

Introduction

1. In November 2003, all the Chief Secretaries and Expenditure Secretary in the Central Government were requested to involve audit in various phases of system development. Consequent to that, several State Governments have requested the local Accountant General to be involved in the development of specific systems. These guidelines are issued in order to assist field offices to effectively and constructively audit the process of system development in the auditee units.
2. The guidelines and programmes are comprehensive and relate to all the phases of the system development life cycle and are more useful when applied in context of development of large systems of capital intensive nature. In case of all systems, all of these may not be applicable. The field offices and particularly the officer who is associated with the audit of the system development process should decide which ones would be applicable.
3. System development has become critical to government departments and organizations hoping to improve governance and the delivery of services to its citizens and clients by investing in large software applications. Yet, often expensive applications development projects fail to deliver on the promises. Government departments and organizations can reduce the risk of such failures by adopting a structured approach such as System Development Life Cycle (SDLC) Methodology to guide themselves and the developers.
4. **Definition of System Development Life Cycle (SDLC) Methodology**
System Development Life Cycle Methodology (SDLC) is defined as, “a structured approach that divides an information systems development project into distinct stages which follow sequentially and contain key decision points and sign-offs. This permits an ordered evaluation of the problem to be solved, an ordered design and development process, and an ordered implementation of the solution. A final stage allows for management feedback and control through a post-installation evaluation”.
5. In practice, however, the process of development of any system tends to take an unstructured path. Problems that might not have been anticipated earlier may compell the system development team to retrace some of the route already trodden. Other methodologies like Rapid Application Development, Joint Application Design Methodology, Soft Systems Methodology etc.often are combined with the structured system development process.
6. Audit must take great care in associating itself only with such systems where a development methodology is distinctly discernible. If the methodology adopted is purely ad hoc without any clear structure and adequate documentation, it would be extremely risky to offer any comments on such systems.
7. When Audit is involved in the System Development Phase of Information Technology systems it should not take up the role of a consultant or that of an internal auditor but should remain a keen observer whose findings are reported from time to

time to the appropriate level of management for further action. Moreover it should be made clear to the auditee that audit involvement is not to be construed as an 'audit certificate' and the system performance and functioning will be open to audit in future as well.

Audit of Systems under Development

8. The audit of Systems Under Development has three main thrusts: first, to provide an opinion on the efficiency, effectiveness, and economy of project management (Project Controls); second, to assess the extent to which the system being developed provides for adequate audit trails and controls to ensure the integrity of data processed and stored (Data Controls); and third to assess the controls being provided for the management of the system's operation (System Management Controls). The first thrust is pursued by having the auditor attend project and steering committee meetings, examining project control documentation and conducting interviews. As for the second thrust, the auditor is limited to examining system documentation, such as functional specifications, to arrive at an opinion on controls.. The same is true for the third thrust, the system's operational controls.

Audit Checklist :

I PROJECT INITIATION PHASE (PI)

At this stage, terms of reference for the project should be formally defined and the project control parameters established. Procedures involve performing a preliminary review of the existing system (including manual system) to assess the need for change and the nature of the suggested changes. The "problem" must be defined. A potential solution should be conceptualized for reference during the feasibility study phase. The description of the solution need not be so detailed that it prejudices the alternatives examined during the feasibility study. At this time all external and internal constraints (cost, time, legislation, departmental guidelines, user needs, etc.) should be identified along with their impact on the problem and the solution. This phase produces a Project Initiation Report.

Audit objective: To establish that project is formally initiated and that appropriate project control measures exist.

Checklist (PI)

- PI.1.** Review the business and ensure a formal business case exists for the project.
- PI.2.** Ensure that a Project Initiation document exists and it has the approval of the competent authority.
- PI.3** If yes, then verify that the Project Initiation document contains at least the following features:
 - ➔ Broad reasons for undertaking the Project, such as:
 - ❖ The problem to be remedied or process to be improved, and/or
 - ❖ Enhancing the organisation's ability to achieve its goals, and/or
 - ❖ Description of the deficiencies in relevant existing system; and/or
 - ❖ The opportunities that would be provided for increasing economy or efficiency of operations; and/or
 - ❖ Internal controls and security needs that would be satisfied by the Project.
 - ➔ A clear statement of the project definition.
 - ➔ The project initiation document is in consonance with the Policy on the subject;
 - ➔ In case, the project is Centrally sponsored or institution-aided, then the conditions of such grants/ aid have been followed;
 - ➔ Major risks have been identified such as staff resistance, hardware/software obsolescence, and technological constraints like communication infrastructure etc. along with a statement of internal and external constraints, such as organizational changes required & impact on other systems.
- PI.4.** Ensure that the Project Initiation document has been reviewed and approved by the competent authority.
- PI.5.** Ensure that an appropriate project organization has been outlined in the Project Initiation documentation. Determine by examining the Project Initiation document that:

- ➔ Project Team members and representatives and their responsibilities have been named including:
 - ❖ Project Director /Manager
 - ❖ User Manager/Director
 - ❖ Technical Representatives
 - ❖ User Functional Representatives
- ➔ Steering Committee/ Sign Off Authority has been established and they have been delegated requisite powers.
- ➔ Evaluate the background and qualifications of project members for their assignment to specific project tasks.

