and maintenance of information systems.

There is need for safe, secure, and reliable system solutions is heightened by the increasing dependence on computer systems and technology to provide services and develop products, administer daily activities, and perform short- and long-term management functions.

Organizations need a systematic and uniform methodology for information systems development.

Using SDLC will ensure that systems developed by the Department meet IT mission objectives; are compliant with standards and are easy to maintain and cost-effective to enhance.

Sound life cycle management practices include planning and evaluation in each phase of the information system life cycle.

Systems Development Life Cycle (SDLC) emphasizes decision processes that influence system cost and usefulness.

These decisions must be based on full consideration of business processes, functional requirements, and economic and technical feasibility in order to produce an effective system.

The primary objectives of any SDLC are to deliver quality systems that:

1) Meet or exceed customer expectations promised and within cost estimates.

2) Work effectively and efficiently within the current and planned information technology infrastructure.

3) Deploy IT infrastructure that are inexpensive to maintain and cost-effective to enhance.

**Purpose**

This SDLC methodology establishes procedures, practices, and guidelines governing the initiation, concept development, planning, requirements analysis, design, development, integration and test, implementation, and operations, maintenance and disposition of management information systems (MIS) within the organization.

It should be used in conjunction with existing policy and guidelines for acquisition and procurement.

**Scope**

This methodology should be used for all organizational information systems and applications.

It is applicable across all information technology (IT) environments (e.g., mainframe, client, and server) and applies to contractually developed as well as in-house developed applications.

The specific participants in the life cycle process, and the necessary reviews and approvals, vary from project to project.

SDLC should be tailored to the individual project based on complexity, and criticality to the agency’s mission.

**Applicability**

The SDLC methodology can be applied across organizational units; Offices, Boards, Divisions and Bureaus (OBDB) who are responsible for information systems development.

All Project Managers and development teams involved in system development projects represent the primary audience for the SDLC.

The SDLC serves as the mechanism to assure that systems under development meet the established requirements and support an organization’s mission functions.

It provides a structured approach to managing information technology (IT) projects beginning with establishing the justification for initiating say stems development or maintenance effort and concluding with system disposition.

The primary audience for SDLC is the systems developers, IT project managers, program/account analysts and system owners/users responsible for defining and delivering organizational systems, their staff, and their support contractors. Specific roles and responsibilities are described throughout each life cycle phase.

**Key Principles of SDLC**

- Life Cycle Management Should be used to Ensure a Structured approach to Information Systems Development, Maintenance, and Operation

- Support the use of an Integrated Product Team

- Each System Project must have a Program Sponsor

- A Single Project Manager must be Selected for Each System Project

- A Comprehensive Project Management Plan is Required for Each System Project

- Specific Individuals Must be Assigned to Perform Key Roles throughout the Life Cycle

- Obtaining the Participation of Skilled Individuals is Vital to the success of the System Project

- Documentation of Activity Results and Decisions for Each Phase of the Life Cycle are Essential

- Data Management is Required throughout the Life Cycle

 -Each System Project Must Undergo Formal Acceptance

- Consultation with Oversight Organizations Aids in the Success of a System Project

- A System Project may not Proceed until Resource Availability is Assured

**SDLC Phases**

1) Initiation Phase

2) System Concept Development Phase

3) Planning

4) Requirement Analysis

5) Design

6) Development

7) Integration and Test

8) Implementation

9) Operation and Maintenance

10) Disposition

**Documentation**

This life cycle methodology specifies which documentation shall be generated during each phase.

Some documentation remains unchanged throughout the systems life cycle while others evolve continuously during the life cycle.

Other documents are revised to reflect the results of analyses performed in later phases.

Each of the documents produced are collected and stored in a project file.

Care should be taken, however, when processes are automated. Specifically, components are encouraged to incorporate a long-term retention and access policy for electronic processes.

Be aware of legal concerns that implicate effectiveness of or impose restrictions on electronic data or records. Contact your Records Management Office for specific retention requirements and procedures.

**System Development Models**

- The Waterfall Model

- Rapid Application Development (RAD)

- Joint Application Development (JAD)

- The Prototyping Model

- Synchronize-and-Stabilize

- The Spiral Model

**Chapter 2 - Overview of Information System Development Methods**

**Paradox to the Use of methods**

- Low acceptance of methods

- Use of local methods (Instead of theoretical and textbook method)

 These methods are backed by training programs, manuals, tutorials etc.

**Degree of modification**

Changes made to the local method to improve applicability

1) Selection paths within a method

2) Combination of methods

3) Organization or project develops its own method

**Frequency of method modification**

1) Based on advances in external method knowledge

2) Based on changes in the organization's ISD situation

3) Project-by-project Basis

4) Refinement

**Chapter 3 - Strategic planning for Design of Information Systems**

Strategic planning is the process by which an organization identifies its business objectives; selects the acceptable means to achieve them; initiates the necessary causes of action and allocation of resources.

Information system must accommodate rapid technological changes, its projects are often very high cost, and increasingly competitive, organizational well-being depends on information system delivering those systems that enable the business to function effectively.

Without planning, there will be low morale, missed opportunity, management infighting, customer dissatisfaction.

MIS produces reports to help managers in decision making.

Information system strategy is a plan for the Information System and their supporting infrastructures to maximize the ability of management to achieve organizational objectives.

The key is information made useful and available thru Information systems.

Information systems strategic planning consists of identifying organizational objectives to auditing information systems resources to prioritizing future information systems development to detailing an implementation plan.

An organization’s information strategy and the plan that documents it must be consistent with:

- Its corporate plan

- Its management review of the role of information system in the organization

- Its stage of maturity of use and management information system

**Strategic Information System Planning**

Strategic information system planning is a disciplined, systematic approach to determining the most effective and efficient means of satisfying organizational information needs.

- It is top down

- Structured

- must employ technical and managerial processes in a systems engineering context.

**Factors that initiate changes in Strategic Information System Planning**

1) Major corporate change

2) Threats

3) Evolutionary Changes in information System Maturity

**Major contents of information System strategic plan**

1) Business information strategy {support for the business}

2) Information System functional strategy {features and performance the organization will need for the system i.e. the resources to be used and policies}

3) Information System/Information technology strategy {policies for the hardware/Software}

**Benefits and Importance of strategic information system planning**

Information System opportunities and needs are identified and prioritized according to the organization’s fundamental objectives rather than to technical criteria

- Top management develops commitment to a strategic vision for information system

- Methods for future information system’s development, management and investment decision are specified

- Compatibility between information systems is ensured, thus avoiding wasted investments.

**Factors for Failure of Information System’s Strategy**

Information system is planning may falter when:

- There is little demand for information and little experience of the problems caused by an adhoc approach to information system

- There are insufficient in-house skills in strategic planning; IS analysis, design and managing; management services; and project management

- Organizational sub-unit resists this top-down approach

- The required participation, openness and feedback are not present

- Departments are unwilling to share their information with others

- The external environment is too unstable to permit long-term planning

**How to Develop an Information System Strategy**

1. Understand Organizational Objectives

2. Establish Organizational Information Requirements

3. Outline Generic Systems and Technology to Meet Organizational Information Requirements

4. Conduct Information System Audit

5. Determine Major Issues Affecting Information System

6. Decide Information System Priorities and Strategies

7. Estimate Alternatives and Decide about them

8. Determine role of Finance and HR

9. Detail action plan

10. Manage, review and evolve information system strategy

**Chapter 4 - Initiation of System Design and Development**

Design project initiation may be defined as the process of defining deliverables and anticipation of those actions needed in order to complete a design project.

It involves;

1) Identifying activities and task

2) Project schedule

3) Estimating those resources that will be needed in the project together with projected costs.

**Purposes of initiation**

- Identify and validate an opportunity to improve business accomplishments of the organization or a deficiency related to a business need,

- Identify significant assumptions and constraints on solutions to that need

- Recommend the exploration of alternative concepts and methods to satisfy the need.

MIS projects can be as a result of;

- Business Process improvement activities

- Advances in information technology

- Arise from external sources

A project sponsor articulates this needs while the project manager writes a concept proposal/statement of need.

**Task and activities**

The following activities are performed as part of the Initiation Phase. The results of these activities are captured in the Concept Proposal. For every MIS project, the agency should designate a responsible organization and assign that organization sufficient resources to execute

the project.

