Canada

ANALYSIS GUIDE

INFORMATION SYSTEMS MANAGEMENT

Regional Economic Expansion
Expansion Économique Régionale

DEPARTMENT OF REGIONAL ECONOMIC EXPANSION

SYSTEMS DEVELOPMENT LIFE CYCLE METHODOLOGY

ANALYSIS GUIDE

OCTOBER, 1981

I N D E X

NOTE: It is recognized that all roles referred to throughout this document will be filled by persons of either sex. However, to maintain readability, personel pronouns of the male gender are used.

He should be read as he/she.

His should be read as his/hers.

Him should be read as him/her.

SYSTEMS DEVELOPMENT LIFE CYCLE METHODOLOGY

ANALYSIS GUIDE

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1. INTRODUCTION

1.1 Purpose

- The purpose of this document is to provide analysts and their managers with an easy to read guide to carrying out analysis in any phase of an information systems development project.

- Although the underlying philosophy of this methodology is a belief that the analysis approach must be disciplined and structured in order to be successful, the guidelines contained herein are flexible.

- It is unlikely that any two development projects will be of similar size and complexity or have identical expectations. In view of this, managers are advised to use their discretion in adapting the methodology to match the specific circumstances of each project.

- Each phase is described in terms of its objectives, inputs, method, working documents and deliverables. Detailed descriptions of the deliverables can be found in the Deliverables Reference Manual.

1.2 Objectives

The methodology provides techniques and methods for:

- accurately specifying information and processing requirements which form the basis for system design;
- effective and efficient use of human resources engaged in the analysis process;
- management of large and complex analysis projects;
- encouraging analysts to think in a structured way about information systems problems;
- assessing progress by establishing regular checkpoints;
- controlling integrity and quality through review and approval of output; and
- clearly communicating results through graphics and descriptions written in plain business language.

1.3 Scope

- Although this phase is concerned with the functional analysis of information systems requirements, the terms "analysis" and "systems analysis" are used instead. Because the use of the term "function" usually has organizational connotations, application of the term "functional analysis" may generate confusion. The reason for this is that the process and the products of functional analysis do not necessarily follow existing or predetermined organizational lines. On the contrary, in the first instance pure functional analysis eliminates the existing "system" mechanisms (one of which is organization) in order to examine the logical information requirements free of physical constraints.

- This guide describes the key activities and procedures related to systems analysis carried out primarily in the Analysis phase of a systems development project life cycle. Since systems analysis is also carried out in a general, but more limited extent, in Systems Planning and during the Feasibility Study phase, the principles of analysis apply also to those activities.

- Non-analytical duties, that form part of an analyst's responsibilities within a project management administrative framework, such as progress reporting and budgetary control, are also covered in the Project Management Handbook.

1.4 Other Aids

This guide should be used in conjunction with:

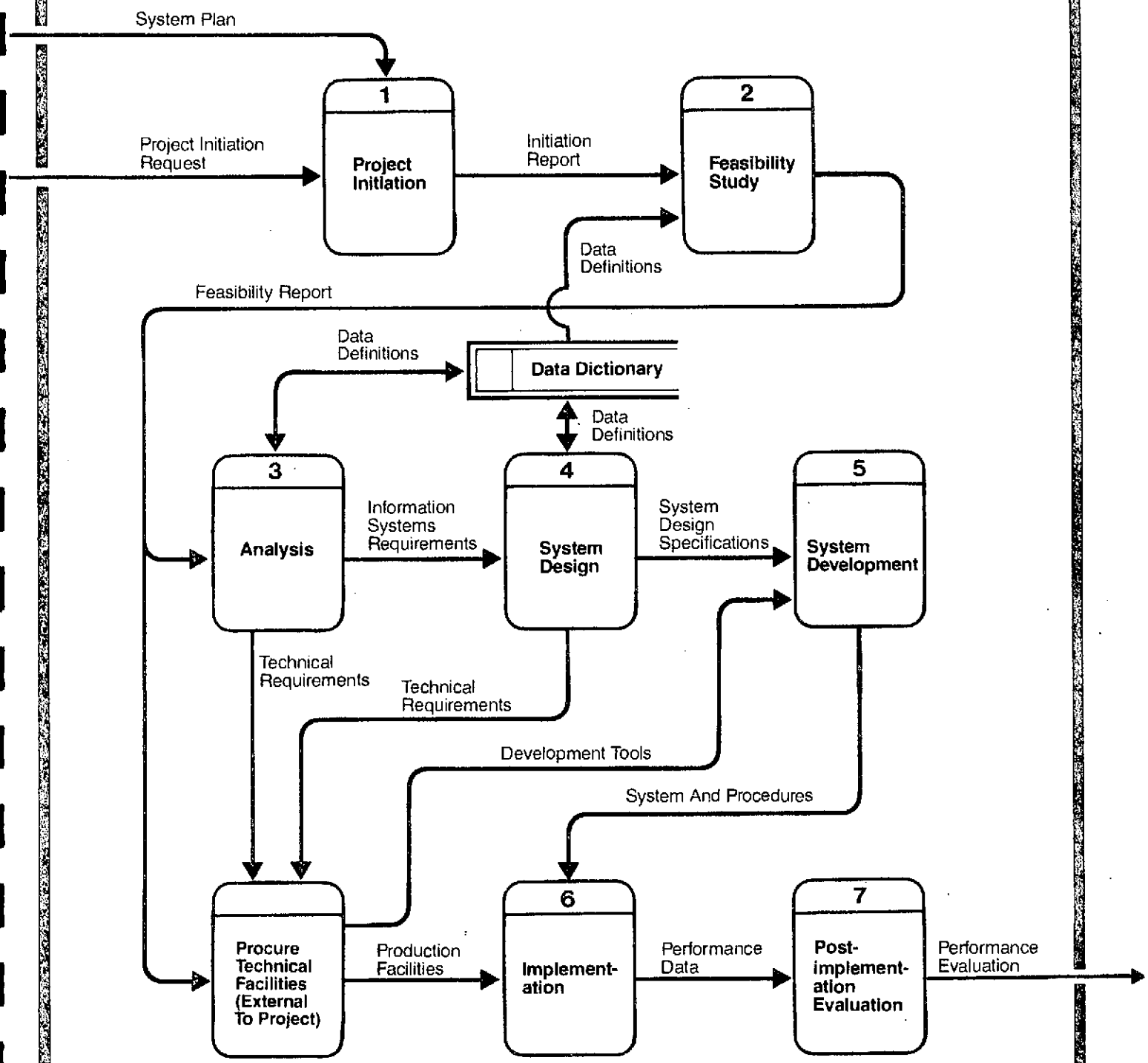
- Project Management Handbook;
- Deliverables Reference Manual.

SECTION 2

SUMMARY OF SYSTEM DEVELOPMENT LIFE CYCLE

2.1 Overview Data Flow Diagram
2.2 Phase Summaries

Systems Development Life Cycle



2.2 Phase Summaries

The preceding diagram illustrates the phases comprising the System Development Life Cycle of most information systems project. It depicts how the cycle commences with the receipt of a Project Initiation Request and ends with the preparation of a Post-Implementation Evaluation Report following system implementation. The end of each phase represents a major checkpoint where management, external to the project, may review the continuing viability of the project and, as appropriate, commit only the resources needed to complete the following phase.

Summaries of each phase are as follows:

. Project Initiation

Every project begins with the identification of an opportunity to be exploited, a problem to be solved, or a requirement to be satisfied. This phase starts when a request is received (on a Project Initiation Request form) from a user. The request is first screened to ensure that it is properly authorized, that it is consistent with overlal systems plans, that the source of development funds is identified and that there is justification for proceeding further. Following this, details of the request are documented by a (Business) Systems Analyst. He/she prepares a brief Initiation Report which documents the issues to be addressed, objectives, scope, benefits, timeframe, policies, constraints and potential solution strategies.

The objective of the report is to outline for management the initial perception of the issue, and to recommend an action plan to study the feasibility of various solutions.

Normally, preparation of the report takes one half of a day or so.

. Feasibility Study

This phase involves the Analyst working together with user management in the research and analysis of subject related data in order to document general user requirements and to identify various solutions. These solutions are both manual and automated, and are evaluated for their relevance and costs/ benefits.

The overall objectives are to select a solution (or path), to develop a conceptual system design, and to secure further resources in order to perform a detailed analysis of the information systems requirements.

The Feasibility Study is carried out at a general, or conceptual, level. It provides management with an early opportunity to evaluate the project's viability before any substantial amounts of money have been expended, and to re-evaluate it in relationship to the user's priorities and strategies.

- Analysis

The Feasibility Study examined the issue being addressed by the system at a general level. The Analysis phase examines it at a very detailed level. The precise business processes and the set of information forming the business system are clearly defined.

This establishes the basis for outlining the system from a user perspective. For EDP systems, this means that at the end of this phase the user will know what information is included in the system and what business processes will be computer assisted.

The Analysis phase involves substantial end-user participation since it is during this phase that the business content of the system is documented in preparation for the design and development phases.

- System Design

Whereas the Analysis phase defined the "what" of the system, the System Design phase defines "how".