- PI.6.** Ensure that the user department management has appointed personnel from its department to participate in the project.
- PI.7.** Verify that the Project Manager or one of the team members is responsible to ensure the complete and accurate accumulation of project costs.
- PI.8.** Determine from the Project Initiation document that a work plan, including target dates and resource requirements has been prepared. It delineates the manner in which each phase of the development process (the preparation of feasibility study, requirement definition, system design etc) is to be approved prior to proceeding to the next phase of the project (programming, system testing, transaction testing, parallel testing etc.).
- PI.9.** Verify that the target dates indicated in the work plan are in keeping with the resource requirements outlined and any constraints involved.

II FEASIBILITY STAGE (FS)

When this stage is complete an appropriate solution to the problem should have been determined and a preliminary plan for its implementation designed. User Requirements may be documented or established thus providing a basis for identifying the solution. It is of prime importance that enough alternative approaches be examined. A detailed analysis, at the conceptual level, of the various alternatives should support a formal justification for the suggested solution. This analysis should include cost benefit analysis, consideration of financial and operational controls, and organization compatibility. As in the project initiation phase, care must be taken that evaluations are objective and complete and that there is no "built-in" bias towards one particular solution. Resource requirements for the remainder of the project should be identified and time and costs estimated for management approval. Broken into appropriate project phases, these factors will be used to maintain and monitor project development. Documentation of the above should be contained in a Feasibility Study Report.

Audit objective: To establish that a feasibility study, including an Overall Project Plan, has been undertaken to determine the most appropriate solution to a stated problem in terms of organizational capability, economic justification, and technical suitability.

- FS.1** Ensure that steps have been taken by the project team to identify and consult all affected parties?

- FS.2** Ensure that a Technological Feasibility Study been prepared and documented?
- ➔ Is the proposed technology feasible, considering the technical sophistication existing or available through the organization?
- FS.3** Review the technology feasibility report to see if it has adequately addressed:
- ➔ Hardware needs and availability.
 - ➔ System software needs and availability.
 - ➔ Communications hardware and software needs availability. Valid time constraints in the user department's information requirements and the manner of satisfying them.
 - ➔ Operational feasibility (compliance with information architecture e.g. whether the new project fits into the current mix of hardware, software, and communications).
- FS.4** Verify that there is a consensus among user departments and designers concerning the technological aspects of the system's configuration.
- FS.5** Determine the organizational capability to manage the related technologies and to decide whether the technologies should be developed or bought, operated in-house or out, and maintained in-house or out.
- FS.6** Has a User Requirements document been prepared and released? Does it include the following expression of need in terms of the organization's mission:
- ➔ A description of the current function.
 - ➔ Analysis of the deficiencies of the current function.
 - ➔ Resources expended on the current function.
 - ➔ Volume of work produced with the current function, including peak processing performance and projected growth.
 - ➔ Internal control and security requirements.
 - ➔ Justification for improvement and changes.
 - ➔ Scope and objectives of proposed system.
 - ➔ Alternative solutions to solving the need.
 - ➔ Relationships with other systems.
 - ➔ Relationships with long-range plans and other information resource management initiatives.
- FS.7** Has the accuracy and completeness of user requirements been acknowledged by the appropriate level of user, and by Data Processing management.
- FS.8** Has the User Requirements document been reviewed by the Steering Committee/Sign off Authorities?
- ➔ Have they signified acceptance of the need to continue the project? Note any conditional acceptance for follow-up in later stages.
- FS.9** Confirm, if possible, with independent sources the reliability and track record of the recommended hardware and software.
- FS.10** Confirm if there is a plan to address the intellectual Property issues, including the ownership of source code in case of development of customised software being outsourced.

- FS.11** Check whether a Cost/Benefit document has been prepared and released? Are all costs identified as operating or capital?
- FS.12** Ensure that the analysis of the project costs and benefits was prepared to evaluate the economic feasibility of each alternative; check that
- ➔ the assumptions and constraints in the cost/benefit analysis are reasonable
 - ➔ the user and system costs cover all stages of the life cycle
 - ➔ the estimated costs for each alternative include hardware and software enhancements needed to support that alternative
 - ➔ estimated costs for each alternative includes cost of security and internal controls, data preparation and entry, file conversion, testing, parallel operations, acceptance, and related costs
 - ➔ the basis of estimation and computation of costs is reasonable
 - ➔ there is a consensus among end users, designers, and implementers concerning system costs, benefits, and contractual agreements
- FS.13** Ensure that the analysis of the project costs and benefits takes into consideration the impact on human resources. Verify that estimated costs for each alternative includes:
- ➔ training,
 - ➔ redeployment of staff,
 - ➔ ergonomic issues.
- FS.14** Check whether the accuracy and completeness of the cost/benefit analysis and acceptance of the recommended alternative has been acknowledged by the appropriate level of user and by Data Processing management.
- FS.15** Has the Cost/Benefit document been reviewed by the Steering Committee/Sign off Authorities?
- ➔ Have they signified acceptance of the recommended alternative and the need to continue the project? Note any conditional acceptance for follow-up in later stages.
- FS.16** Check whether the users of an appropriate level and Data Processing management have acknowledged that the analysis of processing alternatives is accurate and complete and agrees with the recommendations.
- FS.17** Check whether steps been taken by the project team to identify and consult all affected parties?
- FS.18** Does the Project documentation show that the skills of the staff employed on the project meet the requirements specified in the Personnel Skills Summary?
- FS.19** Has a Steering Committee Meeting Schedule document been prepared and released to all interested parties, including EDP and user management?
- FS.20** Review the minutes of the Committee meetings and note the following:
- ➔ that EDP and user management were represented at each meeting, and
 - ➔ that meetings were held regularly.