1) Identify the Opportunity to Improve Business Functions

2) Identify a Project Sponsor

3) Form (or Appoint) a Project Organization

4) Document the Phase Efforts

5) Review the Approval to Proceed

6) Other forms of tasks include the following

 - Set initial project objectives and scope

 - Define project scope

 - Define project's benefits

 - Identify sources of business knowledge

 - Prepare preliminary project timeline

 - Determine preliminary project costs

 - Establish business user participation

 - Identify source of project funding/resources

 - Decide whether to continue with project

 - Prepare project plan

 - Create formal project plan document

 - Set analysis stage standards

**Approaches to system design initiation**

1) Establishing Structure

2) The Statement of Need/Requirement

3) project plan

4) Quality plan

5) Project control log and reporting

6) Project completion report

7) Project Initiation Checklist of Requirements

**Roles and Responsibilities**

1. Sponsor: The Sponsor is the senior spokesperson for the project, and is responsible for ensuring that the needs and accomplishments within the business area are widely known and understood. He is also responsible for ensuring that adequate resources to address their business area needs are made available in immediately.

2. Project Manager: The appointed project manager is charged with leading the efforts to ensure that all business aspects of the process improvement effort are identified in the Concept Proposal. This includes establishing detailed project plans and schedules.

**Deliverables**

The following deliverables shall be initiated during the Initiation Phase:

Concept Proposal - This is the need or opportunity to improve business functions. It identifies where strategic goals are not being met or missionperformance needs to be improved.

**Issues for Consideration**

In this phase, it is important to state the needs or business opportunities terms. Avoid identifying a specific product or vendor as the solution. The Concept Proposal should not be more than 2-5 pages in length.

**Phase Review Activity**

At the end of this phase, the Concept Proposal is approved before proceeding to the next phase. The Concept Proposal should convey that this project is a good investment and identify any potential impact on the infrastructure/architecture.

The phase output should bring approval to launch a project of defined mission and scope. It should include the following:

- Information System Preliminary Requirements

- Project Scope Document

- Preliminary Project Plan

- Next Stage Project Plans

- Needs Analysis Report

- Decision As To Whether To Proceed With Project As Defined

**Chapter 5 - Concept Development and planning of System Design**

System Concept Development begins when the Concept Proposal has been formally approved and requires study and analysis that may lead to system development activities.

Planning the entire project is created in this phase.

**Task and Activities**

The task and activities are under concept development and planning;

*Concept Development*

- Study and Analyze the Business Need

- Plan the Project

- Form the Project Acquisition Strategy

- Study and Analyze the Risks

- Obtain Project Funding, Staff and Resources

- Document the Phase Efforts

- Review and Approval to Proceed

*Planning*

- Define Acquisition Strategy in System Boundary Document

- Analyze Project Schedule

- Create Internal Processes

- Staff Project Office

- Establish Agreements with Stakeholders

- Develop the Project Management Plan

- Develop the Systems Engineering Management Plan (SEMP)

- Review Feasibility of System Alternatives

- Study and Analyze Security Implications

- Plan the Solicitation, Selection and Award

- Develop the CONOPS(Concept of Operations)

- Revise Previous Documentation

**Roles and Responsibilities**

*Concept Development*

1. Sponsor: The sponsor should provide direction and sufficient study resources to commence the System Concept Development Phase.

2. Project Manager: The appointed project manager is charged with leading the efforts to accomplish the System Concept Development phase tasks discussed above. The Project Manager is also responsible for reviewing the deliverables for accuracy, approving deliverables and providing status reports to management.

3. Component Chief Information Officer (CIO) and Executive Review Board (ERB): The CIO/ERB approves the System’s Boundary Document. Approval allows the project to enter the Planning Phase.

*Planning*

1. Project Manager: The project manager is responsible and accountable for the successful execution of the planning phase. The project manager is responsible for leading the team that accomplishes the tasks shown above. The project manager is also responsible for reviewing deliverables for accuracy, approving deliverables; and providing status reports to management.

2. Project Team: The project team members (regardless of the organization of permanent assignment) are responsible for accomplishing assigned tasks as directed by the project manager.

3. Contracting Officer: The contracting officer is responsible and accountable for the procurement activities and signs contract awards.

4. Oversight Activities: Agency oversight activities, including the IRM office, provide advice and counsel to the project manager on the conduct and requirements of the planning effort. Additionally, oversight activities provide information, judgments, and recommendations to the agency decision makers during project reviews and in support of project decision milestones.

5. Chief Information Officer/Executive Review Board: At an appropriate level within the organization, an individual should be designated as the project decision authority (may or may not be the same individual designated as the sponsor in the previous phase). This individual should be charged with assessing:

(1) the completeness of the planning phase activities,

(2) the robustness of the plans for the next life-cycle phase,

(3) the availability of resources to execute the next phase, and

(4) the acceptability of the acquisition risk of entering the next phase.

For applicable projects, this assessment also includes the readiness to award any major contracting efforts needed to execute the next phase.

During the end of phase review process, the decision maker may;

(1) Direct the project to move forward into the next life-cycle phase (including awarding contracts),

(2) Direct the project to remain in the planning phase pending completion of delayed activities or additional risk reduction efforts

(3) Terminate the project.

**Deliverables**

*Concept Development*

- System Boundary Document (SBD)

- Cost-Benefit Analysis

- Feasibility Study

- Risk Management Plan

*Planning*

- Acquisition Plan

- Configuration Management Plan

- Quality Assurance Plan

- Concept of Operations(CONOPS)

- System Security Plan

- Project Management Plan

- Validation and Verification Plan

- System’s Engineering Management Plan

**Issues for consideration**

*Concept development*

- Automated data processing(ADP) Position Sensitivity Analysis

- Identification of Sensitive Systems

- Project Continuation Decisions

*Planning*

- Audit Trails

- Access Based on “Need to Know”

**Phase Review Activity**

*Concept Development*

The System Concept Development Review shall be performed at the end of this phase. The review ensures that the goals and objectives of the system are identified and that the feasibility of the system is established.

Products of the System Concept Development Phase are reviewed including the budget, risk, and user requirements. This review is organized, planned, and led by the Program Manager and/or

representative.

*Planning*

Upon completion of all Planning Phase tasks and receipt of resources for the next phase, the Project Manager, together with the project team should prepare and present a project status review for the project stakeholders. The review should address:

- Planning phase activities status

- Planning status for all subsequent life-cycle phases (with significant detail on the next phase, to include the status of ending contract actions)

- Resource availability status

- Acquisition risk assessments of subsequent life cycle phases given the planned acquisition strategy.

**Chapter 6 - Requirements analysis of system design**

It begins with the previous phase documentation that has been approved, or by management direction.

Documentation related to user requirements from the Planning Phase shall be used as the basis for further user needs analysis and the development of detailed user requirements. The analysis may reveal new insights into the overall information systems requirements, and, in such instances, all deliverables should be revised to reflect this analysis.

During the Requirements Analysis Phase, the system shall be defined in more detail with regard to system inputs, processes, outputs, and interfaces. This definition process occurs at the functional level.

The system shall be described in terms of the functions to be performed, not in terms of computer programs, files, and data streams.

The emphasis in this phase is on determining what functions must be performed rather than how to perform those functions.

**Task and Activities**

- Analyze and document requirements

- Develop test criteria and plans

- Develop an interface control document

- Review and Assess FOIA/PA Requirements

- Conduct functional review

- Review previous documentation

**Roles and Responsibilities**

*Project Manager:* The project manager is responsible and accountable for the successful execution of the Requirements Analysis Phase. The project manager is responsible for leading the team that accomplishes the tasks shown above. The Project Manager is also responsible for reviewing deliverables for accuracy, approving deliverables and providing status reports to managers.

*Technical Review Board:* Formally established board that examines the functional requirements documented in the FRD for accuracy, completeness, clarity, attainability, and traceability to the high-level requirements identified in the Concept of Operations.

*Project Team:* The project team members (regardless of the organization of permanent assignment) are responsible for accomplishing assigned tasks as directed by the project manager.

*Contracting Officer:* The contracting officer is responsible and accountable for the procurement activities and signs contract awards.

*CIO/ERB:* Agency oversight activities, including the Executive Review Board office, provide advice and counsel to the project manager on the conduct and requirements of the Requirements Analysis Phase effort. Additionally, oversight activities provide information, judgments, and recommendations to the agency decision makers during project reviews and in support of project decision milestones.

