What is Systems Analysis

Systems analysis – a problem-solving technique that decomposes a system into its component pieces for the purpose of studying how well those component parts work and interact to accomplish their purpose.

Systems design – a complementary problem-solving technique (to systems analysis) that reassembles a system's component pieces back into a complete system—hopefully, an improved system. This may involves adding, deleting, and changing pieces relative to the original system.

Information systems analysis – those development phases in an information systems development project the primarily focus on the business problem and requirements, independent of any technology that can or will be used to implement a solution to that problem.

Repository – a location (or set of locations) where systems analysts, systems designers, and system builders keep all of the documentation associated with one or more systems or projects.

- Network directory of computer-generated files that contain project correspondence, reports, and data
- CASE tool dictionary or encyclopedia
- Printed documentation (binders and system libraries)
- Intranet website interface to the above components

The System Environment

The need for a new development will be formulated within an existing environment, and it is important to have an understanding of that environment at the outset.

Economic

Economic factors centre around the expected increase in profitability and/or improvement in both internal and external services provided. Such improvements should be stated in actual factual values rather than "vague generalizations", although there are of course categories of improvement which, by their nature, are difficult to place a tangible value upon.

Technical

Technical considerations can be subdivided into those which affect the firm and those that relate to the computer – its operating constraints and environment. It is important that these considerations include all aspects of the new system, including the effect on old or existing systems as well as any wider implications of the new system.

Computer constraints can be said to relate to the technical demands of the system such as hardware and software requirements, programming complexity, user complexity and training, etc.

Social

The third consideration, social, is often very difficult to quantify because it involves such issues as job satisfaction and industrial relations. Nevertheless, it is important to indicate in some way the expected effect in these areas.

SYSTEMS INVESTIGATION

- The actual project development begins with a very full investigation by the systems analyst. To establish requirements and constraints, the systems analyst must elicit all the necessary facts from potential users and all other interested parties.

- ***The Scope of Fact Finding***
- "Investigation" is concerned with the review of what is known now, the discovery of the previously unknown, and the structuring of experiments to find out facts about known areas and unknown ones. Merely finding out about what is known is insufficient. Systems investigation should include such activities as model building, "brainstorming" and simulation, as well as experimentation- techniques, therefore, that are often regarded as going beyond the fairly straightforward concepts of the interview, the questionnaire, observation and document analysis.

(a) Problems

- The most essential feature of any fact-finding technique is that the facts so found must be correct. A number of factors can distort the truth of facts discovered:
- The facts may be distorted, intentionally but more likely unintentionally, by the person presenting the information.
- The communication containing the facts must be interpreted by the person receiving it and the interpretation may distort the truth.
- The written word creates potential difficulties when the writer and readers do not know each other.
- Observation of the actions of people does not always reveal the true facts, as again it is subject to the interpretation of the observer; also, the person observed can disguise what is actually being done – how else does the conjurer operate?
- These problems can be overcome provided systems analysts take steps to ensure that all facts are thoroughly checked. They must also be aware of the distortion they themselves may impose.

(b) Sources of Information

- Each project may be concerned with different sources of information – some may rely on internal, others on external data.
- As far as the current system is concerned, users are the most important source.
- Most investigations start by looking at the current system, and documentation for this will vary greatly in quality. Occasionally, it is found to be correct to the smallest detail, or alternatively, it may be almost non-existent.

(c) What Facts are Required?

- If it were possible to list the facts that should be obtained during a systems investigation, then a systems analyst's job would be easy. This cannot be done because no two systems are alike, but it is possible to give guidelines that pertain to most commercial applications. Systems analysts must use their common sense when following these guidelines.

- ***The organization's range***

This includes not only the products or services supplied, but also the number of people employed, the number of suppliers' and customers' accounts serviced, etc. – in other words, any items relevant to the area under investigation.

- ***Details of items in the range***

The quantities, values, descriptions and fluctuations are required. In addition, the type of code numbers and their range are very important.

- ***Volumes***
- Once the type of data has been established, the volumes, receipt and dispatch of documents, peaks and troughs in data flow, etc. must be recorded.

- ***Calculations***

It is necessary to record precisely the calculations performed, particularly with regard to fractions, rounding-off, and the degree of accuracy required.

- ***Movement***

Documents will move between departments in the organization and also in from, and out to, other organizations. These movements will probably be shown diagrammatically.