The specifications delivered by the Analysis phase represent the bridge between the user community, who collectively define the business requirements for the project, and the project designers who design a system to address these requirements.

User participation in this phase involves reviewing and approving more detailed aspects of the system such as report and screen layouts, office procedures, forms etc.

- System Development

  The objective of this phase is to develop the working procedures and, if automated, the computer programs according to the system design specification. The procedures and programs are tested to ensure that all components of the system work properly.

- Implementation

  In this phase the working procedures and programs developed are made operational. Users are trained in preparation for the live running of the new system, data files are converted from old media to new media, and the new system is installed. Parallel running, when applicable, takes place.

- Post-Implementation Evaluation

  This phase studies the operational performance of the system for a pre-determined period, and presents to management its conclusions and recommendations. Optionally, according to management's preferences, it may also study the effectiveness and efficiency of the development process itself.

SECTION 3

ROLES IN SYSTEM DEVELOPMENT LIFE CYCLE

3.1 Major Responsibilities by Phase (Matrix)
3.2 Summary of Roles

3.1 MAJOR RESPONSIBILITIES BY PHASE

PHASE	DELIVERABLE/TASK	APPROVAL AUTHORITY	MANAGEMENT AUDIT	USER		PROJECT TEAM			
				MANAGEMENT	STAFF	PROJECT MANAGER	SYSTEMS ANALYST	SYSTEMS DESIGNER	PROGRAMMER
1. Initiation	Initiation Report	Approve	Approve	Approve	Participate	Prepare			
2. Feasibility Study	Feasibility Report -User Requirements -Conceptual Solution	Approve	Approve	Approve	Participate	Review	Prepare		
3. Analysis	Requirements		Review	Approve	Participate	Review	Prepare	Participate	
	Approval Authority Submission	Approve		Approve		Prepare			
4. System Design	EDP Design Specification		Review		Participate	Approve	Review	Prepare	
	Design of User Aids			Approve	Participate	Review	Prepare	Participate	
	Approval Authority Submission	Approve		Approve		Prepare			
5. System Development	Program Design							Participate	Prepare
	Program Code						Review		Prepare
	Program Test					Approve	Review		Prepare
	System Test		Participate			Approve	Prepare	Perform	Participate
	Operations Manual					Approve	Participate	Prepare	Participate
	User Manual			Approve	Participate		Prepare	Participate	
	Procedures Manual			Approve	Update		Participate		
	Training Manual			Approve	Participate	Review	Prepare		
	Approval Authority Submission	Approve				Prepare			
6. Implementation	Acceptance Test		Participate	Approve	Perform		Participate	Participate	Participate
	Conversion			Approve	Participate		Participate	Participate	Participate
	Production Operation				Perform				
	Approval Authority Submission	Approve				Prepare			
7. Post-Implementation Evaluation	Evaluation Report	Approve	Participate	Approve	Participate	Approve	Prepare		

3.2 Summary of Roles

Approval Authority

The Approval Authority for any information systems project may be a systems management committee, a project steering committee, the head of ISM (Information Systems Management) or a senior functional manager depending upon the nature of development project.

The Approval Authority acts on behalf of the user by approving each of the end-of-phase submissions, by allocating resources to each project phase, and by maintaining control over the project's progress. These responsibilities are exercised through periodic receipt of documents and submissions from both the Project Manager and the Systems Assurance Manager. Refer to the Departmental ISM policy manual for specific policies related to the approval process.

Business Systems Analyst

See: Systems Analyst

Data Analyst

A Data Analyst provides functional guidance and support to the project on matters related to the logical representation of data in project specifications. A Data Analyst is a specialist in data and data relationships. External to projects, he models the department in terms of its data for the purpose of developing efficient, cost effective data management facilities, e.g., data bases. In order to achieve this he must develop data models for each project application and synthesize them into the Departmental data model.

NOTE: The Data Analyst's role may not be a full-time staff position. The role may be filled by staff with other responsibilities.

Inspector

An Inspector reviews project specifications in order to assure their quality prior to release external to the project. In this regard he examines specifications for consistency in level of detail and style, and adherence to standards. He also looks for incompatabilities among related documents.

Depending upon the size of the project team and the volume of project deliverables, the Inspector may be one individual appointed for the duration of the project, or he may be any member of the project team (for example, a Systems Analyst) appointed for the inspection of a single document.

An Inspector should not review specifications which he developed.

Programmer

A Programmer designs, develops and tests program modules using structured programming techniques. He may also be required to perform duties in system testing, acceptance testing, conversion and post-implementation support.

See Programming Guide for further details.

Project Manager

The Project Manager has overall responsibility for achieving the project goals through the day-to-day conduct of the project. In this respect, he develops operational plans and budgets, acquires the required resources, identifies and organizes the appropriate business and technical expertise, periodicaly submits plans, requests for approval and progress reports to the approval authority, coordinates with user management and the Systems Assurance Manager user participation in the project, conducts regular project management progress meetings and ensures effective quality control over project deliverables.

See Project Management Handbook for further details.

Steering Committee

See: Approval Authority

Systems Analyst

A Systems Analyst identifies, analyzes and specifies information systems requirements using structured analysis techniques. He may also carry out ancillary duties involving user interface such as development of user manuals, training, system conversion, and acceptance testing. Systems Analysts may be members of a user section or branch (Business Systems Analysts) or may be drawn from ISM staff.

Systems Assurance Manager

The Systems Assurance Manager represents the departmental interest in a systems project and is responsible for ensuring that all user-related matters pertaining to quality control are addressed. Acting on behalf of the user, the Systems Assurance Manager:

- participates with the Project Manager in planning the commitment of user resources to the project;

- ensures that the appropriate level and quality of user resources are available to the project (i.e., that sufficently senior user personnel are assigned the key review and sign-off roles for all user-related deliverables produced by the project team);

- ensures that the user community's participation is comprehensive and active;

- verifies that the Project Manager has obtained user sign-off of all user-related deliverables (it is the responsibility of the Project Manager to obtain each sign-off);

- verifies that any changes to project plans which impact the user community have been agreed and approved by the user community;

- brings forward user concerns regarding the project to the Steering Committee for resolution if and when these concerns cannot be addressed through negotiations between the Project Manager and the user community;

- reports to the Steering Committee on user satisfaction with the project.

Ideally, the Project Manager and the Systems Assurance Manager should work cooperatively to support the successful execution of the project. Situations may arise, however, in which the Project Manager and the Systems Assurance Manager disagree (i.e., the Systems Assurance Manager may request, on behalf of the users, the expansion of the project scope, beyond the terms of reference understood by the Project Manager). The Project Manager and the Systems Assurance Manager are jointly responsible for making every effort to resolve any such disagreements to the mutual satisfaction of the project team and the user community. Disagreements should be brought forward to the Steering Committee only when resolution cannot be achieved through negotiation.

System Designer

A System Designer transforms information systems requirements, in the form of functional specifications, into system and sub-system design specifications using structured design techniques. Although a System Designer is normally the designer of the computer internals - system transactions, screens, files, input, output, etc. - this role may also encompass design of user aids such as training packages and user manuals.

See Design Guide for further details.

Technical Specialist

A Technical Specialist provides functional support and guidance to the project on matters of a technical nature. These would include hardware studies, telecommunications networking, technical feasibility of design alternatives, and acquisition and use of development tools.

He is considered "external" to any project and his abilities are shared on an organization-wide basis. This is to optimize the economic efficiency of using specialized technical staff.

User

The User's role in the Systems Development Life Cycle relates to those activities which have direct impact on him and his area of responsibility. These include:

- definition of systems subject matter;
- planning and provision of subject matter expertise;
- delegation of authority to staff assigned to participate in development activities;
- quality control over subject matter documented by the project team;
- training of staff;
- preparation of administrative environment for system installation;
- approval and acceptance of project deliverables.