**Deliverables**

- Functional requirements documents

- Test and evaluation master plan

- Interface control document

- Privacy Act Notice/Privacy Impact Assessment

**Issues for Consideration**

In the Requirements Analysis Phase, it is important to get everyone involved with the project to discuss and document their requirements. A baseline is important in order to begin the next phase. The requirements from the FRD may become part of a solicitation in the Acquisition Plan.

**Phase Review Activity**

Upon completion of all Requirements Analysis Phase tasks, and receipt of resources for the next phase, the Project Manager, together with the project team, should prepare and present a project status review for the decision maker and project stakeholders. The review should address:

- Requirements Analysis Phase activities status

- Planning status for all subsequent life cycle phases (with significant detail on the next phase, to include the status of pending contract actions)

- Resource availability status

- Acquisition risk assessments of subsequent life cycle phases given the planned acquisition strategy

**Conclusion**

Requirements analysis allows for further analysis to know if more items and details should be added, therefore serves to define system’s design and development. In some system’s development lifecycle, this phase is not identified but is considered as part of the general analysis phase.

**Chapter 7 - Design of System**

The objective of the Design Phase is to transform the detailed, defined requirements into complete, detailed specifications for the system to guide the work of the Development Phase.

The decisions made in this phase, address, in detail, how the system will meet the defined functional, physical, interface, and data requirements. Design Phase activities may be conducted in an iterative fashion, producing first, a general system design that emphasizes the functional features of the system, and then a more detailed system design that expands the general design by providing all the technical detail.

System design is also the evaluation of alternative problem solution, and the detailed specification of the final system. The specification produced in the analysis phase is used to construct a design for the complete system. The emphasis of system design is to develop a new system that helps to achieve the goals and objectives of the organization and overcomes some of the shortcomings and limitations of the existing system. If the problems are minor only small modifications are required.

On the other hand major changes may be suggested by system analysis. Regardless of the complexity and scope of any system, it is the purpose of system design to develop the best possible system.

The purpose of the system’s design stage is also to architect and design a technical solution that is able to meet all the requirements the of customer, as defined in the business requirements document.

The recommended technical solution will comprise of various elements:

- A specification of the technical architecture to be employed and the required configuration

- Programme structure and flow

- A definition of any interfaces between systems

- Screen design (if required)

The TAD and SDS should be circulated within MIS first for review. If necessary an internal meeting should be held to discuss and resolve any issues. The documents should then be presented to the project stakeholder for sign off and the PPDR template used to record distribution, lists and actions.

This stage completes when all the key tasks have been performed and the exit criteria met.

**Tasks and Activities**

- Establish the application environment

- Design the application

- Develop maintenance manual

- Design operations manual

- Conduct preliminary design review

- Design human performance support(training)

- Design conversion/migration/transition strategies

- Conduct a security risk assessment

- Conduct critical design review

- Revise documentations

Other tasks associated with design and development of information systems are:

1. Book a technical architect to write the TAD

2. Book a system analyst and, where necessary, a system designer to write the SDS

3. Circulate completed TAD and SDS documents to MIS distribution list and arrange internal meeting to discuss, where necessary

4. Obtain sign off of TAD and SDS from project stakeholders

5. Complete PPDR template

6. Obtain final resource estimates for build stage tasks from the system analyst and provisionally book developer and technical architect resource for the build stage

7. Provisionally book the system analyst at 10% throughout the Build stage

8. Update sign off log

**Roles and responsibilities**

*Project Manager:* The project manager is responsible and accountable for the successful execution of the Design Phase. The project manager is responsible for leading the team that accomplishes the tasks shown above. The Project Manager is also responsible for reviewing deliverables, for accuracy, approving deliverables and providing status reports to management.

*Project Team:* The project team members (regardless of the organization of permanent assignment) are responsible for accomplishing assigned tasks as directed by the project manager.

*Contracting Officer:* The contracting officer is responsible and accountable for procurement activities and signs contract awards.

*Oversight Activities:* Agency oversight activities, including the IRM office, provide advice and counsel to the project manager on the conduct and requirements of the Design Phase. Additionally, oversight activities provide information, judgments, and recommendations to the agency decision makers during project reviews, and in support of project decision milestones.

**Deliverables**

- Security risk assessment

- Conversion plan

- System design document

- Implementation plan

- Maintenance manual

- Operations manual

- Training manual

- User manual

**Issues for Consideration**

*Project Decision Issues*

The decisions of this phase re-examine in greater detail many of the parameters addressed in previous phases. The design prepared in this phase will be the basis for the activities of the Development Phase. The overall objective is to establish a complete design for the system.

The pre-requisites for this phase are the Project Plan, Functional Requirements Document, and Test Plan. A number of project approach, project execution, and project continuation decisions are made in this phase.

Project approach decisions include:

- Identifying existing or COTS components that can be used, or economically modified, to satisfy validated functional requirements.

- Using appropriate prototyping to refine requirements and enhance user and developer understanding and interpretation of requirements.

- Selecting specific methodologies and tools to be used in the later life cycle phases, especially the Development and Implementation Phases.

- Determining how user support will be provided, how the remaining life cycle phases will be integrated, and newly identified risks and issues handled.

Project execution decisions include:

- Modifications that must be made to the initial information system need.

- Modifications that will be made to current procedures.

- Modifications that will be made to current systems/databases or to other systems/databases under development.

- How conversion of existing data will occur.

Project continuation decisions include:

- The continued need of the information system to exist.

- The continued development activities based on the needs addressed by the design.

- Availability of sufficient funding and other required resources for the remainder of the systems life cycle.

The system user community shall be included in the Design action phases as needed. It is also in the Design Phase that new or further requirements might be discovered that are necessary to accommodate individuals with disabilities. If so, these requirements shall be added to the FRD.

*Security Issues*

The developer shall obtain the requirements from the System Security Plan and the FRD and allocate them to the specific modules within the design for enforcement purposes. For example, if a requirement exists to audit a specific set of user actions, the developer may have to add a work flow module into the design to accomplish the auditing.

Detailed security requirements provide users and administrators with instructions on how to operate and maintain the system securely. They should address all applicable computer and telecommunications security requirements, including: system access controls; marking, handling, and disposing of magnetic media and hard copies; computer room access; account creation, access, protection, and capabilities; operational procedures; audit trail requirements; configuration management; processing area security; employee check-out; and emergency procedures. Security operating procedures may be created as separate documents or added as sections or appendices to the User and Operations Manuals. This activity should be conducted during the Design Phase.

**Phase Review Activity**

Upon completion of all Design Phase tasks and receipt of resources for the next phase, the Project Manager, together with the project team should prepare and present a project status review for the decision maker and project stakeholders. The review should address:

- Design Phase activities status

- Planning status for all subsequent life cycle phases (with significant detail on the next phase, to include the status of pending contract actions)

- Resource availability status

- Acquisition risk assessments of subsequent life cycle phases given the planned acquisition strategy

**Conclusion**

Though there could be several design approach depending on the type of project, system’s design as a phase in the development of an information system is what translates all the conception and analysis into reality by coming up with the sample of what is needed to improve an information system.

**Chapter 8 - Development, Integration and Testing of Information System**

**Development, Integration and Testing phases**

*Development*

The objective of the Development Phase will be to convert the deliverables of the Design Phase into a complete information system. Although much of the activity in the Development Phase addresses the computer programs that make up the system, this phase also puts in place the hardware, software, and communications environment for the system and other important elements of the overall system.

The activities of this phase translate the system design produced in the Design Phase into a working information system capable of addressing the information system requirements. The development phase contains activities for building the system, testing the system, and conducting functional qualification testing, to ensure the system functional processes satisfy the functional process requirements in the Functional Requirements Document (FRD). At the end of this phase, the system will be ready for the activities of the Integration and Test Phase.

*Integration and Testing*

The objective of this phase is to prove that the developed system satisfies the requirements defined. Several types of tests will be conducted in this phase. First, subsystem integration tests shall be executed and evaluated by the development team to prove that the program components integrate properly into the subsystems and that the subsystems integrate properly into an application.

Next, the testing team conducts and evaluates system tests to ensure the developed system meets all technical requirements, including performance requirements.

Next, the testing team and the Security Program Manager conduct security tests to validate that the access and data security requirements are met.

Finally, users participate in acceptance testing to confirm that the developed system meets all user requirements as stated. Acceptance testing shall be done in a simulated “real” user environment with the users using simulated or real target platforms and infrastructures.