FS.21 Has a Feasibility Stage Status document been prepared and released? Verify that it contains at least the following:

- ➔ actual resources used to date, compared to planned, with reasons for variance
- ➔ actual milestones achieved to date, compared to planned, with reasons for variance
- ➔ plan for the next stage including reference to the following:
 - ❖ analyzing and specifying the user's detailed requirements
 - ❖ establishing change control processes
 - ❖ updating the cost/benefit analysis
 - ❖ obtaining management approval
 - ❖ updated budget and reasons for any changes
 - ❖ updated schedule and reasons for any changes
 - ❖ recommendation to continue or discontinue the project

FS.22 Check whether the Feasibility Study identifies the need for a System Processing Controls Specifications or similar document?

FS.23 Determine that a statement of the level of security, privacy and accessibility needed for system's data conforms to the government Acts, and that the statement is included with the documentation to be reviewed by the Steering Committee/Sign off Authorities.

III SYSTEM DESIGN STAGE (SD)

Work during this phase will translate the proposed conceptual solution, determined during the feasibility study, into a workable solution ready for detailed design and implementation.

This will require:

- **The preparation of a system outline, including flowcharts, system performance criteria and the identification, definition and preliminary formatting of all inputs, outputs and files used or produced by the system. (This will require extensive liaison with users.)**
- **An overview of the internal control framework and operating procedures to ensure that they meet the objectives of the system being developed (The proposed system should satisfy all user requirements.)**
- **The selection of facilities and job specifications for suppliers.**
- **An outline of all functional specifications to ensure that the general design meets all system objectives that have been determined.**
- **The revised costs, time estimates, and other criteria relating to future phases for management approval.**

Audit objective: To ensure that the general design of the system expands on the findings of the feasibility study, produces a functional description of manual and EDP processes, and devises an overall system design that can be used to obtain a commitment for Detailed Design Stage.

- SD.1** Check whether the organization has adopted any system development methodology and framework to ensure that a process is in place that appropriately addresses all system design issues (i.e. input, processing, output, internal controls, security, disaster recovery, response time, reporting, change control etc.)
- SD.2** Check whether a Systems Specifications document has been prepared and released? Verify that it contains at least the following specifications/features:
- ➔ system objectives and scope
 - ➔ general system concept and design considerations
 - ➔ chart showing function structure in terms of processes
 - ➔ logical data flow diagram showing flow among processes and data stores at the data element level
 - ➔ Process descriptions, including complete and detailed definitions of processes for all business cases involved.
 - ➔ Appropriate audit trails and controls are built into the system
 - ➔ Specifies volumes, timings, highs and lows, and quality specified for inputs, outputs, and data stores
 - ➔ Service levels: Complete description of performance requirements. This will be used in later stages to confirm the technical feasibility and resources requirement of the system
- SD.3** Check that the accuracy and completeness of system specifications has been acknowledged by the appropriate level of user and by Data Processing management.
- SD.4** Ensure that the System Specifications document been reviewed by the Steering Committee/Sign off Authorities? Have they signified acceptance of the need to continue the project? Note any conditional acceptance for follow-up in later stages.
- SD.5** Ensure that the data dictionary/ directory has been prepared or updated to contain the system specifications.
- SD.6** Ensure that the skills of the staff being employed on the project (as Team Members or Steering Committee/Sign off Authority members) continue to meet the requirements envisaged in the Project Initiation report or Feasibility Report.
- SD.7** Has a General Design Stage Status document been prepared and released? Verify that it contains at least the following:
- ➔ actual resources used to date, compared to planned, with reasons for variance
 - ➔ actual milestones achieved to date, compared to planned, with reasons for variance
 - ➔ a roadmap for the Detailed Design Stage, including the following activities:
 - ❖ updating the data dictionary/directory
 - ❖ carrying out the final design of all inputs and outputs
 - ❖ verification of security concerns having been met
 - ❖ need for a detailed testing plan.
 - ❖ estimating performance and resource requirements
 - ❖ updating project plans and budgets
 - ❖ updating the cost/benefit analysis
 - ❖ obtaining management approval
 - ❖ the preliminary plan for the Implementation Stage, including the following:

- ◆ identification of manual procedures to be developed
- ◆ manuals that will be affected
- ◆ facilities needs
- ◆ communications needs
- ◆ training

- ➔ an updated budget and reasons for any changes
- ➔ an updated schedule and reasons for any changes
- ➔ an updated cost/benefit analysis
- ➔ a recommendation to continue or discontinue the project

SD.8 Verify actual resources used in source documents.

SD.9 Verify that the updated budget and schedule is in keeping with the updated cost/benefit analysis.

SD.10 Verify the updated cost/benefit analysis against the cost/benefit analysis from the previous stage and from source documents.

SD.11 Determine that the updated cost/benefit analysis has taken into consideration the human resource impact requirements.