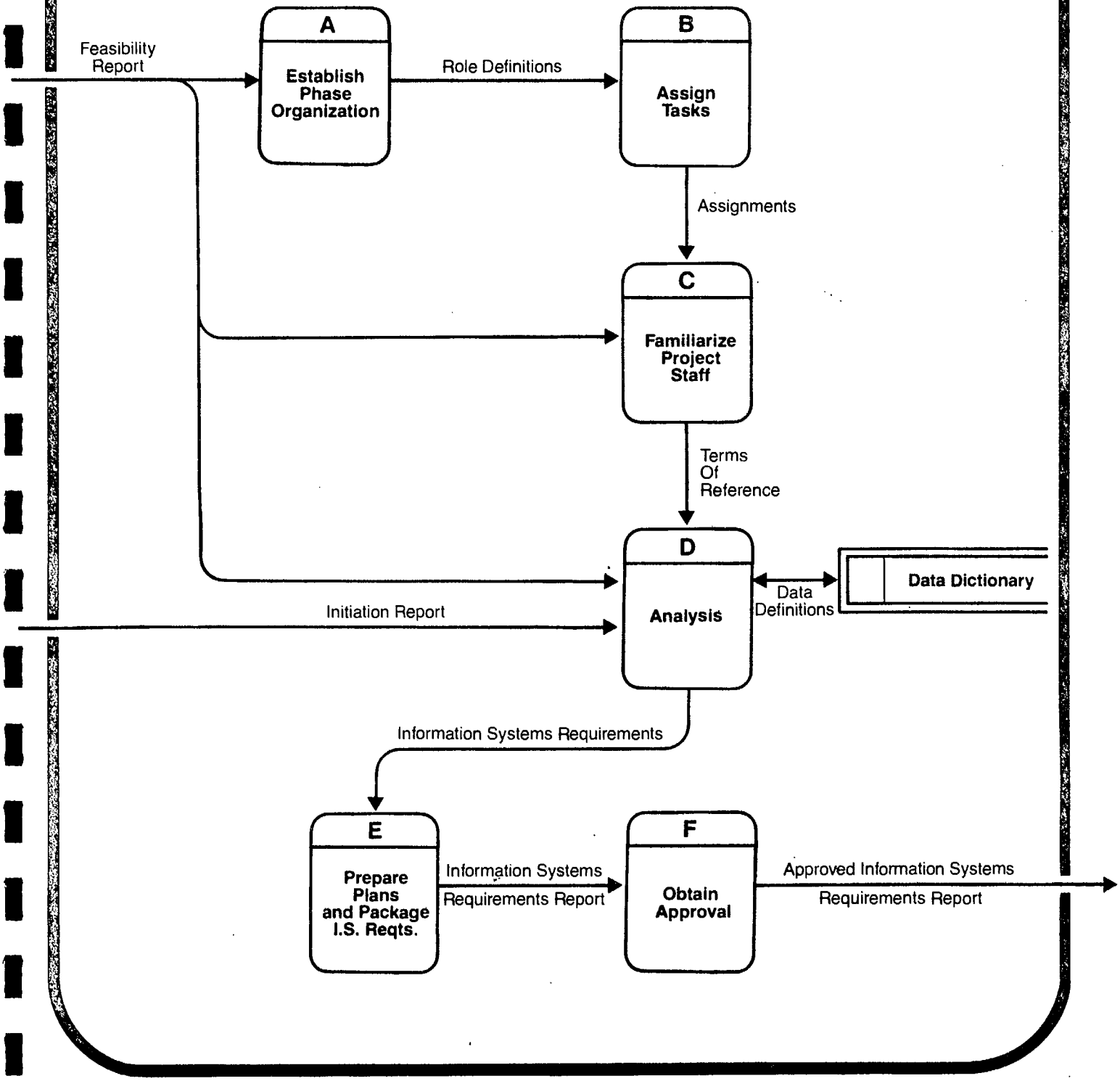
In some sections or branches, user staff may also be engaged in carrying out development roles, such as systems analysis. These are not considered user roles.

See the User's Guide for further details.

SECTION 4

THE METHODOLOGY

Phase 3 — Analysis



4. THE METHODOLOGY

4.1 Introduction

Analysis processes are carried out at three distinct levels of detail in the information systems management cycle. At the highest level, they are part of the systems planning process when an information systems development framework as a whole is formulated for the Department. The two lower levels occur during two phases in the life cycle of any systems development project. These are the Feasibility Study phase and the Analysis phase.

Each of the three stages involve similar activities:

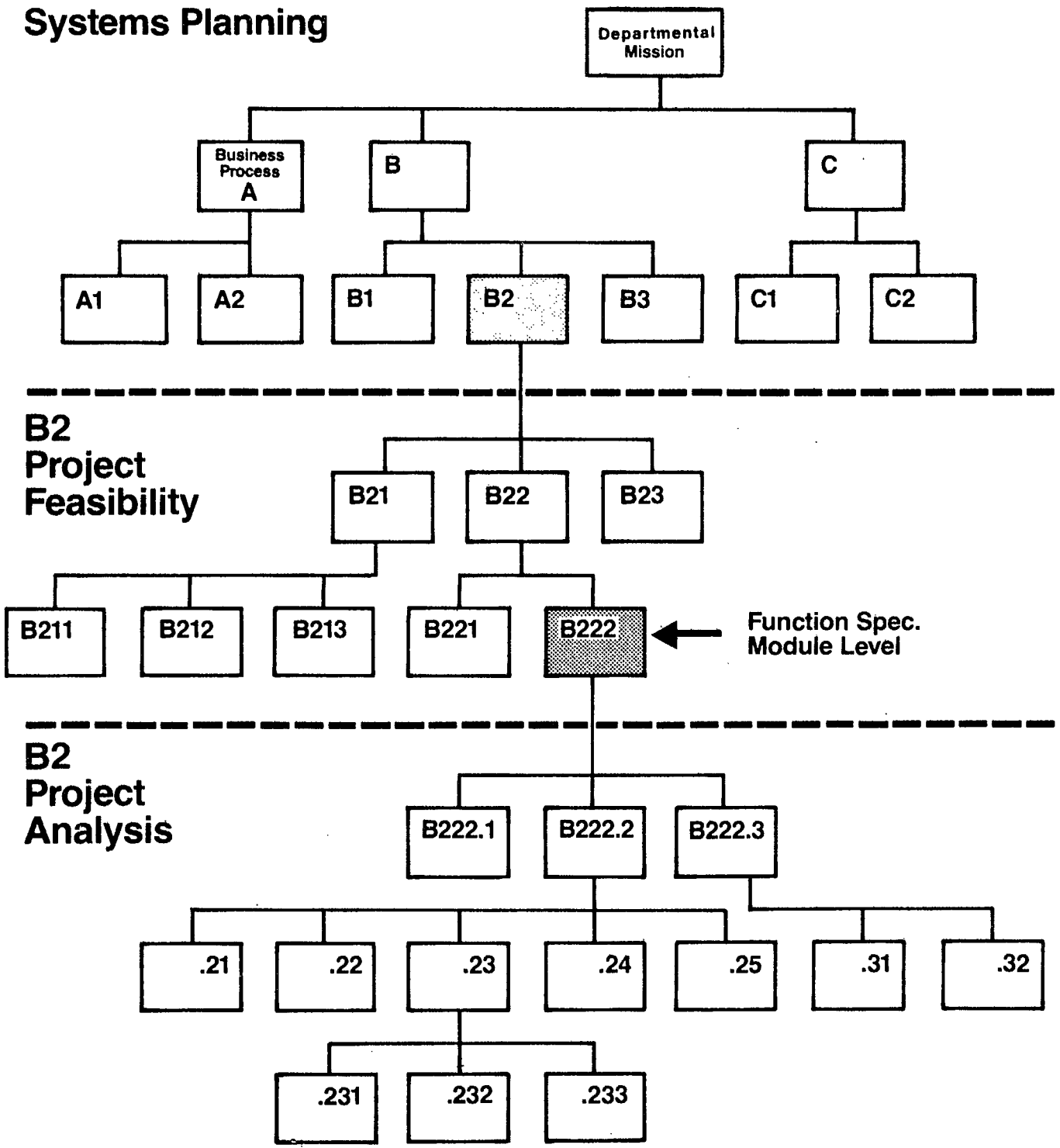
- data gathering and research to identify problems, requirements and opportunities to improve information systems;
- analysis of business processes and information requirements;
- analysis and evaluation of the mechanisms of existing systems;
- development and specification of requirements;
- conceptual design.

A structured "top-down" approach is applied to the research, analysis, development and specification of requirements. The use of function charts initially and then data flow diagrams is an essential element of the process.

Starting in systems planning, requirements are represented hierarchically and model the assignment in terms of its major business processes and its major information flows between the processes. During individual project development, parts of the high level hierarchy are progressively broken down to form individual hierarchies.

The format of the three level functional (business process) hierarchy is represented on the following page.

Business Processes



During Systems Planning, information system projects are identified in the first two to four levels of the hierarchy.

The next analysis activity will take place once one of the projects in the hierarchy is initiated and a feasibility study is performed. During the study a project hierarchy is developed reflecting the business processes being addressed. This hierarchy will stay at a general level but with enough detail to be able to develop and evaluate conceptual system solutions.

Through this process, the study will have identified one or more sub-processes which will be subject to detailed analysis during the Analysis phase. In the example, business process B2 is the subject of the feasibility study, and B222 will be one of the components analyzed in the Analysis phase. Ultimately B222 and other components will have their own hierarchy documented in functional specification modules. Each module will contain precise specification of the information and data processing requirements of all the elementary business process at the bottom of the hierarchy. Since the development of each level of the hierarchy implies consideration of data relationships between each of the processes, all the specifications at the elementary level should be "integrated". This is achieved through the use of data flow diagrams which mirror the function charts.

Because most of the analysis tasks occur during the Analysis phase of any project, and because all the basic principles of the methodology are applied at that time, this guide describes the methodology only in the context of the Analysis phase. This eliminates unnecessary redundancy.