**Task and activities**

*Development*

- Code and test the software

- Integrate the software

- Conduct software qualification testing

*Integrate System*

Integrate the software configuration items with hardware configuration items, manual operations, and other systems as necessary, into the system. The aggregates shall be tested, as they are developed, against their requirements. The integration and the test results shall be documented. For each qualification requirement of the system, a set of tests, test cases (inputs, outputs, test criteria), and test procedures for conducting System Qualification Testing, shall be developed and documented. Ensure that the integrated system is ready for System Qualification Testing.

- Conduct System Qualification Testing

- Install Software

- Document Software Acceptance Support

- Revise Previous Documentation

- Integration and Testing

- Establish Test environment

- Conduct Subsystem/System testing

- Conduct security testing

- Conduct acceptance testing

- Revise previous documentation

**Roles and responsibilities**

*Development*

*Project Manager:* The project Manager is responsible and accountable for the successful execution of the Development Phase. The project Manager is responsible for leading the team that accomplishes the tasks shown above. The Project Manager is also responsible for reviewing deliverables for accuracy, approving deliverables and providing status reports to management.

*Project Team:* The project team members (regardless of the organization of permanent assignment) are responsible for accomplishing assigned tasks as directed by the project manager.

*Contracting Officer:* The contracting officer is responsible and accountable for the procurement activities, and signs contract awards.

*Oversight Activities:* Agency oversight activities, including the IRM office, provide advice and counsel to the project manager on the conduct and requirements of the Development Phase. Additionally, oversight activities provide information, judgments, and recommendations to the agency decision makers during project reviews, and in support of project decision milestones.

*Developer:* The developer is responsible for the development activities to include coding, testing, documenting and delivering the completed system.

*Integration and Testing*

*Project Manager:* The project manager is responsible and accountable for the successful execution of the Integration and Test Phase. The project manager is responsible for leading the team that accomplishes the tasks shown above. The Project Manager is also responsible for reviewing deliverables for accuracy, approving deliverables and providing status reports to management.

*Project Team:* The project team members (regardless of the organization of permanent assignment) are responsible for accomplishing assigned tasks as directed by the project manager. This includes establishing the test environment.

*Contracting Officer:* The contracting officer is responsible and accountable for the procurement activities and signs contract awards.

*Security Program Manager:* The Security Program Manager is responsible for conducting security tests according to the Systems Security Plan.

*Oversight Activities*: Agency oversight activities, including the IRM office, provide advice and counsel for the project manager on the conduct and requirements of the Integration and Test

Phase. Additionally, oversight activities provide information, judgments, and recommendations to the agency decision makers during project reviews and in support of project decision milestones.

*User:* Users participate in acceptance testing to ensure systems perform as expected.

**Deliverables**

*Development*

- Contingency plan

- Software development document

- System(application) software

- Test files/data

- Integration document

*Integration and Testing*

- Test analysis report

- Test analysis approval determination

- Test problem report

- IT systems security certification and accreditation

**Issues for Consideration**

*Development*

There are three phase prerequisites that should be completed before beginning this phase:

- Project management plan and schedule indicating target date for completion of each module, and target date for completion of system testing

- System design document, containing program logic flow, identifying any existing code to be used, and the subsystems with their inputs and outputs

- Unit/module and integration test plans, containing testing requirements, schedules, and test case specifications for unit and integration testing.

*Integration and Testing*

Security controls shall be tested before system implementation to uncover all design and implementation flaws that would violate security policy. Security Test and Evaluation (ST&E) involves determining a system’s security mechanisms adequacy for completeness and correctness, and the degree of consistency between system documentation and actual implementation.

This shall be accomplished through a variety of assurance methods such as analysis of system

design documentation, inspection of test documentation, and independent execution of function testing and penetration testing.

Results of the ST&E affect security activities developed earlier in the life cycle such as security risk assessment, sensitive system security plan, and contingency plan. Each of these activities will be updated in this phase, based on the results of the ST&E. Build on the security testing recorded in the software development documents, unit testing, integration testing, and system testing.

**Phase Review Activity**

*Development*

Upon completion of all Development Phase tasks and receipt of resources for the next phase, the Project Manager, together with the project team, should prepare and present a project status review for the decision maker and project stakeholders. The review should address:

- Development Phase activities status

- Planning status for all subsequent life cycle phases (with significant detail on the next phase, to include the status of pending contract actions)

- Resource availability status

- Acquisition risk assessments of subsequent life cycle phases, given the planned acquisition strategy.

*Integration and Testing*

Upon completion of all Integration and Test Phase tasks and receipt of resources for the next phase, the Project Manager, together with the project team, should prepare and present a project status review for the decision maker and project stakeholders. The review should address:

- Integration and Test Phase activities status

- Planning status for all subsequent life cycle phases (with significant detail on the next phase, to include the status of pending contract actions)

- Resource availability status

- Acquisition risk assessments of subsequent life cycle phases given, the planned acquisition strategy

**Conclusion**

Development is what converts the design model into reality. It is an important phase of system’s development. On the other hand, integration and testing is used to fine-tune a system to detect errors and shortcomings in systems development processes.

**Chapter 9 - Implementation and Disposition of System**

**Implementation and Disposition Phases**

*Implementation*

Implementation phase of the system development in system’s design and development is the most expensive and time consuming of the entire life cycle. Implementation is expensive because so many people are involved in the process. It is time consuming because of all the works that has to be completed; implementing a developed and new information system into an organizational context is not a mechanical process.

The organizational concept has been shaped and reshaped by the people who work in the organization. The work habits, belief, interrelationships, and personal goals of an organization’s members, all affect the implementation process.

Although factors important to successful implementation have been identified, there are no more recipes you can follow. During implementation, you must be attuned to key aspects of the organizational context such as history, politics, and environmental demands - aspects that can contribute to implementation failure if ignored.

In this phase, the system or system modifications are installed and made operational in a production environment. The phase is initiated after the system has been tested and accepted by the user and Project Manager.

Activities in this phase include notification of implementation to end users, execution of the previously defined training plan, data entry or conversion, and post implementation review. This phase continues until the system is operating in production in accordance with the defined user requirements.

The new system can fall into three categories;

- Replacement of a manual process

- Replacement of a legacy system

- Upgrade to an existing system

Regardless of the type of system, all aspects of the implementation phase should be followed. This will ensure the smoothest possible transition to the organization’s desired goal.

*Disposition*

The Disposition Phase will be implemented to eliminate a large part of a system or as in most cases, close down a system and end the life cycle process. The system in this phase has been declared surplus and/or obsolete and will be scheduled for shutdown.

The emphasis of this phase will be to ensure that data, procedures, and documentation are packaged and archived in an orderly fashion, making it possible to reinstall and bring the system back to an operational status, if necessary, and to retain all data records in accordance with policies regarding retention of electronic records.

The Disposition Phase represents the end of the system’s life cycle. A Disposition Plan shall be prepared to address all facets of archiving, transferring, and disposing of the system and data.

Particular emphasis shall be given to proper preservation of the data processed by the system so that it is effectively migrated to another system, o r archived in accordance with applicable records management regulations and policies for potential future access. The system disposition activities preserve information not only about the current production system but also about the evolution of the system through its life cycle.

**Task and responsibilities**

*Implementation*

- Notify Users of New Implementation

- Execute training plan

- Perform data entry or conversion

- Install system

- Conduct post implementation review

- Revise previous documentation

*Disposition*

- Prepare disposition plan

- Archive or transfer data

- Archive or transfer software components

- Archive Life Cycle Deliverables

- End the system in an orderly manner

- Dispose of equipment

- Conduct Post-Termination Review Report

**Roles and responsibilities**

*Implementation*

*Project Manager:* The project manager is responsible and accountable for the successful execution of the Implementation Phase. The project manager is responsible for leading the team that accomplishes the tasks shown above. The project manager is also responsible for reviewing deliverables for accuracy, approving deliverables and providing status reports to management.

*Project Team:* The project team members (regardless of the organization of permanent assignment) are responsible for accomplishing assigned tasks as directed by the project manager.

*Contracting Officer:* The contracting officer is responsible and accountable for the procurement activities and signs contract awards.

*Oversight Activities:* Agency oversight activities, including the IRM office, provide advice and counsel for the project manager on the conduct and requirements of the Implementation Phase. Additionally, oversight activities provide information, judgments, and recommendations to the agency decision makers during project reviews and in support of project decision milestones.

*Disposition*

*Project Manager:* The Project Manager is responsible and accountable for the successful execution of the Disposition Phase activities.