SD.12 Check the accuracy and completeness of the General Design Stage Status document and agreement with it has been acknowledged by the appropriate level of user and by Data Processing management.

SD.13 Ensure that the General Design Stage Status document has been reviewed by the Steering Committee/Sign off Authorities and have they signified acceptance of it?

SD.14 Ensure that a System Processing Controls Specifications or similar document been prepared and released? Verify that it addresses at least the following issues

Completeness

- ➔ Ensuring that all data are initially recorded and identified.
- ➔ Control should be established close to the source of the transaction.
- ➔ Output should be reconciled to input.
- ➔ Ensuring that corrections for all identified errors are re-entered into the system.
- ➔ The timing of input submissions and output distribution should be properly coordinated with processing.
- ➔ Procedures are needed to ensure that output reports are independently reviewed for completeness and form.

Accuracy

- ➔ Procedures should exist to prevent errors in the preparation of input or source data, and to detect and correct any significant errors that do occur.
- ➔ Procedures should exist to prevent errors arising when data are converted to machine processable form, and to detect and correct any significant errors that do occur.
- ➔ There should be procedures to ensure that data are transmitted accurately to the computer centre.
- ➔ Procedures should ensure that only valid files are used.
- ➔ Controls must ensure that the accuracy of data is maintained during processing.
- ➔ Procedures should ensure that program computations are performed correctly.
- ➔ There should be a system of control over the physical operations of the computer system.

- Procedures should exist to ensure that all significant errors that have been identified at various stages in the system have been corrected, re-entered and properly reflected in the output.
- Procedures are needed to ensure that all required output reports are delivered to the proper user departments.

Authorization

- To ensure that only authorized data is processed.
- Security, privacy, and accessibility level classifications for data related to the system should be determined and appropriate measures devised to ensure proper storage, transmittal, access, privacy and destruction.
- There should be a method of identifying and locating the component file records and input/output documents involved in the processing of a given transaction or in the accumulation of a given total.

Backup/Recovery

- Procedures for system backup/recovery should be documented and related training plans prepared.
- Procedures for data preparation, transcription, data control, and output distribution should be documented and related training plans prepared.

Audit Trail

- There should be logs to identify and locate the component file records and input/output documents involved in the processing of a given transaction or in the accumulation of a given total.

SD.15 Ensure that the system will operate efficiently and effectively check whether:

A System Management Controls Specifications Report or similar document has been prepared and released and verify that it addresses at least the following:

Efficiency

- There should be a standard or set of standards to determine system efficiency.
- There should be a mechanism to compare performance with standards and to report variances.
- There should be procedures for managers to follow up on variances from standards and for recording action taken.

Effectiveness

- Effectiveness standards for the system's objectives should be established.
- There should be a mechanism to determine and report situations where systems are no longer able to meet their original objectives.

Economy

- Management should have formal procedures to review projects and their resulting applications system regularly for economy.

IV

DETAILED DESIGN STAGE (DD)

Based on the functional specifications from the System design stage, detailed procedures and computer specifications are produced. All controls, procedures, work flows, input/output documents, processing logic, file/data base layouts, and data elements will be finalized. Management and user approval of this design stage is paramount. Therefore, the final product of this phase, the Detailed Design Report, should contain, in addition to detailed program specifications,

workflows, etc., a non-technical description of the entire system. This should encompass:

- a system description, objectives, inputs, outputs
- a system flowchart illustrating the conceptual design

Appropriate members of management should review the detailed specifications and technical requirements. Documented system test plans and implementation and conversion plans should also be produced at this stage, and, in addition, a plan on how the activities in the implementation and installation phases will be coordinated.

Audit Objective: To ascertain that a detailed system design is developed from the functional specification created in the general system design.

DD.1 Has a Detailed Systems Design document been prepared and released? Verify that it covers at least the following:

- ➔ system flow and description, by function
- ➔ data dictionary
- ➔ system files
- ➔ system inputs, including design of forms and video screens
- ➔ system outputs, including design of forms, reports and video screens
- ➔ system interface specifications
- ➔ system software specifications
- ➔ hardware specifications
- ➔ communications specifications
- ➔ system management utility specifications
- ➔ audit, control, and security specifications
- ➔ conversion specifications
- ➔ Ensures that file requirements for at least the following files are being structured as per system and user requirement and the organizations data dictionary rules: master, transaction, command, programme, control, table, report, print, log, transmission.
- ➔ common processing module specifications
- ➔ Input control and output control issues like :
 - ❖ does the application include control features, to help ensure that only specifically authorised persons can input transaction and master data into the system, such as access control matrix and logical access controls (including passwords and biometrics) are in place depending on the security needs of the organization.
 - ❖ do audit trails and controls provide the possibility of protecting the users against discovery and misuse of their identity by other end users (e.g. by offering anonymity, pseudonymity, unlinkability or unobservability) without jeopardising the systems security.
 - ❖ do input routines trap the userid, logon etc that permit authorised persons to identify the end user responsible for that element
 - ❖ are controls in place to ensure that all items entered can be accounted for, such as having the system automatically attach a sequential number to each item;

- ❖ are there procedures in place to help ensure that all successfully entered transactions are processed fully or followed up to ensure their proper final disposition;
- ❖ does the application include procedures that should ensure transaction are recorded into the proper period,
- ❖ does the application system include automated or manual procedures to identify transaction designed to circumvent automated controls?
- ❖ are application logs inbuilt to keep track of the transactions done? Are there controls designed to ensure that data stored in the application is protected from unauthorised changes or deletion;
- ❖ does the application system have automated or manual features designed to backup all or changed application system data at regular intervals.