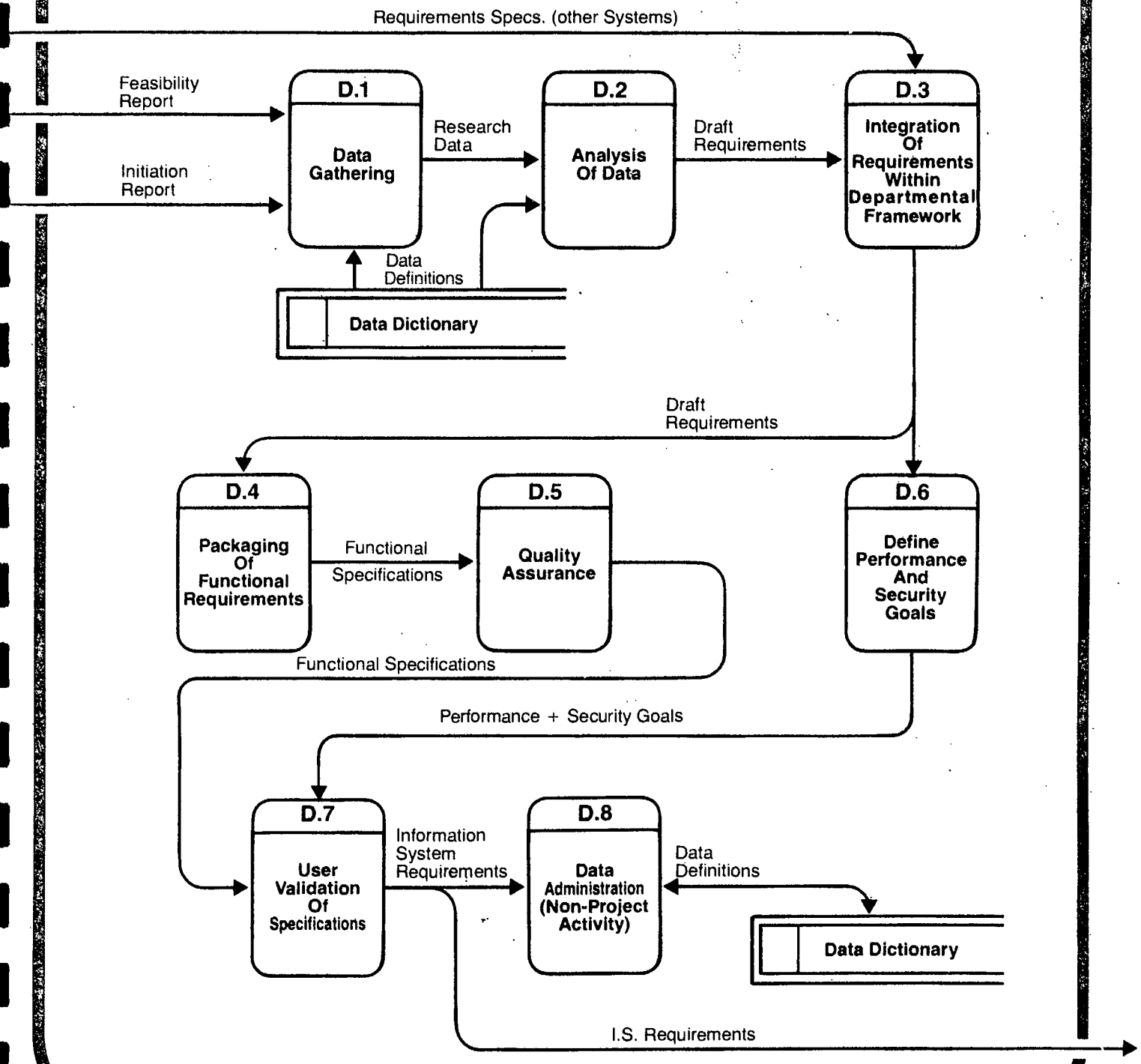
The rest of this guide describes in detail methods and techniques for the following Analysis phase processes:

- Data Gathering
- Analysis of Data
- Integration of Requirements within a Departmental Framework

- Packaging of Functional Requirements
- Quality Assurance
- Definition of Performance and Security Goals
- User Validation of Specifications
- Data Administration (non-project)
- Prepare Plans and Package Information Systems Requirements
- Departmental Approval

Management discretion should be applied when planning small or modest undertakings where less rigorous formality may be appropriate.

Activity 3.D — Analysis



4.2 Starting Off (3.A to 3.C)

Before carrying out any analysis work it is mandatory to spend some time familiarizing analysts with the project.

The project manager or analysis team leader conducts a seminar to introduce analysis team members to general aspects of the project. Basing it upon the Initiation Report and the Feasibility Report, he uses the seminar to establish a common understanding of the phase objectives and the integrated nature of the business processes being analyzed. The Analysis team leader is responsible for ensuring that team activities are coordinated, and that the products of each team member are compatible and consistent with that of the others.

It is the analyst's responsibility to acquire a thorough understanding of the aims of the phase and of the project as a whole. Of particular importance is the definition and scope of the business processes to be analyzed. The analyst must verify that the boundaries of the study are unambiguously defined by the input documents and well understood before proceeding further.

Familiarization with the project and the user's business is especially important for the analyst working on the project.

Also important are the policies and constraints imposed on the undertaking by the user in the Feasibility Report and the Initiation Report. In this regard, the analyst must be clear as to the type of requirement to be analysed. Are the business processes operational ones requiring precise definition of the input data, processing steps and output data? Or are they managerial ones whose requirements are specified in terms of their information needs only, and do not require definition of the precise managerial process?

The answers to these questions must be clearly stated and understood if the analyst is to stay within the terms of reference of the project.

4.3 Data Gathering (3.D.1)

Objectives

- To assemble a comprehensive set of information and statistics concerning the business processes under study.
- To identify key users and sources of information for use in the Analysis phase and subsequent phases of the project.
- To demonstrate a broad understanding of the subject matter by diagramming the existing system in terms of its data flow.

Input

Feasibility Report
Project Initiation Report

Method

- Summary of Steps

  - Identification of Sources of Information
  - Research of Printed Material
  - Walkthrough 1 (Optional)
  - Interview Users
  - Representation of the Existing System Flows
  - Walkthrough 2

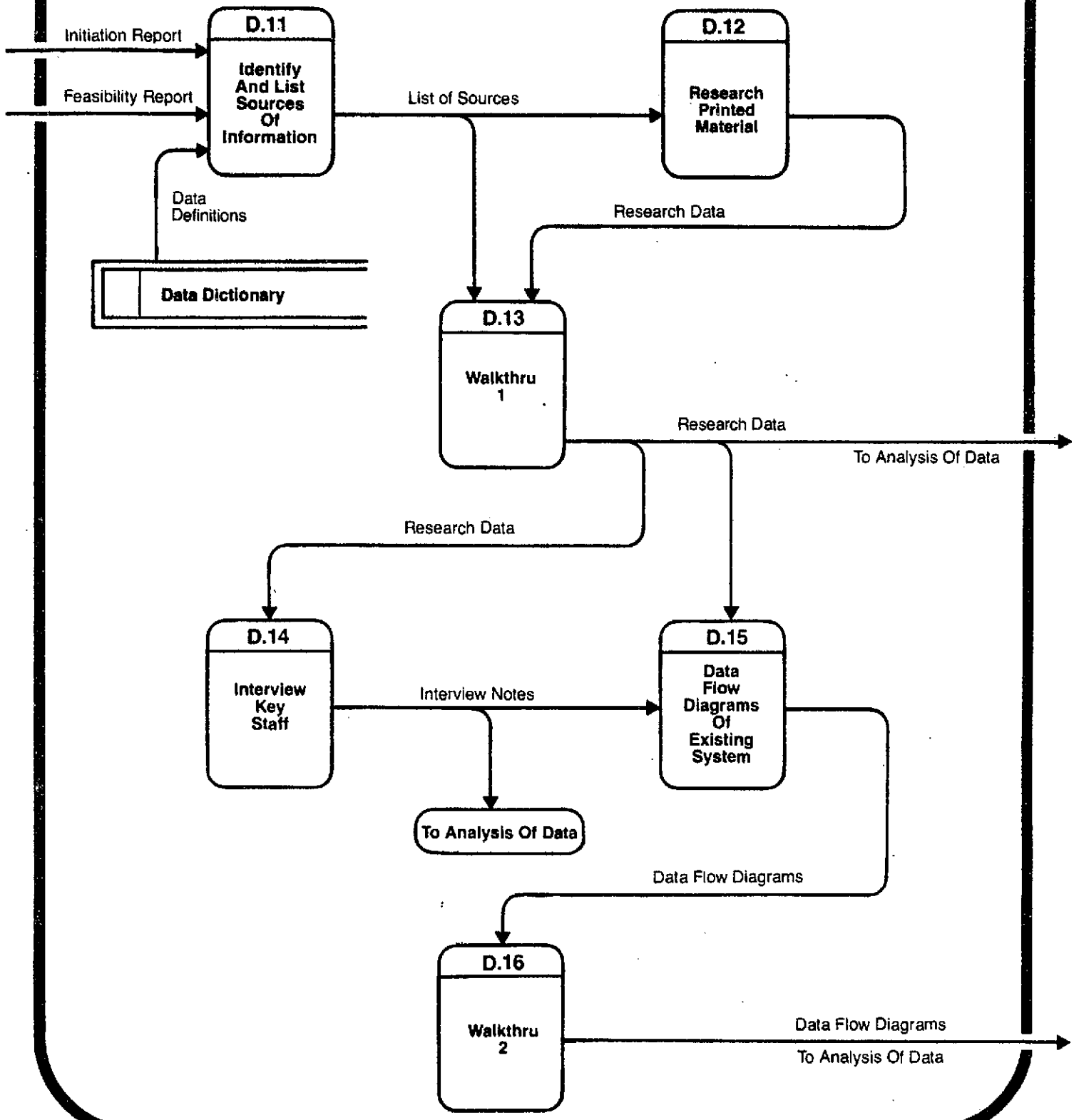
- Identification of Sources of Information

  A list of sources of information is compiled containing references to:

  - Related Functional Specifications
  - Procedure Manuals
  - Specifications of existing systems
  - Relevant Policy Documents
  - Correspondence files
  - Organization Charts
  - Job Descriptions/Role Definitions
  - Any other relevant printed material
  - Key staff and their organizations
  - Sources of transaction volumes

  As the Analysis phase progresses this list is updated as part of the set of project records maintained by the project team.