- ***Exceptions***

It is relatively easy to record what the usual procedures are. Because the exceptions occur infrequently and unpredictably, it may be difficult to identify them. Most of the problems that occur after the computer system has been implemented result from the exceptions that were not recorded during the systems investigation.

- ***Staff***

An organization chart will be helpful, and details of the number of different grades of staff and a brief description of what they do should be obtained. In this context it is important to ensure that the data gathered reflects the actual situation in force. In other words, care needs to be exercised to ensure that the organization chart and supporting documentation have been accurately updated upon each change in organizational structure.

- **How are these facts gathered?**

Through things like, **interviews, questionnaires, focus groups, observations, document analysis** etc

The Feasibility Study

As a result of gathering and analyzing facts about the existing system, the analyst will draw up a feasibility study. This is an extremely important document as it is used to justify (or not) expenditure on the development of a new system.

- **(a) Technical**

Is the current state of hardware and software technology capable of supporting the idea of the system?

(b) Personnel

- Is the expertise of the systems development section sufficiently advanced to tackle (and successfully achieve) the production of the system? Such a question must also be asked of an outside agency if it is to produce the system. If the answer is "No", can the expertise be obtained by hiring new staff or training existing staff? Is the cost of this justifiable?

c) Financial

- Even if the system does provide an acceptable return on investment, is the capital available for outlay on the project?

Determining the Main Requirements of the System

- The assignment brief will have specified in general terms the requirements of the proposed system. However, even at this preliminary stage, detailed requirements must be determined, otherwise the analyst will be unable to envisage the total scope of the problem and thereby suggest possible solutions.
- Initially, therefore, the team will conduct a survey of all interested parties to find out exactly what will be required of the system.

- **(a) Main Characteristics**
- These will be defined in terms of the output information required. At this preliminary stage, the detailed layouts and methods of presentation will not be needed, but the team will need to find out:
- Volumes of output required.
- Frequencies of the output.
- Geographical location of the receivers of the information.
- Response times to requests for information if on-demand output is required.

(b) Main Constraints

Others might include:

- Limitations caused by associated existing systems. Financial and staffing considerations. Statutory constraints. Auditing requirements.
- IT policies governing the inclusion of ultra-new technology (many firms will only use tried and tested technologies – many "fingers have been burnt" by pioneering organizations). Current computer equipment. Environmental constraints.
- Time, especially when information must be available at a particular time (as in a payroll system). Performance in terms of throughput, response times with a given number of users, etc.
- Accuracy of output information. Control and security procedures.

(c) Input Data

- This section will describe all the input data. It will indicate the type of data, its quantity and frequency. If relevant, it will define the structure and layout of the data when the design of input data documents is outside the control of the systems designer. The medium for input may be a specific requirement.

(d) Output Information

- All the output to be produced by the system will be specified in this section. Unless there is a specific requirement, it may be left to the systems designer to prepare the actual layouts and presentation of the information. However, this section will specify the elements of information required for each output, the frequency and volume of output, together with the medium on which the output is to be presented.

(e) Validation Requirements

- The data input to any automatic data processing system must be correct. It is important that the validation procedures to be adopted in the new system are specified fully so that the designer can incorporate them in the design.
- This section will specify both the validation procedures to be adopted, and the ranges of values and other associated information for every data element used by the system.
- For example, a name must be given a maximum length, a code number, its check digit mechanism and the range of values it can adopt.
- In addition, if the system is to be on-line with direct data entry from keyboards, then the methods of indicating errors and the action to be taken by the system should be specified, especially if the user is to be allowed to make immediate corrections to any data erroneously input

(f) File Requirements

Unless the system uses files created by other systems, it is usual to leave the file requirements to the system designer. If the system does use existing files, then their details will be included in this section. This is a fundamentally important point with existing files increasingly being used to promote integration throughout systems methodology.

(g) Enhancements

- It is quite usual for a system to be specified with the intention of enhancing its facilities at a later date, or for there to be a future system envisaged which will use the output or files of the specified system.
- The system designer, in studying this section of the requirement specification, will be able to allow for such enhancements and facilitate their inclusion in the future.