- DD.2** Review system specifications for each application within the system for clarity, completeness, and consistency.
- DD.3** Review flow charts, decision tables, or narratives to assess the reasonableness of program logic incorporated in applications.
- DD.4** Check whether the accuracy and completeness of Detailed System Design specifications has been acknowledged by the appropriate level of user and Data Processing management.
- DD.5** Check that the Detailed System Design document has been reviewed by the Steering Committee/Sign off Authorities? Have they signified acceptance? Note any conditional acceptance for follow-up in later stages.
- DD.6** Check whether a program and system test plan has been developed and released? Verify that it covers at least the following both for program and system testing, and for volume and operational testing:
- ➔ overview of the software to be tested, including vendor software and conversion software and the work environment it operates in
 - ➔ test schedule
 - ➔ materials and supplies including equipment, software, storage facilities, documentation, test input, sample output, and special forms
 - ➔ training requirements
 - ➔ list of user requirements to be tested
 - ➔ list of operational requirements to be tested
 - ➔ overview of test progression
 - ➔ description of the test to be performed on each requirement including the type of input to be used, the method for recording results, constraints such as equipment or personnel availability, evaluation criteria and any data manipulation required for reporting purposes
- DD.8** Check whether the accuracy and completeness of the Test Plan has been acknowledged by the appropriate level of user and by Data Processing management.
- DD.9** Check that the Test Plan document has been reviewed by the Steering Committee/Sign off Authorities?
- DD.10** Check about all of the items in the User Requirements document being tested? Appropriate tests may include: walk throughs, simulations and prototypes. Ensure that each module program, interrelated subsystem and the system as a whole are

thoroughly tested. Sufficient time is allowed and sufficient staff (both in number and qualifications) is allocated for testing purposes. Where items are not being tested, check that a suitable explanation has been provided and accepted by the Steering Committee/Sign off Authorities.

DD.11 Check that the skills of the staff being employed on the project (as Team Members or Steering Committee/Sign off Authority members) continue to meet the requirements specified in the Personnel Skills Summary?

DD.12 Has a Steering Committee Meeting Schedule document been prepared and released to all interested parties including EDP and user management?

DD.13 Has a Detailed Design Stage Status document been prepared and released. Verify that the status document contains at least the following:

- actual resources used to date, compared to planned, with reasons for variance
- actual milestones achieved to date, compared to planned, with reasons for variance
- a roadmap for the Implementation stage, including the following activities:
 - ❖ designing the structures, logic, and flow of each system component
 - ❖ designing all data bases and files
 - ❖ estimating system performance and resource requirements and confirming that service levels will be met
 - ❖ designing conversion tools
 - ❖ coding and testing programs
 - ❖ purchasing and testing vendor software
- preliminary plan for the Installation Stage including reference to the following:
 - ❖ conversion of files
 - ❖ training
 - ❖ instruction manuals
 - ❖ redeployment of staff
- updated budget and reasons for any changes
- updated schedule and reasons for any changes
- updated cost/benefit analysis
- recommendation to continue or discontinue the project

DD.14 Verify actual resource use in source documents.

DD.15 Verify that the updated budget and schedule are in keeping with the updated cost/benefit analysis.

DD.16 Verify the updated cost/benefit analysis against the cost/benefit analysis from the previous stage and from source documents.

DD.17 Verify that the updated cost benefit analysis takes into consideration the human resource impact requirements.

DD.18 Verify the accuracy and completeness of the Detailed Design Stage Status document and agreement with it has been acknowledged by the appropriate level of user and by Data Processing management.

DD.19 Verify that the Detailed Design Stage Status document has been reviewed by the Steering Committee/Sign off Authorities and have they signified an acceptance of it?

- DD.20** To ensure that the data processed and stored by the system is complete, accurate and authorized check whether the Processing control techniques outlined in the Processing Controls Specifications Report have been included for testing in the Test Plan.
- DD.21** Verify that the test plan addresses the control requirements outlined in the Processing Control Specifications
- DD.22** To ensure that the system will operate efficiently and effectively check that the control techniques to satisfy the requirements outlined in the system management controls specification document have been included for testing in the test plan.
- DD.23** Verify that the test plan addresses the control requirements outlined in the System Management Control Specifications document

V IMPLEMENTATION STAGE (IM)

This stage creates all computer programs, forms, manuals and training material needed for an operational system. Detailed program logic will be designed and application software coded. User, operations and training manuals will be finalized and should cover, where appropriate:

- ◆ data capture
- ◆ data validation
- ◆ system audit trails and controls
- ◆ verification of analysis report
- ◆ computer operating instructions
- ◆ back-up and re-run procedures
- ◆ security procedures

All aspects of the system, including program logic and operational procedures, should be thoroughly tested. All procedures required for the installation of the system should be defined and scheduled.

Audit objective: To establish that all appropriate forms, manuals, programs and training materials have been created from the detailed systems specifications and testing has been done according to the plan.