Activity 3.D.1 – Data Gathering



. Research of Printed Material

Interviews with key staff are preceded by study of available printed material and discussion with knowledgable project team members. This is to maximize the use of time in an interview as well as to establish a rapport with the user on first contact. The product of this initial research should be a developing understanding of the functional structure of the business under study. As this occurs, the analyst sketches out the structure on a function chart (see figure one next page).

. Walkthrough 1 (Optional on smaller projects)

A walkthrough (see Appendix C) is conducted by the analyst to present material developed so far. As a minimum, the walkthrough will examine the List of sources and the preliminary function chart (in conjunction with the High Level Charts from the Feasibility Study and other related function charts).

Attendees:

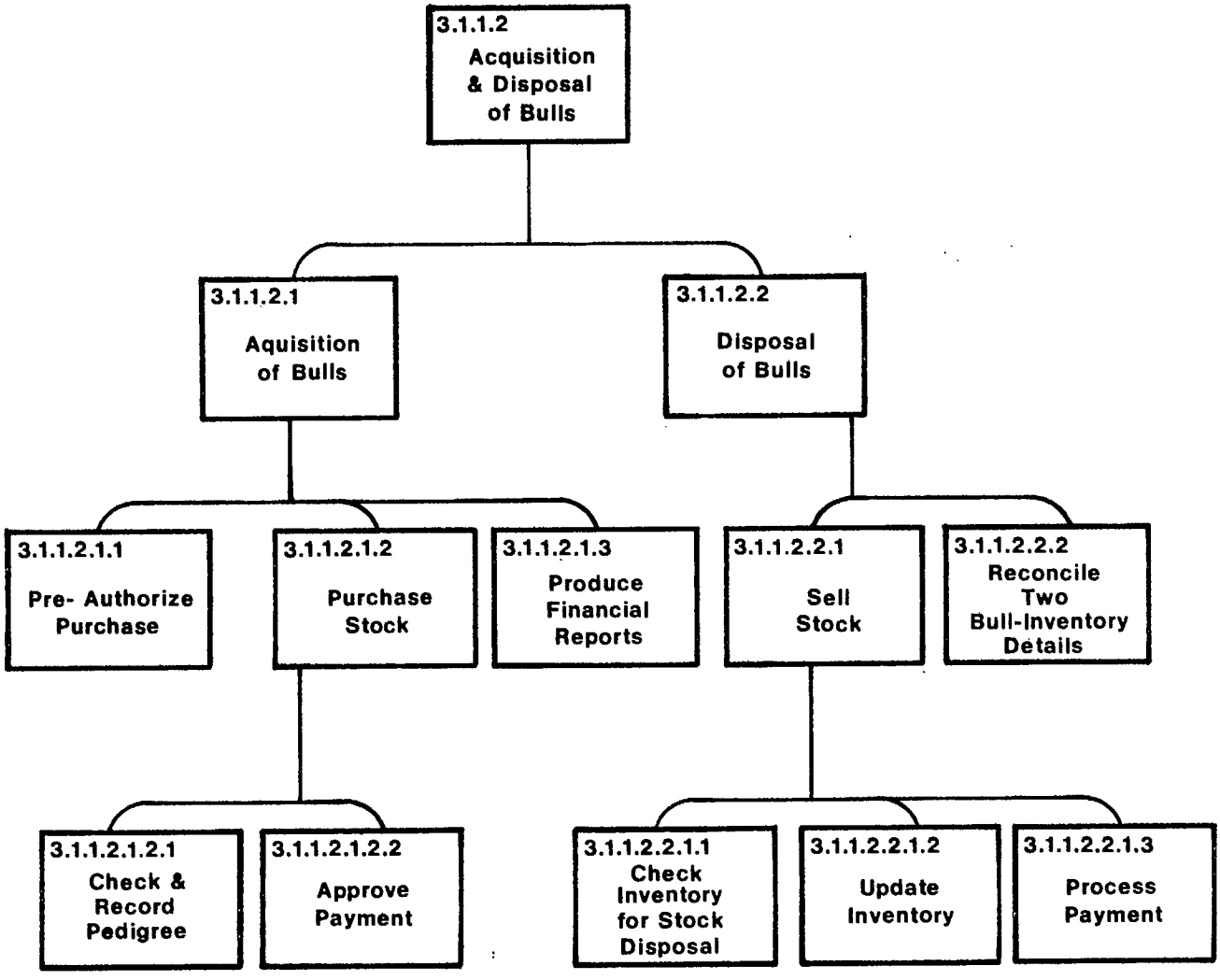
- Team Leader (or Project Manager);
- Analysts responsible for analyzing related business processes; and
- Data Analyst (optional).

The objectives are:

- To confirm that the initial research has been done;
- To verify that the developing understanding of the functional structure is compatible with the general view presented by the team leader; and
- To provide the analyst with additional insight into the subject.

Minutes of the walkthrough are taken.

ACQUISITION AND DISPOSAL OF BULLS



- Interview Users

  Interviews are planned to proceed "top down", from functionally higher levels of staff on down.

  Support from user management is essential and prior management commitment should have been obtained through the project planning process.

  Once an interview is scheduled, careful preparation will help maximize use of time available. The user is advised in writing before the interview of the objectives of the interview, in sufficient detail that he can also be prepared. Double teaming at interviews is to be arranged when different analysts are examining related business processes. This maximizes use of the interviewee's time by eliminating potential repetition in overlapping areas.

  The Interview Action List (Appendix A) is a useful aid to planning interviews.

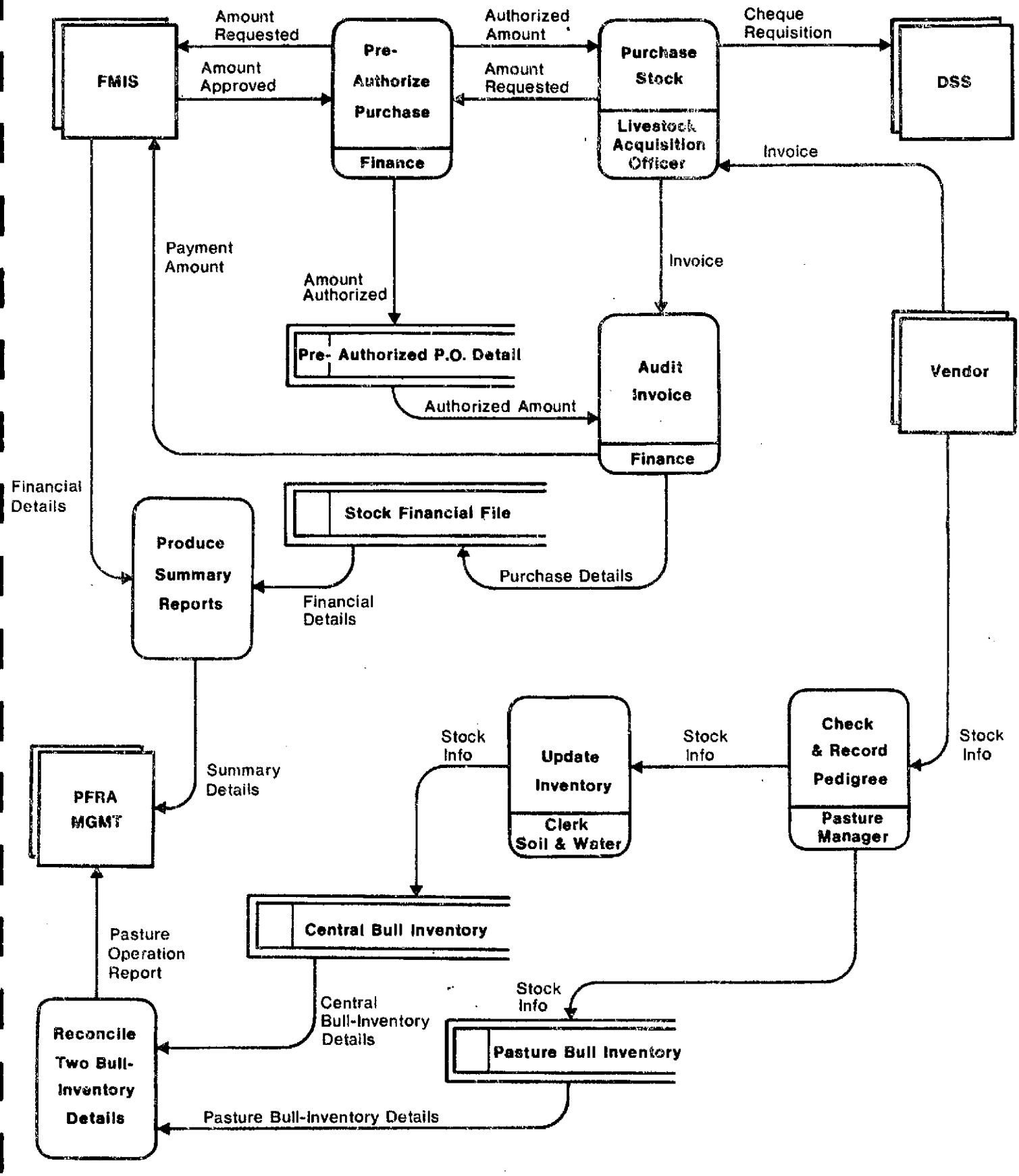
  An Interview Checklist (Appendix B) should be used as a basis for structuring and controlling the interviews. The questions to be asked and the strategy to be applied will depend upon the relative level of responsibility of the interviewee. For example, senior management will not take too kindly to being asked for detailed lists of data elements. These will have to come from somebody else. Therefore it is up to the analyst to use his skill in adapting the interview to the level and outlook of the interviewee, and still achieve the objectives.