REQUIREMENTS SPECIFICATION

- The Requirements Specification is the output from the Systems Analysis phase. It should contain all the information needed for the next phase, System Design.
- The specification should include enough detail for the designers to design the computer processing, the databases, the navigation and the user interfaces. In structured analysis, these would be supplied by:
- A requirements catalogue
- A set of required data flow diagrams
- A set of process descriptions to support the bottom level data flow diagrams
- A required entity relationship diagram
- Entity descriptions

- User roles
- Function definitions
- A matrix linking users to functions
- Input/output structure diagrams and descriptions
- Entity life histories.
- It is these documents and diagrams that the designer uses to construct a logical design of the system. Other approaches will use different techniques. Object-oriented systems, for example, will incorporate "use cases" instead of data flow diagrams and class diagrams instead of entity relationship diagrams.

Types of Analysis

1. Model driven analysis

Traditional Approaches

- Structured Analysis
  - Focuses on the flow of data through processes
  - Key model: data flow diagram
- **Information Engineering**
  - Focuses on structure of stored data
  - Key model: entity relationship diagram

Object-Oriented Approach

- integrates data and process concerns into objects

2. **Accelerated System analysis**

Approaches emphasize the construction of prototypes to more rapidly identify business and user requirements for a new system.

prototype – a small-scale, incomplete, but working sample of a desired system.

- Accelerated systems analysis approaches
  - Discovery Prototyping
  - Rapid Architected Analysis

3. Agile Methods

Agile method – integration of various approaches of systems analysis and design for applications as deemed appropriate to problem being solved and the system being developed.

- Most commercial methodologies do not impose a single approach (structured analysis, IE, OOA) on systems analysts.
- Instead, they integrate all popular approaches into a collection of agile methods.
- System developers are given the flexibility to select from a variety of tools and techniques to best accomplish the tasks at hand,
- Hypothetical *FAST* methodology operates this way.

FAST Systems Analysis

- Scope Definition Phase
  - *Is the project worth looking at?*
- Problem Analysis Phase
  - *Is a new system worth building?*
- Requirements Analysis Phase
  - *What do the users need and want from the new system?*
- Logical Design Phase
  - *What must the new system do?*
- Decision Analysis Phase
  - *What is the best solution?*

Typical System Proposal Outline

I. Introduction
   A. Purpose of the report
   B. Background of the project leading to this report
   C. Scope of the report
   D. Structure of the report
II. Tools and techniques used
   A. Solution generated
   B. Feasibility analysis (cost-benefit)
III. Information systems requirements
IV. Alternative solutions and feasibility analysis
V. Recommendations
VI. Appendices

Data Modeling

- A model is a representation of 'real world' objects and events, and their associations.
- **Data model** is an integrated collection of concepts for describing and manipulating data, relationships between data, and constraints on the data in an organization.

- A data model comprises three components:
- A **structural part**, consisting of a set of rules according to which system can be constructed
- A **manipulative part**, defining the types of operation that are allowed on the data
- A **set of integrity constraints**, which ensures that the data is accurate.

Categories of Data Models

i. Object-based data models

- Object-based data models use concepts such as entities, attributes, and relationships. An **entity** is a distinct object in the organization that is to be represented in the system. An **attribute** is a property that describes some aspect of the object to be recorded, and a **relationship** is an association between entities.
- Some of the more common types of object-based data model are: Entity–Relationship, Semantic, Functional and Object-Oriented.

ii. Record-based data models

- In a record-based model, the system consists of a number of fixed-format records possibly of differing types. Each record type defines a fixed number of fields, each typically of a fixed length.
- The three principal types of record-based logical data model are:

a). Relational data model

- The relational data model is based on the concept of mathematical relations. In the relational model, data and relationships are represented as tables, each of which has a number of columns with a unique name. Examples,
- Branch (branchNo, street, city, postcode)
- Staff (staffNo, fName, lName, position, sex, DOB, salary, branchNo)

b).Network data model

- In the network model, data is represented as collections of **records**, and relationships are represented by **sets**. The records are organized as generalized graph structures with records appearing as **nodes** (also called **segments**) and sets as **edges** in the graph.

c). Hierarchical data model.

- The hierarchical model is a restricted type of network model. Data is represented as collections of **records** and relationships are represented by **sets**. However, the hierarchical model allows a node to have only one parent. A hierarchical model can be represented as a tree graph, with records appearing as **nodes** (also called **segments**) and sets as **edges**.

iii).Physical data models

- Physical data models describe how data is stored in the computer, representing information such as record structures, record orderings, and access paths.