*Data Administrator:* The Disposition Plan may direct that only certain systems data be archived. The Data Administrator would identify the data and assist technical personnel with the actual archive process. The Data Administrator may be involved with identifying data which due to its sensitive nature must be destroyed. They would also be involved with identifying and migrating data to a new or replacement system.

*Security Managers:* The security managers will need to make sure that all access authority has been eliminated for the users. Any users that only use the application should be removed from the system while others that use other applications as well as this one may still need access to the overall system, but not the application being shutdown. If there is another application that is taking the place of this application, the security managers should coordinate with the new security managers.

**Deliverables**

*Implementation*

- Delivered system

- Change Implementation notice

- Version description document

- Post implementation review

*Disposition*

- Disposition plan

- Post termination review report

- Archived system

**Issues for Consideration**

*Implementation*

Once a system has been developed, tested and deployed, it will enter the operations and maintenance phase. All development resources and documentation should be transferred to a library or the operations and maintenance staff.

*Disposition*

Update of Security plans for archiving and the contingency plans to re-establish the system, should be in place. All documentation about the application, system logs and configuration will be archived, along with the data and a copy of the Disposition Plan.

**Phase Review Activity**

*Implementation*

During the Implementation Phase Review, recommendations may be made to correct errors, improve user satisfaction, or improve system performance. For contractor development, analysis shall be performed to determine if additional activity is within the scope of the statement of work, or within the original contract. An Implementation Phase Review and Approval Certification should be signed off by the Project Manager to verify the acceptance of the delivered system by the system’s users/owner.

The Implementation Phase-End Review shall be organized, planned, and led by the Project Quality Assurance representative.

*Disposition*

The Post-Termination Review shall be performed after the end of this final phase. This phase-end review shall be conducted within 6 months after disposition of the system. The Post-Termination Review Report documents the lessons learned from the shutdown and archiving of the terminated system.

**Conclusion**

Most information systems have failed because of the ineffectiveness and inefficiency in the implementation of the concept and model. The right team should be put together to ensure safe and accurate implementation of systems. On the other hand, disposition of developed information system is necessary for continuity and future reference. It is particularly important for system’s re-evaluation a redesign. It also ensures a perfect completion of a project cycle, to make room for other projects.

**Chapter 10 - Operations and Maintenance of System Design**

**Maintenance Phase**

More than half of the life cycle costs are attributed to the operations and maintenance of systems. In this phase, it is essential that all facets of operations and maintenance be performed.

The system is being used, and scrutinized, to ensure that it meets the needs initially stated in the

planning phase. Problems are detected, and new needs arise. This may require modification to existing code, new code to be developed and/or hardware configuration changed. Providing user support is an ongoing activity. New users will require training, and others will require training

as well.

The emphasis of this phase will be to ensure that the user’s needs are met and the system continues to perform as specified in the operational environment. Additionally, as operations and maintenance personnel monitor the current system, they may become aware of better ways to improve the system and therefore make recommendations.

Changes will be required to fix problems, possibly add features and make improvements to the system. This phase will continue as long as the system is in use.

When a system is in maintenance phase, some persons within the system’s development group are responsible for collecting maintenance request from systems users and other interested parties such as systems auditors, data center, network management staff and data analysts.

Once collected, each request is analyzed. To better understand it, it will alter the system and what business benefits and necessities will result from such a change. If the change request is approved, a system change is designed and then implemented. As with the initial development of the system implemented, changes are formally reviewed and tested before installation into operational systems.

**Types of Maintenance**

There are several types of maintenance you can perform on an information system. By maintenance we mean, the fixing or enhancing of an information system.

*Corrective Maintenance*: this refers to changes made to repair defects in the design, coding or implementation of the system. For example, if you have just purchased a new home, corrective

maintenance would involve repairs to things that had never worked as designed, such as, faulty electrical outlet, or a misaligned door.

Most corrective maintenance faults surface soon after installation. When corrective maintenance problems surface, they are typically urgent, and need to be resolved to curtail possible interruption in normal business activities. Of all types of maintenance, corrective maintenance account for activities as much as 75% of all maintenance. This is unfortunate because corrective maintenance adds little or no value to the organisation, it simply focuses on removing defects from an existing system without adding new functionality.

*Adaptive Maintenance*: This involves making changes to evolve its functionality, to changing business needs, or to migrate to a different operating environment. Within a home, adaptive maintenance might be adding storm windows to improve the cooling performance of an air-conditioner. Adaptive maintenance is usually less urgent than corrective maintenance because of business and technology. Changes typically occur over some period of time. Contrary to corrective maintenance, adaptive maintenance is generally a small part of an organization’s maintenance effort, but it adds value to the organization.

*Perfective Maintenance:* This involves making enhancement to improve processing performance or interface usability or to add desired, but not necessarily required system’s features. In our home example, Perfective maintenance would be adding a new room. Many systems professionals feel that Perfective correction is not really maintenance, but rather new development.

*Preventive Maintenance:* This involves changes made to a system to reduce the chances of future system’s failure. An example of preventive maintenance might be to increase the number of records that the system process far beyond what is currently needed, or to generalize how a system sends report information to a printer so that the system can easily adapt to changes in technology. In our home example, preventive maintenance could be painting of the exterior to

better protect the room from severe weather conditions. As with adaptive maintenance, both

Perfective and preventive maintenance are typically a much lower priority than corrective maintenance. Over the life of a system, corrective maintenance is most likely to occur after initial system installation or after major changes. This means that adaptive maintenance, Perfective maintenance, and preventive maintenance activities can lead to corrective maintenance activities if not carefully designed and implemented.

**Task and Activities**

- Identify system operations

- Maintain Data /Software Administration

- Identify problem & modification process

- Maintain system/software

- Revise Previous Documentation

**Roles and responsibilities**

*Systems Manager*: The Systems Manager develops documents and executes plans and procedures for conducting activities and tasks of the Maintenance Process. To provide for an avenue of problem reporting and customer satisfaction, the Systems Manager should create and discuss communications instructions with the systems customers.

*Technical Support:* Personnel which proved technical support to the program. This support may involve granting access rights to the program. Setup of workstations or terminals to access the system. Maintaining the operating system for both server and workstation. Technical support personnel may be involved with issuing user ids or login names and passwords. In a Client server environment technical support may perform systems scheduled backups and operating system maintenance during downtime.

*Operations or Operators (Turn On/Off Systems, Start Tasks, Backup etc):* For many mainframe systems, technical support for a program is provided by an operator. The operator performs scheduled backup, performs maintenance during downtime, and is responsible to ensure the system is online and available for users. Operators may be involved with issuing user ids or login names and passwords for the system.

*Customers:* The customer needs to be able to share with the systems manager the need for improvements or the existence of problems. Some users live with a situation or problem because they feel they must. Customers may feel that change will be slow or disruptive. Some feel the need to create work-around. A customer has the responsibility to report problems or make recommendations for changes to a system.

*Program Analysts or Programmer:* Interprets user requirements, designs and writes the code for specialized programs. User changes, improvements, enhancements may be discussed in Joint Application Design sessions. Analysts programs for errors, debugs the program and tests program design.

*Process Improvement Review Board:* A board of individuals may be convened to approve recommendations for changes and improvements to the system. This group may be chartered. The charter should outline what should be brought before the group for consideration and approval. The board may issue a Change Directive.

*Users Group or Team:* A group of computer users who share knowledge they have gained concerning a program or system. They usually meet to exchange information, share programs and can provide expert knowledge for a system under consideration for change.

*Contracting Officer:* The contracting officer is responsible and accountable for the procurement activities, and signs contract award.

*Data Administrator*: Performs tasks which ensure that accurate and valid data are entered into the system. Sometimes this person creates the information systems database, maintains the databases security and develops plans for disaster recovery. The data administrator may be called upon to create queries and reports for a variety of user requests. The data administrator is responsibilities include maintaining the databases data dictionary. The data dictionary provides a description of each field in the database, the field characteristics, and what data is maintained with the field.

*Telecommunications Analyst and Network System Analyst:* Plans, installs, configures, upgrades and maintains networks as needed. If the system requires it, he ensures that external communications and connectivity are available.

*Computer Systems Security Officer (CSSO):* The CSSO has a requirement to review system change requests, review and in some cases, coordinate the Change Impact Assessments, participate in the Configuration Control Board process, and conduct and report changes that may be made, that affect the security posture of the system.