  Essential activities after the interview are the prompt documenting of the interview record and its verification or amendment by the interviewee. The latter activity is useful as a memory jog for any promised follow-up activities.

- Representation of the Existing System Flows (see Physical Data Flow Diagram on next page).

  To develop an understanding of the current physical business context, a data flow diagram of the existing system is developed. This helps to determine who the users are and indicates areas potentially impacted by the introduction of new systems. It is also a tangible demonstration to users of the analyst's understanding of the existing environment. When documented competently it helps to increase the users confidence in the analyst and, consequently, in the project.

ACQUISITION OF BULLS
PHYSICAL 3.1.1.2.1



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Concurrent with the above the following working documents are developed:

- refined function charts;
- preliminary logical data flow diagrams;
- preliminary data models.

Logical data flow diagrams are distinct from physical data flow diagrams in that they reflect the flow of data among the business processes appearing on the corresponding Function Charts. Therefore all reference to existing physical mechanisms and flows are absent. They will not necessarily be reconcilable to the physical data flow diagrams of the existing system. Physical DFD's are drawn in terms of the physical context of existing forms, interfaces with existing system mechanisms and existing organizations; that is to say, in terms of the way things are done currently.

Data models, representing the data relationships, are documented by the data analyst concurrently with assisting the systems analyst in the logical representation of the data itself. The data analyst uses existing data models as references for initiating department-wide compatibility early in the Analysis phase.

A data model is a representation of the logical structure of data required by the user to carry out his business. It is the user's (as opposed to application) view of data, independent of the physical mechanisms used for access or storage. It is used predominantly for design of data bases. Further information on data modelling techniques can be obtained from the following publications:

. Structured Systems Analysis Techniques
  - Gane and Sarson

. Structured Analysis and System Specification
  - Tom De Marco

. Computer Database Organization
  - James Martin

. An Introduction to Database Systems
  - C.J. Date

So, in addition to completing a representation of the existing system, logical views of the functional framework and data structure are beginning to evolve.

The next step is to examine these in a group environment.

. Walkthrough 2

The analyst conducts another walkthrough to present for examination material developed so far.

Attendees:

- Team Leader (or Project Manager);
- Analyst responsible for specification of related business processes;
- Data Analyst; and
- User Representative(s).

The objectives of the walkthrough are:

- To confirm that the description and understanding of the existing system is correct;
- To verify the functional view and its compatibility in the global context (or to modify the High Level Function Charts); and
- To identify omissions and weaknesses to be corrected.

Minutes of the walkthrough are taken.

Working Documents

. Existing documents, publications and other written material

. Existing system specifications

. Organization charts

. Function Charts (hierarchical representation of business processes)

. Logical Data Flow Diagrams

. Data Models

Deliverables

- List of Sources of Information
- Record of Interviews and Walkthroughs
- Data Flow Diagram of the Existing System

4.4 Analysis of Data (3.D.2)

Objectives

- To develop a graphical representation of the logical system.
- To derive a graphical representation of the proposed system as viewed by the user (i.e. to define the preliminary man/machine interface).

Inputs

- Records of Interviews and Walkthroughs
- Data Flow Diagram of Existing System
- High Level Function Charts (from Feasibility Report)
- Existing Data Models

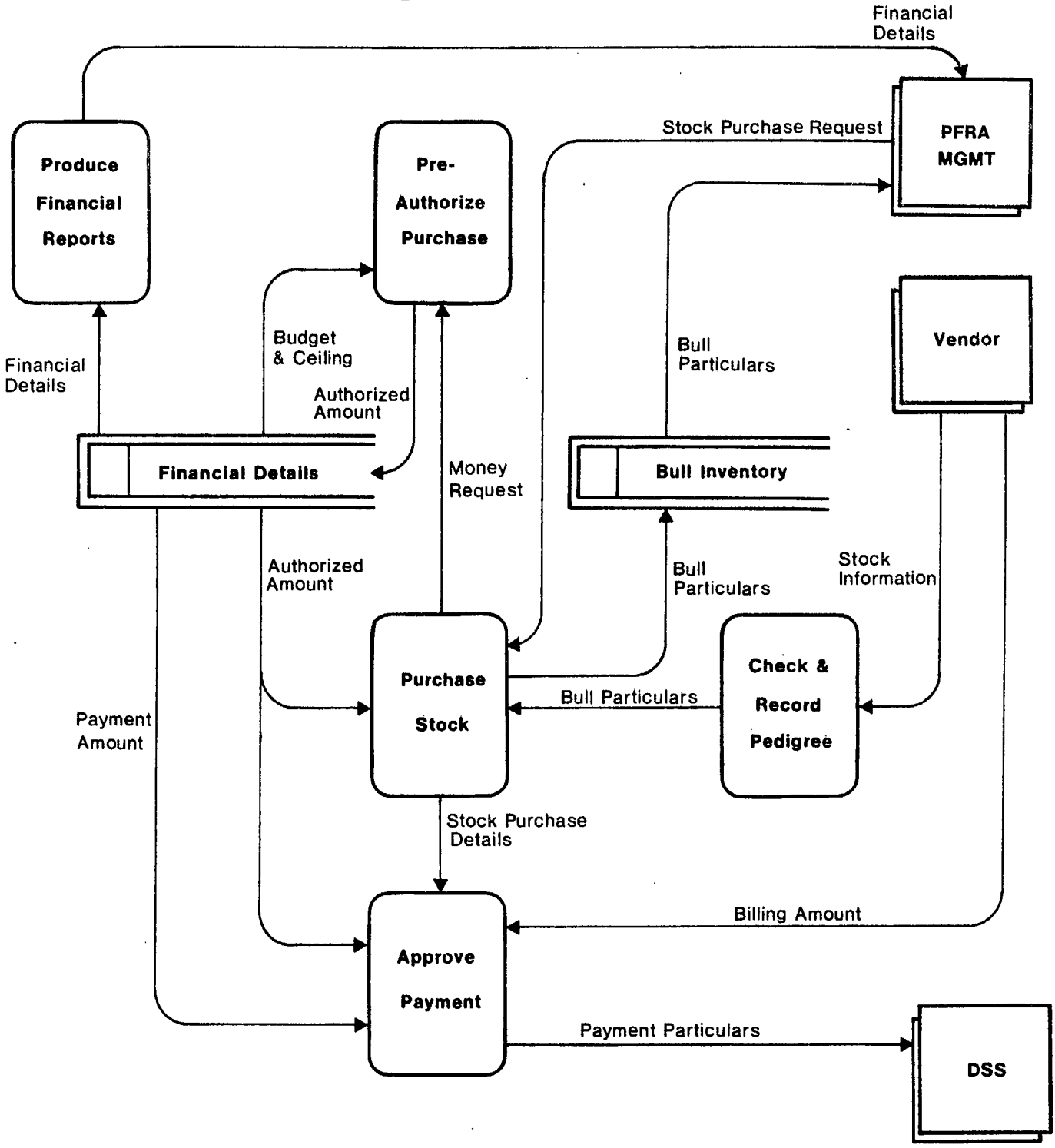
Method

- Representation of the Logical System Flows

  It is important to understand that analysis is an iterative process in which deliverables are reworked and refined progressively as the analysis proceeds down to successively lower levels of detail. This iteration often identifies a need to initiate further data gathering and to search for new sources of information. This in turn may call for reworking of previously developed high level views. Nevertheless, the aim of the exercise is to analyze from the "top down" to the lowest level of detail, progressively breaking down each business process into its sub-process components, and each data flow into more precise data components.

  Whereas a Data Flow Diagram of the Existing System shows the physical context of offices, regions, forms, computer outputs, etc., a Logical Data Flow Diagram ignores these so as to represent a "solution-independent" view of the system. The logical-physical distinction is the difference between "what" the system needs to do and "how" the system does it (compare the figure on the next page with the previous figure).