- IM.1** Check that all manuals and other outputs required have been completed before installation begins.
- IM.2** Determine that the following have been prepared:
- ➔ conversion tools
 - ➔ user manuals
 - ➔ conversion manuals
 - ➔ training manuals
 - ➔ operations manuals
 - ➔ program and systems documentation.
- IM.3** Verify that the user manual has at least the following specifications/ features:
- ➔ Overview of the system and the environment

- Explanation of the all system inputs, programmes, output and integration with other systems
 - Explanation of all data entry screens and data display screens
 - Explanation of any and all error messages and appropriate response
 - Describes the functions sufficiently,
 - Serves as a reference document,
 - Explains how to prepare input data and parameters,
 - Explains how to interpret output results,
 - Provides a full description of the application,
 - Describes how to correct errors,
 - Describes how to recover operations.
- IM.4** Ensure that an Operators manual has been prepared which includes but is not limited to:
- System name, program name and sequence of execution
 - Definition of file names, input, procedure and output and media format
 - Console commands and parameters requiring entry by operator
 - Backup, restart, and restore procedures at various points or upon abnormal end
 - Special output forms or procedures; report/output distribution
 - Emergency fix procedures.
- IM.5** Check whether the accuracy and completeness of the required manuals and outputs have been acknowledged by the appropriate level of user and by Data Processing management.
- IM.6** Check whether the required manuals and outputs been reviewed by all members of the Project Team and have they signified acceptance? Note any conditional acceptance for follow-up in later stages.
- IM.7** Check whether parallel processing is used to support the implementation of highly complex or high risk application systems?
- IM.8** Check whether a Test Report has been prepared and released (consisting of system testing, integration testing, hardware and component testing, procedure testing, load and stress testing, tuning and performance testing, user acceptance testing and finally pilot testing of the total system to avoid any unexpected system failure. Specific technology acceptance tests should include inspection, functionality tests and workload trials).
- IM.9** Verify that the test report covers at least the following, both for program and system testing, and for volume and operational testing:
- test results
 - reasons for any testing not completed
 - follow-up action taken where required as indicated by test results
- IM.10** Check whether the accuracy and completeness of the Test Report have been acknowledged by the appropriate level of user and by Data Processing management.
- IM.11** Has the Test Report document been reviewed by the Steering Committee/Sign off Authorities and have they signified acceptance? Note any conditional acceptance for follow-up in later stages.
- IM.12** Whether the status of the project compared to the budget and schedule contained in the Detailed Design Stage Status document has been addressed.
- IM.13** Has an Implementation Stage Status document been prepared and released. If so, verify that it contains at least the following:
- actual resources used to date, compared to planned, with reasons for variance

- ➔ actual milestones achieved to date, compared to planned, with reasons for variance
- ➔ a road map for the Installation stage, including the following:
 - ❖ file conversion, including any reconciliations and sampling of results
 - ❖ training, including schedules and distribution of materials
 - ❖ distribution of user and operations manuals
 - ❖ redeployment of staff
 - ❖ updated budget and reasons for any changes
 - ❖ updated schedule and reasons for any changes
 - ❖ updated cost/benefit analysis
 - ❖ recommendation to continue or discontinue the project

IM.14 Verify actual resource use in source documents.

IM.15 Verify that the updated budget and schedule are in keeping with the updated cost/benefit analysis.

IM.16 Verify the updated cost/benefit analysis against the cost/benefit analysis from the previous stage and source documents.

IM.17 Determine that the updated cost/benefit analysis has taken into consideration the human resource impact requirements.

IM.18 Verify the accuracy and completeness of the Implementation Stage Status document and agreement with it has been acknowledged by the appropriate level of users and by Data Processing management.

IM.19 Ensure that key data controls are effective check that effective procedures are in place to ensure that no data are lost or erroneously changed during conversion to the newly designed system (e.g. the conversion date may be mistaken as the transaction date in the new system)

IM.20 To ensure that key system controls are effective ensure that

- ➔ the system acceptance is performed by quality assurance personnel by evaluating both manual and automated procedures,
- ➔ system acceptance was performed using data similar to, but independent of program testing data.
- ➔ the quality assurance group certifies in writing that the system performs in accordance with the functional and performance specifications.
- ➔ the “go/no go” decision is made by the user based on the quality assurance group’s certification and user satisfaction.

IM.21 Ensure that when the system is ready for initial operation its implementation is coordinated with all personnel involved and with the representatives of other systems that are affected.

VI INSTALLATION STAGE (IN)

This stage converts the system to operational status. The work includes converting existing files (if any) or creating the initial information base, training all personnel involved with the system (user and EDP), and instituting control and operational procedures through pilot or parallel run phase-in. All documentation from previous phases should be finalized. Conversion and installation procedures should be reviewed and tested. The project manager should issue a formal Project Completion Notice for approval.

Audit objective: To ensure that the system and any file conversions properly move from the development status to the operational and maintenance status.

- IN.1.** Whether there is a formal SDLC methodology in place for system installation, including but not limited to a phased approach of training, performance sizing, conversion plan, testing of program, group of programmes and total system, a parallel test plan, acceptance testing, security testing, operational testing, change controls, implementation and post implementation review and modification.
- IN.2.** Whether the accuracy, completeness, and authenticity of the files created by conversion are ensured through the use of appropriate control techniques.
- IN.3.** Review the conversion plan before it is executed, referring to the List of Minimum System Processing Controls.
- IN.4.** Verify that control techniques are being included in the conversion process to satisfy all control concerns.