**Deliverables**

- In process review report

- User satisfaction review report

**Issues for consideration**

- Documentation

- Guidelines in determining new development from maintenance

- Security re-certification

**Phase Review Activity**

Review activities occur several times throughout this phase. Each time the system is reviewed, one of three of the following decisions will be made:

- The system is operating as intended and meeting performance expectations

- The system is not operating as intended and needs corrections or modifications

- The users are/are not satisfied with the operation and performance of the system

The In-Process Review shall be performed to evaluate system performance, user satisfaction with the system, adaptability to changing business needs, and new technologies that might improve the system.

This review is diagnostic in nature and can trigger a project to re-enter a previous SDLC phase. Any major system modifications needed after the system has been implemented will follow the SDLC process from planning through implementation.

**Maintenance Cost**

Information system maintenance costs are significant expenditure. For some organizations as much as 60% to 80% of their information system budget is allocated to maintenance activities.

This proportion has risen from roughly 50% 20 years ago, due to the fact that many organizations have accumulated more and older so called legacy systems that require more and more maintenance. More maintenance means more maintenance work for programmers. A recent opinion poll of over 20 executives revealed that on average, 52% of a company’s programmers are assigned to maintain existing software.

Only 3% is assigned to new application development. In situations where a company has not developed its in-house system, but has licensed software, maintenance cost remains high. In many cases annual maintenance fee can be as high as 20% of the up-front cost. In addition, about one third of the cost of establishing and keeping a presence on the web goes to programming.

**Conclusion**

Operations and maintenance is continual throughout the life of any project and thus could be the most expensive and cumbersome. In fact it is considered as the longest of all the systems development phases. It consists of making sure that developed systems run in operational use and continues to do so for as long as is required. The Centre of Software maintenance estimates that 50% and 90% of cost of computer systems over its lifetime is maintenance.

**Chapter 11 - Dynamic systems development method (DSDM)**

DSDM is a framework based originally around Rapid Application Development (RAD), supported by its continuous user involvement in an iterative development and incremental approach which is responsive to changing requirements, in order to develop a system that meets the business needs on time and on budget.

It is one of a number of agile methods for developing software.

DSDM was developed in the United Kingdom in the 1990s by a consortium of vendors and experts in the field of Information System (IS) development. The DSDM Consortium combined their best-practice experiences. The DSDM Consortium is a non-profit and vendor independent organisation which owns and administers the framework.

The first version was completed in January 1995 and published in February 1995. The current version in use at this point in time (April 2006) is Version 4.2: Framework for Business Centered Development, released in May 2003.

As an extension of rapid application development, DSDM focuses on Information Systems, projects that are characterized by tight schedules and budgets. DSDM addresses the common reasons for information system project failure, including exceeding budgets, missing deadlines, and lack of user involvement, and top management commitment.

DSDM consists of 3 phases: pre-project phase, project life-cycle phase, and post project phase.

The project life-cycle phase is subdivided into 5 stages: feasibility study, business study, functional model iteration, design and build iteration, and implementation.

DSDM recognizes that projects are limited by time and resources, and plans accordingly to meet the business needs. In order to achieve these goals, DSDM encourages the use of RAD with the consequent danger that too many corners are cut. DSDM applies some principles, roles, and techniques.

**Principles of DSDM**

There are nine underlying principles of DSDM consisting of four foundations and five starting-points for the structure of the method. These principles form the cornerstones of development using DSDM.

- User Involvement is the Main Key in running an efficient and effective project, where both users and developers share a workplace, so that the decisions can be made accurately.

- The Project Team must be Empowered to make decisions that are important to the progress of the project, without waiting for higher level approval.

- DSDM focuses on frequent delivery of products, with assumption that to deliver something "good enough" earlier is always better than to deliver everything "perfectly" in the end. By delivering product frequently from an early stage of the project, the product can be tested and reviewed where the test record and review document can be taken into account at the next iteration or phase.

- The main criteria for acceptance of deliverable in DSDM is on delivering a system that addresses the current business needs. It is not so much directed at delivering a perfect system addressing all possible business needs, but focuses its efforts on critical functionality.

- Development is Iterative And Incremental, driven by users’ feedback to converge on an effective business solution.

- All changes during the development are reversible.

- The high level scope and requirements should be base-lined before the project starts.

- Testing is carried out throughout the project life-cycle.

- Communication and cooperation among all project stakeholders is required to be efficient and effective. DSDM is also supported by some other principles (or so called

 assumptions). These are;

1) No system is built perfectly in the first try (the Pareto

principle-80/20 rule). In the process of developing an information system, 80% of the business benefit comes from 20% of the system requirements, therefore DSDM starts implementing this first 20% of system requirements to meet 80% of the business needs, which is good enough as long as the users are intimately involved in the development process, and in a position to ensure that the missing 20% would not cause any serious business consequences. Implementing the entire requirements often causes the project to go over deadlines and budgets, therefore it is most times unnecessary to construct the perfect solution.

2) Project delivery should be on time, on budget and with good quality.

3) DSDM only requires each step of the development to be completed far enough for the next step to begin. This way a new iteration of the project can commence without having to wait for the previous to be completed entirely. And with every iteration the system is improved incrementally. Recall that the business requirements are changing over time at any rate.

4) Both Project Management and Development techniques are incorporated in DSDM.

5) DSDM can also be used both in new projects and for expanding current systems.

6) Risk assessment should focus on business function being delivered, not on the construction process nor on development process artifacts (such as requirements and design documents).

7) Management rewards product delivery rather than task completion.

8) Estimation should be based on business functionality instead of lines of code.

**Prerequisites for Using DSDM**

In order for DSDM to be a success, a number of prerequisites need to be realized.

First, there needs to be interactivity between the project team, future end users and higher management. This addresses well known failures of IS development projects due to lack of top management motivation and/or user involvement.

The second important prerequisite for DSDM projects is the decomposability of the project. The possibility of decomposition into smaller parts enables the iterative approach, and activities that are hard to prioritize often cause delays--exactly the effect that DSDM was developed to avoid.

Another group of projects for which DSDM is not well-suited are safety-critical ones. The extensive testing and validation found in these kinds of projects conflict with DSDM goals of being on time and on budget.

Finally, projects that aim at re-usable components might not be well-suited for development using DSDM, because the demands on perfection are too high and conflict with the 80%/20% principle described earlier.

**Phases of DSDM**

The DSDM framework consists of three sequential phases, namely the pre-project, project life-cycle and post-project phases. The project phase of DSDM is the most elaborate of the three phases. The project lifecycle phase consists of 5 stages that form an iterative step-by-step approach in developing an IS. The three phases and corresponding stages are explained extensively in the subsequent sections. For each stage/phase, the most important activities are addressed and the deliverables are mentioned.

*Phase 1 (The Pre-Project)*

In the pre-project phase candidate projects are identified, project funding is realized and project commitment is ensured. Handling these issues at an early stage avoids problems at later stages of the project.

*Phase 2(The Project Lifecycle)*

There are divided into 5 stage as follows;

- Stage 1 (The Feasibility Study)

- Stage 2 (The Business Study)

- Stage 3 (Functional Model Iteration)

- Stage 4(Design and Build Iteration)

- Stage 5(Implementation)

*Phase 3* (The Post-project)

**The Core Techniques of DSDM**

- Timeboxing

- MoSCoW

- Prototyping

- Testing

- Workshop

- Modeling

- Configuration Management

**Roles of DSDM**

There are some roles introduced within DSDM environment. It is important that the project members need to be appointed to different roles before they start to run the project. Each role has its own responsibility. These roles are:

*Executive Sponsor:* So called the “Project Champion”. An important role from the user organization who has the ability and responsibility to commit appropriate funds and resources. This role has an ultimate power to make decisions.

*Visionary:* The one who has the responsibility to initialize the project by ensuring that essential requirements are found early on. Visionary has the most accurate perception of the business objectives of the system and the project. Another task is to supervise and keep the development process in the right track.

*Ambassador User:* Brings the knowledge of user community into the project, ensures that the developers receive enough amount of user’s feedbacks during the development process.

*Advisor User:* Can be any user that represents an important viewpoint and brings the daily knowledge of the project.

*Project Manager:* Can be anyone from user community or IT staff who manages the project in general.

*Technical Coordinator:* Responsible in designing the system architecture and control the technical quality in the project.

*Team Leader:* Leads his team and ensures that the team works effectively as a whole.