ACQUISITION OF BULLS
LOGICAL - 3.1.1.2.1



The analyst examines all the data gathered or developed previously and at any level of the hierarchy, separates the "what" from the "how" for both process and data. It is the "what" that is to be specified by the Analysis phase. At a later stage in the project life cycle system designers evaluate various "how" options which could satisfy the documented "whats".

So, in carrying out the analysis of each business process, the analyst asks questions similar to the following:

- What is the objective of the business process?
- What is the minimum set of information needed to perform it?
- What are the controls and constraints imposed by management, policy, statute, etc.?
- What are the procedures performed for attaining the objective?
- How many times is the process performed per period?
- What are the results (output)?
- What are the transaction and record volumes?
- When do peaks/valleys of transaction loads occur?

The answers to these questions are drafted onto charts and data flow diagrams down to the elementary level at which a discrete process occurs. Narrative is developed concurrently to support the graphic representation. The level of precision of the process narrative will depend upon whether the functions were previously categorized as "operational" or "managerial".

Having sketched out the data flow diagrams at the lowest level, the sequence of events and data dependencies are examined in order to ensure that the order of flow is correct. Each diagram should start with an external entity and end with a logical transaction conclusion or link with an external destination.

Any process occurring in more than one portion of the function chart is to be graphically represented in each DFD, although it need only be specified once.

. Data Modelling

Representation of data is effected with the assistance of a trained data analyst who has functional responsibility for:

- application of the Department's data administration conventions;
- ensuring that data names and definitions are compatible with other system documentation (such as the data dictionary and other functional specifications);
- input/update of the data dictionary; and
- data modelling to ensure that data is maintained as a Departmental resource.

. Representation of the Proposed System Flows

There should be sufficient information at this point to make preliminary design decisions.

If the existing system is to form the basis of the proposed system, then it is evaluated against the logical system. Its shortcomings and/or redundancies are identified and addressed in the proposed system. In these cases, a data flow diagram of the proposed system is derived from the representations of both the existing system and the logical system.

If a decision has already been made to replace the existing system then the representation of the proposed system can be drafted without being constrained by existing system considerations.

Working Documents

. Data Dictionary
. Preliminary Process Narratives

Deliverables (in draft format)

. Function Charts
. Logical Data Flow Diagrams
. Data Models
. Data Flow Diagram of Proposed System (Physical DFD)

4.5 Integration of Requirements Within A Departmental Framework 3.D.3)

Objectives

Where it is the user's strategy to develop multi-function systems, the evolving specifications are reviewed in the wider context of a total systems framework. This involves examining the proposed system in relationship to other specifications in existence or under development.

The objective is to integrate data held in common and thus ensure component system compatibility within the total systems framework.

Inputs

- Draft Function Charts
- Draft Logical Data Flow Diagrams
- Draft Data Flow Diagrams of Proposed Systems
- Draft and Existing Data Models
- High Level Function Charts (from Feasibility Report)

Method

- One or more workshops are conducted in which the products of previous steps are matched in detail against existing specifications for compatibility.

  Particular emphasis is placed upon data consistency and sequence of dependency. One workshop may deal with more than one specification module under development. Regardless, the analyst(s) uses the workshop to "walk across" functional boundaries and thus to resolve differences and omissions. A typical problem to look for would be different name structures being applied to common data, in separate sets of specifications. These should be reconciled by the parties in attendance.

- During the workshop the attendees evaluate and agree to the recommendations to be made in the areas of policy, system design and other areas of impact.

- Attendees:

  - Project Manager;
  - Team Leader(s);
  - Systems Analysts;
  - Data Analyst; and
  - User Representative(s).

- Minutes of the workshop are taken.

- As many workshops are conducted as are necessary to obtain agreement that integration has been achieved.

Working Documents

- Visual Aids for the Workshop

Deliverables

- Integrated Function Charts
- Integrated Data Flow Diagrams
- Integrated Data Models
- Draft Process Narratives
- Record of Workshops

4.6 Packaging of Requirements (3.D.4)

Objectives

- To finalize and complete all components.
- To assemble all the components in one Functional Specification documentation module.

Input

- Integrated Charts
- Integrated Data Flow Diagrams
- Draft Process Narratives
- Data Dictionary

Method

The module is packaged in accordance with the Functional Specifications component of the Information Systems Requirements described in section 3.3 of the Deliverables Reference Manual.

Working Document

Module Documentation File (to be maintained as part of project documentation)

Deliverables

Draft Functional Specification Module

4.7 Quality Assurance (3.D.5)

Objectives

Having packaged the specifications, the module is examined from a quality perspective. It must be complete, accurate, and compatible with other Functional Specifications and it should accord with the documentation requirements described in the Deliverables Reference Manual.

Input

- Draft Functional Specification Module
- Initiation Report
- Feasibility Report

Method

- Each person participating in assuring the quality of the product, has a specific responsibility for an aspect of the Functional Specifications.
- The Data Analyst verifies the data contents of the module and ensures that the data have been integrated across functional boundaries.
- A member of the team playing the role of "Inspector" verifies that the level of detail and format of the module adheres to the documentation guidelines. He also reviews the Module Documentation File to confirm that it contains the minimum set of documents.
- The Team Leader or Project Manager reviews and verifies the whole module package. Before he approves it he must be satisfied that it fits in with other specifications under development, that the other quality control activities have been performed, and that the contents are consistent with the overall project objectives specified in the Initiation Report and the Feasibility Report.

Working Documents

- Module Documentation File
- Data Models
- Project Management Handbook
- Data Dictionary

Deliverables

Functional Specification Module (Internally Approved)

4.8 Definition of Performance and Security Goals (3.D.6)

Objectives

The Functional Specifications define the detailed requirements from the perspective of a number of individual users. In order to complete the overall requirements of a system, it is necessary to define a set of global performance and security requirements which are generally applicable to user's entire operation.

These global requirements set criteria which, subject to economic and technical feasibility, are to be accomodated in the design of the system.

The requirements are stated from a business perspective in common business English.

Input

- Initiation Report
- Feasibility Report
- Project Records

Method

Much performance and security related information will have been gathered by analysts during their data gathering activities, and they should be the initial source of data and opinion.

A survey among selected senior user staff will be carried out in order to achieve some concensus on what constitute reasonable performance goals. These goals will probably be determined by subjective reasoning.

Since the conceptual system design suggested from the Feasibility Report will indicate the type of system sophistication (e.g., on-line data capture, real-time or batch), the analyst's role will be to guide users involved in the survey, on what is within the bounds of possibility and what is not.

The report will specify goals which the analyst considers are appropriate and reasonable, based upon the findings of the survey.

Once prepared the report is distributed among the user community for formal comments.

Working Documents

- Module Documentation Files

- Departmental Policies re:
  - Privacy and Freedom of Information
  - Security
  - Data Retention and Archiving

Deliverables

Goals relative to

- Availability
- Recovery
- Security
- Response Times/Turnarounds
- Data Integrity
- Retention and Access to Data
- Audit Requirements (Trails and Controls)
- Growth Perspectives

4.9 User Validation of Specifications (3.D.7)

Objectives

The Functional Specifications represent the bridge between the user community, which collectively defines the business problem or opportunity, and the project's systems designers who design a technical solution.

These activities result in a) the verification of the content of the specifications by individual users, and b) acceptance of the specifications into the Design phase for the purpose of proceeding with the design of the system.

Input

. Feasibility Report
. Functional Specifications
. Performance and Security Goals

Method

These activities relate to the external interfaces needed to ensure the integrity of the functional specifications. Involvement by analysts may be required in the following:

- Familiarization with the Project
- Distribution of Modules
- Review of Modules
- Verification and Approval

. Familiarization with the Project

Analysts should ensure that seminars are conducted, at the latest during initiation of analysis activities, to introduce project designers, user management and user representatives to the project. They should also be conducted during the life of the phase as the need occurs.

Appropriate subjects for presentation are the project and its objectives, an overview of the Analysis phase and user participation, the high level functions under study, and the project plan and phase schedule.

. Distribution of Modules

Distribution of modules to the user community is done on a selective basis. Only impacted users should be asked to review and comment on modules. A complete record of distribution is to be maintained in the project records.

. Review of Modules:

This involves three steps:

- reading of the module;
- attendance at a walkthrough;
- formal documentation of comments.

Both users and designers prepare themselves for the walkthrough by prior study of the module(s). Walk-throughs are conducted (separately) for both groups in which attendees are given the opportunity to raise questions and obtain any clarifications prior to a formal review. The objective is to ensure that participants are thoroughly briefed on the meaning and purpose of the module(s). Any agreements resulting from this walkthrough are entered in the minutes for follow-up action.

The final step in the process is the formal review which involves users (and designers on large multi-team projects) examining each module in detail and submitting written comments.

. Verification and Approval

The analyst responds formally to all comments and incorporates any consequential modifications into the module(s). Once this has been done, users are requested to approve individual modules so that they can be released to systems designers for acceptance into the Design phase of the project.