This is an extremely critical process. No doubt about the integrity of the data in the new files should be tolerated. Control techniques such as one-to-one checks, may have to be used.

- IN.5.** Verify that the conversion was carried out according to plan.
- IN.6.** Verify that training was carried out according to the schedule prepared in the Implementation stage and that any variations have been agreed to by user management.
- IN.7.** Have installations been carried out according to the schedule prepared in the implementation Stage and have any variations been agreed to by the user management?
- IN.8.** Has user acceptance been formally agreed to, as appropriate, according to schedule? For example, if stand-alone processing locations are being installed on an independent basis, each location should sign-off its acceptance of the system.
- IN.9.** Ensure that all vendor provided system software installation passwords were changed at the time of installation.
- IN.10.** Has an installation Stage Status document been prepared and released?

Verify that it contains at least the following:

- ➔ actual resources used to date, compared to plan, with reasons for variance.
- ➔ actual milestones achieved to date, with reasons for variance.
- ➔ updated budget and reasons for any changes.
- ➔ updated schedule and reasons for any changes.
- ➔ updated cost/benefit analysis

- IN.11.** Verify actual resource use in source documents.
- IN.12.** Verify that the updated budget and schedule are in keeping with the updated cost/benefit analysis.

- IN.13. Verify the updated cost/benefit analysis against the cost/benefit analysis from the previous stage and from source documents.
- IN.14. Determine that the updated cost/benefit analysis has taken into consideration the human resource impact requirements.
- IN.15. Whether the accuracy and completeness of the Installation Stage Status document and agreement with it has been acknowledged by the appropriate level of user and by Data Processing management.

VII POST-INSTALLATION STAGE (PO)

Work during this stage consists of examining the project performance and system performance against the original project documentation of system cost/benefit and project cost and time schedules. A period of settling in is normally allowed between Installation and Post-Installation audit. The audit team could be changed at this point to maximize objectivity. Thus, project reviews are important after system installation to assess the success of the systems development process and to identify any differences in control design and control operation

Audit objective: To establish that the system operates in accordance with the design objectives and other measurement criteria, and project costs/benefits have been achieved.

- PO.1. Whether a formal post-installation review has been undertaken and the results reported to management.
- PO.2. Has a Post-Installation report or similar document been prepared?
Verify that it contains the following:
 - documentation of the system's actual achievements
 - comparison of those achievements against the original objectives
 - recommendations for improvements
 - actual resource use, compared to the original plan, with reasons for variance
 - actual milestones achieved, compared to the original plan, with reasons for variance
 - updated cost/benefit analysis
- PO.3. Verify actual resource use in source documents.
- PO.4. Verify the updated cost/benefit analysis against source documents.
- PO.5. Determine that the updated cost/benefit analysis has taken into consideration the human resource impact requirements.
- PO.6. Confirm that the organization continues to have the necessary resources to manage the Project successfully.
- PO.7. Have the needs of the business and/or end users changed
- PO.8. Do documented procedures exist for controlling all documentation?

PO.9. Have the Project documentation, training material and training program delivered and kept upto date.

PO.10. Are copies of all documentation stored off the premises?

PO.11. Are the contractual relationships satisfactory? Verify the ownership of the source code if the customized software is outsourced.

PO.12. Have all the stakeholders' issues been addressed? These include:

- The statutory process
- Communications
- External relations
- Environmental issues
- Personnel

PO.13. Is the department setting realistic targets for continuous improvement year on year from this service?

PO.14. Is the department tracking its progress to improved performance and the flow of results through milestones and the business planning cycle?

PO.15. Does the organisation have a well defined implemented and effective process for embedding improvement based on the lessons learnt from the Project?

PO.16. Change Management:

Ensure that:

- Change control is a formal procedure for both the user and the development groups
- Change control logs ensure all changes shown were resolved
- User is satisfied with turnaround of change requests- timeliness and cost
- Changes were made as documented
- Current documentation reflects changed environment
- Change process is being monitored for improvements in acknowledgement, response time, response effectiveness and user satisfaction with the process.
- Test that for a sample of changes the following have been approved by the management:
 - ❖ Request for change
 - ❖ Specification of change
 - ❖ Access to source program
 - ❖ Programmer completion of change
 - ❖ Request to move change into test environment
 - ❖ Completion of acceptance testing
 - ❖ Request for move into production
- Overall and specific security impact has been determined and accepted
- Distribution process has been developed
- Test the review of change control documentation for inclusion of
 - ❖ Date of requested change
 - ❖ Person(s) requesting
 - ❖ Approval for change request
 - ❖ Approval for change made-IT function
 - ❖ Approval of change made-users

- ❖ Documentation update date
- ❖ Move date into production
- ❖ Quality assurance sign off of change
- ❖ Acceptance by operation
- ➔ Ensure that
 - ❖ Code check in and checkout procedures for change exist
 - ❖ Change control logs ensure that all changes on log were resolved to user satisfaction.
 - ❖ Users are aware and understand need for formal change control procedures
 - ❖ Staff enforcement process ensures compliance to change control procedures
 - ❖ Documentation determines request or system change has been approved and prioritised by the management of the affected users and the service provider.