*Developer:* Interpret the system requirements and model; it includes developing the deliverable codes and build the prototypes.

*Tester:* Checks the correctness in a technical extent by performing some testing. Tester will have to give some comments and documentation.

*Scribe*: Responsible to gather and record the requirements, agreements, and decisions made in every workshop.

*Facilitator:* Responsible in managing the workshop’s progress, acts as a motor for preparation and communication.

*Specialist Roles:* Business Architect, Quality Manager, System Integrator, etc.

**Critical Success Factors of DSDM**

Within DSDM a number of factors are identified as being of great importance to ensure successful projects:

- *Factor 1:* First there is the acceptance of DSDM by senior management and other employees. This ensures that the different factors of the project are motivated from the start and remain involved throughout the project.

- Factor 2: The second factor follows directly from this and that is the commitment of management to ensure end-user involvement. The prototyping approach requires a strong and dedicated involvement by end user to test and judge the functional prototypes.

- Factor 3: Then there is the project team. This team has to be composed of skillful members that form a stable union. An important issue is the empowerment of the project team. This means that the team (or one or more of his members) has to posses the power and possibility to make important decisions regarding the project without having to write formal proposals to higher management, which can be very time-consuming. In order for the project team to be able to run a successful project, they also need the right technology to conduct the project. This means a development environment, project management tools, etc.

- *Factor 4:* Finally, DSDM also states that a supportive relationship between customer and vendor is required. This goes for both projects that are realized internally within companies or by outside contractors.

**Chapter 11 - Project Management (PM)**

PM Spans across several fields. The father of PM is Henry Gantt who invented the use of bar chart as a PM tool. The beginning of the modern PM era was during1950's.

2 mathematical project scheduling methods were developed;

- The Program Evaluation and Review Technique (PERT)

- The Critical Path Method (CPM)

In 1969, the Project Management Institute (PMI) was formed to serve the interest of the project management industry. The premise of PMI is that the tools and techniques of project management are common even among the widespread application of projects, from the software industry, to the construction industry.

**Overview of PM**

Project management is defined as the discipline of organizing and managing resources in such a way that these resources deliver all the work required to complete a project within defined scope, time, and cost constraints. A project is a temporary and one-time endeavor undertaken to create a unique product or service.

It requires varying technical skills and philosophy, hence requiring the development of project management.

Project management is also a carefully planned and organized effort to accomplish a specific (and usually) one-time effort e.g. building a house etc.

The first challenge of project management is ensuring that a project is delivered within the defined constraints.

The second, more ambitious, challenge is the optimized allocation and integration of the inputs needed to meet those pre-defined objectives. The project, therefore, is a carefully selected set of activities chosen to use resources, (time, money, people, materials, energy, space, provisions, communication, quality, risk, etc.) to meet the pre-defined objectives.

Almost any human activity that involves carrying out a non-repetitive task can be a project. So we are all project managers! We all practice project management (PM). But there is a big difference between carrying out a very simple project

The art of planning for the future has always been a human trait. In essence a project can be captured on paper with a few simple elements: a start date, an end date, the tasks that have to be carried out and when they should be finished, and some idea of the resources (people, machines etc) that will be needed during the course of the project.

But that would be unfair as project management is not only about planning but also about human attributes like leadership and motivation.

Project managers can be found in all industries. Their numbers have grown rapidly as industry and commerce has realized, that much of what it does is project work. And as project-based organisations have started to emerge, project management is becoming established as both a professional career path and a way of controlling business. So opportunities in project management now exist not only in being a project manager, but also as part of the support team in a project or programme office, or as a team leader for part of a project. There are also qualifications that can be attained through the professional associations.

**Policy Requirements**

- Accountability for projects

- Project Management Principles

- Authorities and Resources

- Project Scope

- Management framework

- Project Risk, Complexity and Economy

- Project Profile and Risk Assessment (PPRA)

- Project Management Practices

**Responsibilities**

*Project Leaders*

Project Leaders must notify other federal government departments or agencies who may be affected by a specific project, inviting them to participate in an active or coordinative role as appropriate.

The project leader is also responsible for ensuring that all relevant project submissions and approvals have been obtained prior to initiating any part of the project. It also includes the submission of updated project information to appropriate authorities for significant changes beyond the reporting baseline established in the original or amended approvals.

The project leader should consult as early as possible, with Treasury Board Secretariat, particularly for larger projects of higher risk and complexity, proposing a suitable management framework for staff concurrence. Project leaders are to ensure that a specific project is managed in accordance with the approved management framework.

Updated project documentation may also propose a change in management framework should the risk assessment conducted in accordance with the PM guidelines demonstrate a decrease (or increase) in project risk.

*Project Managers*

Project Managers are responsible for the day-to-day management of the project as set out in the charter or agreement with the project leader.

*Participating Departments*

Participating departments are to determine the nature and degree of the effect of the proposed project on their operations, asset base or other interests. They then respond to the project leader defining the nature and extent of proposed participation in the project. Joint commitment to any project and specific activity to be carried out by a participating department that is deemed essential to the success of the project, must be documented in an appropriate interdepartmental agreement.

Participating departments are to select their project officers based upon an established human resources management profile, project management experience and abilities, and in consideration of the significance, scope, complexity, risk, and visibility of the project.

*Contracting Authority*

The Contracting Authority is responsible:

- for participating in the project as a participating department

- to ensure the legal soundness of any contract, and to maintain the government standards of prudence, probity and equity, when dealing with the private sector

- to support the project in accordance with any existing legislation or general interdepartmental arrangements

- to provide any project-specific services (such as procurement) as described in any agreement or MOU concluded with the sponsoring department

• to make submissions to the Treasury Board for authority to enter into contracts and to amend contracts as set out in the Contracting volume of the Treasury Board Manual.

*Monitoring*

The Treasury Board Secretariat will monitor departmental compliance with this policy through review of the quality of the Project Management Framework and other relevant sections of project approval submissions, and by reviewing adherence to the content of Treasury Board decisions.

**The Traditional Project Management Constraints**

Most people still want their projects to be on time, meet quality objectives, and not cost more than the budget. These form the classic time, quality, cost triangle.

In fact if you have an unlimited budget and unlimited time, project management becomes rather easy. For most people, however, time and money are critical, and that is what makes project management so important today. Like any human undertaking, projects need to be performed and delivered under certain constraints. Traditionally, these constraints have been listed as: scope, time, and cost.

This is also referred to as the Project Management Triangle where each side represents a constraint. One side of the triangle cannot be changed without impacting the others. A further refinement of the constraints separates product 'quality' or 'performance' from scope, and turns quality into a fourth constraint.

The time constraint refers to the amount of time available to complete a project. The cost constraint refers to the budgeted amount available for the project. The scope constraint refers to what must be done to produce the project's end result. These three constraints are often competing constraints: increased scope typically means increased time and increased cost, a tight time constraint could mean increased costs and reduced scope, and a tight budget could mean increased time reduced scope.

The discipline of project management is about providing the tools and techniques that enable the project team (not just the project manager) to organize their work to meet these constraints.

*Time*

This often broken down for analytical purposes into the time required to complete the components of the project, which is then further broken down into the time required to complete each task contributing to the completion of each component. When performing tasks using project management, it is important to cut the work into smaller pieces so that it is easy to follow.

*Cost*

Cost to develop a project depends on several variables including (chiefly): labor rates, material rates, risk management, plant (buildings, machines, etc.), equipment, and profit. When hiring an

independent consultant for a project, cost will typically be determined by the consultant or firm's per diem rate multiplied by an estimated quantity for completion.

*Scope*

Requirements specified for the end result: The overall definition of what the project is supposed to accomplish, and a specific description of what the end result should be or accomplish. A major component of scope is the quality of the final product. The amount of time put into individual tasks determines the overall quality of the project. Some tasks may require a given amount of time to complete adequately, but given more time could be completed exceptionally. Over the course of a large project, quality can have a significant impact on time and cost (or vice versa).

**Project Management Activities**

Project Management is composed of several different types of activities such as:

- Planning the work or objectives

- Analysis & Design of objectives

- Assessing and controlling risk (or Risk Management)

- Estimating resources

- Allocation of resources

- Organizing the work

- Acquiring human and material resources

- Assigning tasks

- Directing activities

- Controlling project execution

- Tracking and Reporting progress

- Analyzing the results based on the facts achieved

- Defining the products of the project

- Forecasting future trends in the project

- Quality Management

- Issues Management.