Working Documents

. User Guide
. Visual Aids for Walkthroughs
. Phase Plans

Output

. Approved Functional Specification Module(s)
. Approved Performance and Security Goals

4.10 Data Administration (3.D.8)

Objectives

The data dictionary is a central repository for the recording of definitions and other information about data. Its use and updating forms an essential part of the analysis process. Specifications are incomplete unless every element referenced in them has been defined and entered in the dictionary.

The objective is to document definitions and other information about data on the data dictionary. This may not be a project responsibility, but nevertheless the project has a substantial interface role.

Input

- Current Data Dictionary
- Functional Specifications

Method

The data analyst works closely with the systems analyst during the Analysis phase in order to develop a view and definition of data that is consistent with the user's view. The data analyst has functional responsibility for ensuring that the specifications and the dictionary are compatible. He therefore organizes the update and maintenance of the dictionary as new characteristics are identified. The dictionary must be completely up-to-date prior to the packaging of functional specification modules. Procedures for updating and maintenance of the dictionary are normally the responsibility of the data administration group.

Working Documents

- Data Models

Deliverables

Updated Data Dictionary

4.11 Prepare Plans and Package Information Systems Requirements (3.E)

Objective

To prepare a modular document which defines in explicit terms, the user requirements and estimates for the next phases.

Inputs

. Information System Requirements

Method

A report consisting of the sections described in the Deliverables Reference Manual (section 3.3) is to be prepared. This report is to be written in clear standard English and with terms that can be understood easily by the user. The report will define explicitly the user's requirements, and will include sufficient detail and be precise enough, to permit the system design phase to progress. In addition, the report will include revised cost/benefit figures and the plans for the next phases.

The report will be publised in a modular format, with loose-leaf binding, to facilitate the modification process.

Working Documents

. Draft Requirements
. Functional Specifications
. Performance and Security Goals

Deliverables

Information System Requirements Report

4.12 Departmental Approval (3.F)

Objective

In order to formally proceed to the Design phase it is necessary to obtain user's approval of the Information System Requirements comprising of the set of Functional Specifications and the Performance and Security Goals.

Input

. Information System Requirements

Method

A submission is prepared for the approval authority recommending formal approval of the Information System Requirements. This submission may be prepared by the analyst on behalf of the Project Manager. It must contain evidence that the user involvement has been active and comprehensive.

Once formal approval has been obtained the Analysis phase is complete.

Working Documents

. Record of Individual User Approval

Deliverables

Signed-off Information System Requirements

SECTION 5

DEFINITIONS

5. DEFINITIONS

. Data Dictionary

The data dictionary is an integral part of the total set of functional specifications. Every data element in any specification should be defined in the dictionary.

The dictionary is a repository for information about data. From a functional specification perspective it contains information about, and definitions of:

- data structures;
- data elements (formats and values); and
- data usage (processes).

Later phases of a project will add further information about data - files, records, program usage, etc.

. Data Model

This represents the logical structure of the data required by the user to carry out his business. It is the user's (as opposed to application) view of data and is independent of the mechanisms used for access or storage.

. Feasibility Report

This is the deliverable from the Feasibility Study phase.

It reports the study's findings which will have further identified and defined the business processes being addressed by the project. These will be represented on high level Function Charts supported by narrative descriptions. Thus the framework for subsequent "top-down" analysis will be established (if not previously established during systems planning).

Also included in the report will be two major components: an evaluation of alternate solutions including a benefits statement for each; and a plan for the next phase.

The study of alternative solutions results in the selection and recommendation to management through the Feasibility Report, of a conceptual design for the preferred solution.

The plan for the next phase, Analysis, will cover user participation as well as the project team's involvement.

. Function Charts

Hierarchical charts identifying the business processes to be studied. These are a component of the Feasibility Study which together with supporting narrative defines the functional boundaries.

As a general principle, function charts are free of reference to organization, geography, systems, procedures and other physical aspects. They do not reflect any particular time dependency. However, if there is an obvious time flow it is:

Policy Development--> Planning--> Operations--> Control.

. Functional Specification Module

A documentation package containing specifications and information about a particular major business process. Usually one of a set making up the Information Systems Requirements of a project.

See description in the Deliverables Reference Manual.

. Initiation Report

This is a deliverable from the Project Initiation phase and is approved by an appropriate governing body.

It is the initial statement defining the terms of reference for the project. Minimum contents are:

- A clear set of objectives for the project including a general description of the problem, opportunity or requirement;

- A definition of the scope of the business process under examination;

- A description of Departmental policies and constraints applicable to the project;

- A project strategy and a plan for the Feasibility Study phase; and

- Definitions of the project management framework and project/user interface.

. Logical Data Flow Diagram

A diagram of data flows in conceptual form. Business context is excluded, leaving the minimum set of processes and data required to achieve the objective of a function. A Logical DFD shows <u>what</u> the business function does.

. Module Documentation File

A file containing records related to the process of developing a Functional Specification module. This forms part of the project documentation and is retained in the Project Work Book. It is progressively compiled during the Analysis phase. When complete it contains:

- a list of sources of information;
- minutes of walkthroughs and workshops;
- records of interviews; and
- correspondence specific to the business process (e.g. formal user comments).

. Physical Data Flow Diagram

A diagram showing flows of data through a system in its business context of forms, files, organizations, methods, etc. Also identifies external interfaces which are sources and destinations of data. A Physical DFD show how the business function operates.

. User's Guide

A guide for distribution among users for familiarization with the system development life cycle. It describes the individual roles of the project team and of the user community.

APPENDIX A

Interview Action List

INTERVIEW ACTION LIST

Analyst:

Business Process:

Name and Organization of User	Interview Scheduled Date	Date Sent	Interview Conducted Date	Interview Record Submitted	Record Returned	Record Amended	References & Comments

APPENDIX B

Interview Checklist

INFORMATION SYSTEMS - ANALYSIS

INTERVIEW CHECKLIST

General

General description of responsibilities and objectives:

. current and planned.

Identify how responsibilities are accomplished:

. current and planned
. any special programs being developed?
. obtain organization chart and staff names
. continue development of organization's function chart.

What information is needed to plan, to solve problems and to make decisions?

. how does information relate to objectives?
. identify performance indicators
. what is relative priority and importance of information needs?
. avoid information needs not within scope of study

What information is actually received?

. current and planned

What systems are being utilized?

. current and planned
. obtain sufficient information to sketch out a data flow diagram

What level of performance and availability would be expected from a computerized facility?

Identify other general problems and their impact.

Identify opportunities for improvement.

Specific

Determine characteristics of information needs:

- when is it needed?
- what is the required frequency?
- where does it orginate?
- what are the volumes?
- when and where do the peaks and valleys of volumes occur?

Obtain information on data classes and, ultimately, data elements and their definitions.

Obtain information on detailed processes (if examining operational processes).

Obtain specific turnaround times, data security requirements, information archiving needs, and names of approval authorities.

Request samples of the following:

- forms
- documents
- reports
- user manuals
- procedure manuals

APPENDIX C

Walkthrough

WALKTHROUGH

The walkthrough/inspection concept came from IBM's programming teams. It uses the theory that the Programmer is a part of the complete team and that the team (not just the Programmer) is responsible for each program. This is commonly known as egoless programming.

The walkthrough concept is basically an extension of the desk check process. During desk checking, the programmer examines his code to discover errors. During a walkthrough members of the team inspect the code in a systematic manner to find any errors.

Although the walkthrough concept was developed for inspecting programming output, and this description is in that context, it is equally applicable to the products of analysis, design and testing.

The objective of this process is to find errors in logic, in specifications, etc. An inspection also looks for errors in style such as readibility, efficiency, unreasonable specifications, etc. the purpose of the inspection is not to find fault with the originator of the product being inspected but to improve upon that product.

Also Refer to Datamation Oct. 1977.

Inspecting Software Design and Code
By M.E. Fagan.

Below is an outline of an inspection technique used on one project.

Inspection team consists of:

- Chairman, who coodinates and schedules the meetings, chairs the inspection, notes all errors, circulates the inspection report and follows up on the rework.

- Document creator, the person who has created the document, whether it be the program specification, design or code. It is his responsibility to have all documents circulated to the other members at least 24 hours before the inspection.

- Implementors, those who will be taking over responsibility for the document (e.g., designers who will receive the specifications, programmers who will receive the program design, etc.). There will normally be one or two people in this category.

Inspection process consists of:

- Preparation and distribution of the document to all members of the inspection team prior to the meeting by the document creator.
- Study by all of the inspection team members. This involves going over the document in some depth before the meeting.
- Inspection of the document by the whole team in the meeting. As the objective is to find and note errors, discussion continues only until the point where an error is recognized. The aim of the inspection is only to find errors. At the end, the team decides if the document passes the inspection and if not, a date is set for further inspection.
- Circulation of the inspection report by the chairman within 24 hours of the conclusion of the inspection meeting.
- Rework by the document creator to correct the errors.
- Follow-up. If the number of errors is small, than the Chairman is responsible for verifying that all errors are redressed. If there are a large number of errors, the inspection cycle is repeated.

During a walkthrough of actual code, there are major areas where problems occur. These are:

DATA REFERENCE
DATA DECLARATION
COMPUTATION
COMPARISON
CONTROL FLOW
INTERFACES
INPUT/OUTPUT