PO. 17. Do preventive maintenance schedules have any negative impact on critical or sensitive applications and is scheduled maintenance being scheduled for peak workload periods.

Literatures that have been consulted include COBIT (Control Objectives for Information & related Techniques) guidelines & Publications of Treasury Board of Canada Secretariat.

Here is a Quick Diagnostic Test for any organization which is developing an Information Technology System.

THE QUICK DIAGNOSTIC

Give the project 3 points for each "yes" answer. Give the project partial credit if you feel that is most accurate—for example, give it 2 points for "probably" and 1 point for "kind of, but not really." If the project is in the early stages, answer the questions based on the project plans. If the project is well underway, answer the questions based on what has actually happened on the project. The section following the test explains how to interpret the score.

Requirements

1. ____ Does the project have a clear, unambiguous vision statement or mission statement?
2. ____ Do all team members believe the vision is realistic?
3. ____ Does the project have a business case that details the business benefit and how the benefit will be measured?
4. ____ Does the project have a user interface prototype that realistically and vividly demonstrates the functionality that the actual system will have?
5. ____ Does the project have a detailed, written specification of what the software is supposed to do?
6. ____ Did the project team interview people who will actually use the software (end users) early in the project and continue to involve them throughout the project?
7. ____ Does the project have a detailed, written Software Development Plan?
8. ____ Does the project's task list include creation of an installation program, conversion of data from previous versions of the system, integration with third-party software, meetings with the customer, and other "minor" tasks?
9. ____ Were the schedule and budget estimates officially updated at the end of the most recently completed phase?
10. ____ Does the project have detailed, written architecture and design documents?
11. ____ Does the project have a detailed, written Quality Assurance Plan that requires design and code reviews in addition to system testing?
12. ____ Does the project have a detailed Staged Delivery Plan for the software, which describes the stages in which the software will be implemented and delivered?
13. ____ Does the project's plan include time for holidays, vacation days, sick days, and ongoing training, and are resources allocated at less than 100 percent?
14. ____ Was the project plan, including the schedule, approved by the development team, the quality assurance team, and the technical writing team—in other words, the people responsible for doing the work?

Project Control

15. ____ Has a single key executive who has decision-making authority been made responsible for the project, and does the project have that person's active support?
16. ____ Does the project manager's workload allow him or her to devote an adequate amount of time to the project?
17. ____ Does the project have well-defined, detailed milestones ("binary milestones") that are considered to be either 100 percent done or 100 percent not done?
18. ____ Can a project stakeholder easily find out which of these binary milestones have been completed?
19. ____ Does the project have a feedback channel by which project members can anonymously report problems to their own managers and upper managers?
20. ____ Does the project have a written plan for controlling changes to the software's specification?
21. ____ Does the project have a Change Control Board that has final authority to accept or reject proposed changes?
22. ____ Are planning materials and status information for the project—including effort and schedule estimates, task assignments, and progress compared to the plan thus far—available to every team member?
23. ____ Is all source code placed under automated revision control?
24. ____ Does the project environment include the basic tools needed to complete the project, including defect tracking software, source code control, and project management software?

Risk Management

25. ____ Does the project plan articulate a list of current risks to the project? Has the list been updated recently?
26. ____ Does the project have a project risk officer who is responsible for identifying emerging risks to the project?
27. ____ If the project uses subcontractors, does it have a plan for managing each subcontract organization and a single person in charge of each one? (Give the project full score if it doesn't use subcontractors.)

Personnel

28. ____ Does the project team have all the technical expertise needed to complete the project?
29. ____ Does the project team have expertise with the business environment in which the software will operate?
30. ____ Does the project have a technical leader capable of leading the project successfully?
31. ____ Are there enough people to do all the work required?
32. ____ Does everyone work well together?

33. ____ Is each person committed to the project?

Total

____ *Preliminary score.* Add up the points next to each answer.

____ *Size multiplier.* Write in 1.5 if the project team has 3 or fewer full-time-equivalent people including developers, quality assurance personnel, and first-level management. Write in 1.25 if it has 4 to 6 full-time-equivalent people. Otherwise, write in 1.0.

____ *Final score.* Multiply the preliminary score by the size multiplier.

Scoring Guidelines

The table below explains how to interpret the score.

Score	Comments
90+ Outstanding	A project with this score is virtually guaranteed to succeed in all respects, meeting its schedule, budget, quality, and other targets. Such a project is fully "self-actualized."
80–89 Excellent	A project at this level is performing much better than average. Such a project has a high probability of delivering its software close to its schedule, budget, and quality targets.
60–79 Good	A score in this range represents a better-than-average level of software development effectiveness. Such a project stands a fighting chance of meeting either its schedule or its budget target, but it probably won't meet both.
40–59 Fair	A project with this score will likely experience high stress and shaky team dynamics, and the software will ultimately be delivered with less functionality than desired at greater cost and with a longer schedule.
< 40 At Risk	A project with this score has significant weaknesses in the major areas of requirements, planning, project control, risk management, and personnel. The primary concern of a project in this category should be whether it will finish at all.

This quick diagnostic material is adapted, with thanks, from the Survival Guide Website at www.construx.com/survivalguide/. This Material is copyright © 1993-1998 Steven C. McConnell.