**Project Development Stages**

Regardless of the methodology used, the project development process will have the same major stages: initiation, development, production or execution, and closing/maintenance.

- Initiation

- Planning and design

- Production or Execution

- Closing and Maintenance

**Chapter 13 - Project planning**

The success of a project is dependent on planning. MIS projects can be expensive in terms of time and money. Careful planning at onset as well as during the project can help avoid costly mistakes. It also provides assurance that a MIS will accomplish its goals on schedule and within budget.

To avoid disappointing experiences like these, MIS professionals have developed a well-defined planning methodology often referred to as project planning lifecycle. Lifecycle planning involves setting goals, defining targets, establishing schedules, and estimating budgets for an entire project.

1. The Project Specification {The global context, Interfaces, Time scales, External dependencies, Resources}

2. Provide Structure {Work breakdown structure, Task allocation and Guesstimation}

3. Establish control {Set milestones, Establish means of communication}

**Artistry of Planning**

1. Who knows best?

2. Dangers in review

3. Testing and quality

4. Fitness for Purpose

5. Fighting for time

6. Planning for error

7. Post-mortem

**Chapter 14 - Risk assessments and management**

Risk management is basically a process of assessing risk and development of strategies to curb such identified risk in management.

It is the process of measuring, or assessing risk and then developing strategies to manage the risk.

Strategies employed include transferring the risk to another party, avoiding the risk, reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk.

Traditional risk management, which is discussed here, focus on risks stemming from physical or legal causes (e.g. natural disasters or fires, accidents, death, and lawsuits). Financial risk management, on the other hand, focuses on risks that can be managed using traded financial instruments.

Regardless of the type of risk management, all large corporations have risk management teams and small groups and corporations practice informal, if not formal, risk management.

In ideal risk management, a prioritization process is followed whereby the risks with the greatest loss and the greatest probability of occurring are handled first, and risks with lower probability of occurrence and lower loss are handled later. In practice the process can be very difficult, and balancing between risks with a high probability of occurrence but lower loss vs. a risk with high loss but lower probability of occurrence can often be mishandled.

Risk management also faces a difficulty in allocating resources properly. This is the idea of opportunity cost. Resources spent on risk management could be instead spent on more profitable activities. Again, ideal risk management spends the least amount of resources in the process while reducing the negative effects of risks as much as possible.

**Risk management process**

1. *Identification*

A first step in the process of managing risk is to identify potential risks. Risks are about events that, when triggered, will cause problems. It starts from source analysis and problem analysis.

Common Identification methods are;

- Objectives-Based Risk Identification

- Scenario-Based Risk Identification

- Taxonomy-Based Risk Identification

- Common-Risk Checking

2. *Assessment*

Once risks have been identified, they must then be assessed as to their potential severity of loss and to the probability of occurrence. These quantities can be either simple to measure, in the case of the value of a lost building, or impossible to know for sure in the case of the probability of an unlikely event occurring. Therefore, in the assessment process it is critical to make the best educated guesses possible in order to properly prioritize the implementation of the risk management plan.

3. *Potential Risk treatment*

Once risks have been identified and assessed, all techniques to manage the risk fall into one or more of these four major categories:

- Transfer

- Avoidance

- Reduction (aka Mitigation)

- Acceptance (aka Retention)

Ideal use of these strategies may not be possible. Some of them may involve tradeoffs that are not acceptable to the organization or person making the risk management decisions.

*Risk Avoidance*

This includes not performing an activity that could carry risk.

*Risk Reduction*

This involves methods that reduce the severity of the loss.

*Risk Retention*

This involves accepting the loss when it occurs. True self insurance falls in this category. Risk retention is a viable strategy for small risks where the cost of insuring against the risk would be greater over time than the total losses sustained. All risks that are not avoided or transferred are

retained by default. This includes risks that are so large or catastrophic that they either cannot be insured against or the premiums would be infeasible. War is an example, since most property and risks are not insured against war, so the loss attributed by war is retained by the insured.

*Risk Transfer*

This means causing another party to accept the risk, typically by contract or by hedging Insurance is one type of risk transfer that uses contracts. Other times it may involve contract language that transfers a risk to another party without the payment of an insurance premium.

Liability among construction or other contractors is very often transferred this way.

4. Create a plan

5. Implementation

6. Review and evaluation of the plan

**Risk Assessment and Cost Estimates**

- Project risk assessment {internal & external}

- Levels of risk {High, medium and low}. It can be periodically updated to reflect additional information available.

- Assessment of Risk

 High risk will result in failure to achieve project objectives.

 Medium risk is present if some of the hazards (in high risk) exist but have been mitigated to the point that allocated resources and focused risk management planning should prevent significant negative effect on the attainment of project objectives.

 Low risk means there exists hazards in a project (or element of a project) do not exist or have been reduced to the point where routine project management control should be capable of preventing any negative effect on the attainment of project objectives}

- Management of project risk

**Limitations**

If risks are improperly assessed and prioritized, time can be wasted in dealing with risk of losses that are not likely to occur. Spending too much time assessing and managing unlikely risks can divert resources that could be used more profitably. Unlikely events do occur, but if the risk is unlikely enough to occur, it may be better to simply retain the risk, and deal with the result if the loss does in fact occur.

Prioritizing too highly the Risk management processes itself could potentially keep an organization from ever completing a project or even getting started. This is especially true if other work is suspended until the risk management process is considered complete.

**Areas of Risk Management**

As applied to corporate finance, risk management is a technique for measuring, monitoring and controlling the financial or operational risk on a firm's balance sheet.

- Enterprise Risk Management

In Enterprise Risk Management, a risk is defined as a possible event or circumstance that can have negative influences on the Enterprise in question. Its impact can be on the very existence, the resources (human and capital), the products and services, or the customers of the Enterprise, as well as external impacts on Society, Markets or the Environment.

- Project Management

In project management, a risk is more narrowly defined as a possible event or circumstance that can have negative influences on a project. Its influence can be on the schedule, the resources, the scope and/or the quality.

In project management parlance, when a risk escalates, it becomes a liability. A liability is a negative event or circumstance that is hindering the project.

Some of the processes for assessing risk include the following;

- Choosing unique identifiers for referring to the same risk in company or project documents (identification)

- Describing the risk and how it could become a liability (description)

- Assessing the consequences of that (effect)

- Considering what precautions could be taken to prevent it (precaution)

- Drawing up contingency plans or procedures for handling it (contingency)

- Categorizing the risk as new, ongoing or closed (risk status)

- Estimating the probability of the risk becoming a liability (Risk escalation probability, P)

- Estimating the consequences in terms of time for the project (Schedule impact, S)

In addition, every probable risk can have a pre-formulated plan to deal with it to deal with its possible consequences (to ensure contingency if the risk becomes a liability).

Risk in a project or process can be due either to special causes of deviation or common causes of deviation and requires appropriate treatment. That is to re-iterate the concern about external cases not being equivalent in the list immediately above.

**Chapter 5 - Design and planning for GIS**

Project lifecycle are used in GIS.

**Key Aspects of GIS project Lifecycle**

- Setting goals and estimating costs

- Functional requirements study

- Creation of a prototype

**System selection as a compromise**

Compromise involves;

- Speed

- Functional richness

- Database size

- Training

The Best "GIS" is the one that gets the job done on time and schedule.

**Planning Schedules and the Scope of Prototype and Pilot Projects**

There is nothing wrong with being cautious during the process of project planning. Rushing through the procedure exposes an organization to potentially costly mistakes. Large projects typically take many years to reach the prototype or pilot stages.

Once a prototype or pilot has been approved, even more time will elapse before full implementation is achieved. Some municipal GIS projects have been underway for over a decade and still have far to go before complete implementation and compilation of a full dataset.

Prototype and pilot projects are kept small, as is indicated in the following table. Remember, prototypes and pilots are intended to demonstrate functions and interfaces. What works best is a carefully selected test area that presents examples of common workflows. It’s a real size of little consequence in most applications.

**Applying the Insights of Project Lifecycle to Research Projects**

1. Think Ahead to How the GIS will be Used, But Keep in Mind Available Sources

2. Exert Special Care in Designing and Creating the Database

3. Always Develop a Prototype or Sample Database to Test the Key Features of the System

**Planning and Database Issues**

- Security

- Documentation

- Data integrity and accuracy

- Synchronization of usage (Concurrency)

- Update responsibility

- Minimization of redundancy

- Data independence and upgrade paths

- Privacy