Systems Analysis – A Brief Overview

Himadri Barman

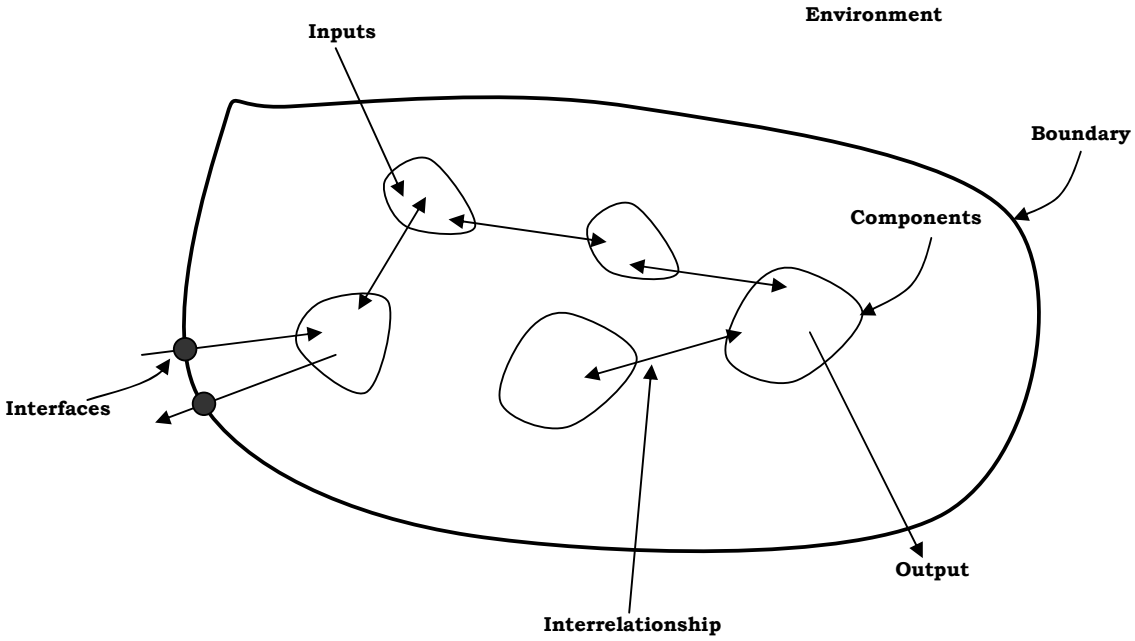
1. Introduction

This write-up gives a very brief introduction to the topic of Systems Analysis and Design starting from

1.1 Systems Thinking:

A system is an inter-related set of components with an identifiable boundary, working together for some purpose. A system has nine characteristics:

- Components (sub-systems)
- Interrelated components
- A boundary
- A purpose
- An environment
- Interfaces
- Input
- Output
- Constraints



A *component* is an irreducible part or an aggregate of parts capable of performing a specific task. A system has a *boundary*, within which all of its components are contained and which establishes the limits of a system, separating the system from other systems. Components within the boundary may be changed whereas things outside the boundary cannot be changed. The *purpose* is the system's reason for existence. A system exists within an *environment* – the internal and the external. Whatever is outside the system's boundary constitutes the external environment. The points at which the system meets the external environment are the *interfaces*. A system must face *constraints* in its functioning because there is a limit to what a system can accomplish. Constraints may either be explicit or implicit. These constraints may be imposed within or outside the system. What comes into the system is the *input* whereas what goes out of the system is the *output*.

1.2 Types of Systems:
Based on how systems interact with its external environment, systems are classified as open or closed systems. *Open system* is a system that interacts freely with its environment taking in input and returning output. As the environment changes, am open system must adapt to the changes or suffer the consequences. All business information systems are by nature open. A system that is cut off from its external environment and does not interact with it is called a *closed system*.

1.3 System Description:
The *Logical System Description* focuses on the system's function and purpose without regard to how the system will be physically implemented. *Physical System Description* focuses on how the system will be materially constructed.

1.4 The Importance of System Decomposition:

1. Break a system into smaller, more manageable and understandable sub-systems
2. Facilitating the focusing of attention on one area (sub-system) at a time without interference from other parts.
3. Permitting different sub-systems to be built at different times by different people.

Modularity: Dividing a system up into chunks or modules of a relatively uniform size.

Coupling: The extent to which sub-systems depend on each other. A low degree of coupling is preferred. In other words, the sub-systems should be as independent as possible in functioning.

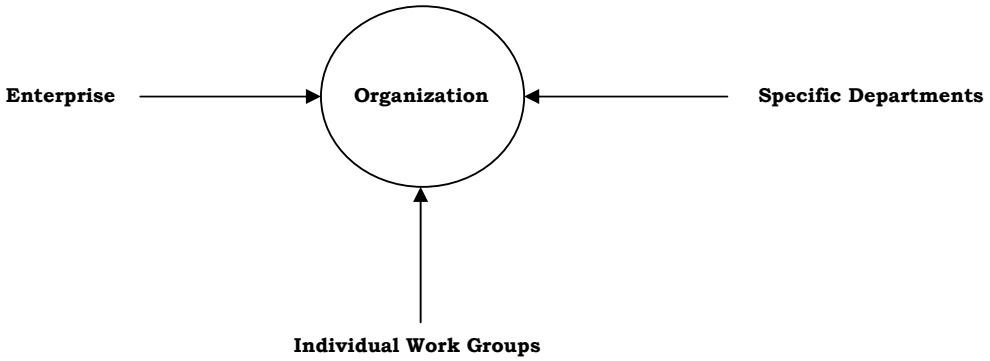
Cohesion: The extent to which a system or a sub-system performs a single function. A high degree of cohesion is preferred.

2. Managing an Information System (IS) Project

Interrelated components working together to collect, process, store, and disseminate information to support decision making, coordination, control, analysis and visualization in an organization constitutes an *information system*. When we talk about IS, we mean a *formal system*, i.e. a system resting on accepted and fixed definitions of data and procedures operating with predefined rules. For all practical purposes, we generally mean a Computer Based Information System (CBIS) by the term IS.

The focus of project management is to assure that system development projects meet customer expectations and are delivered within budget and time constraints.

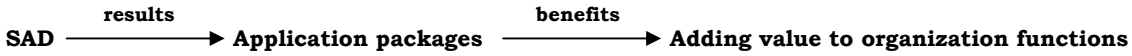
2.1 Information System Analysis and Design (ISAD)
By ISAD, we mean a complex, challenging, and simulating organizational process that a team of business and systems professionals uses to develop and maintain CBIS. The exercise is also termed as *Software Engineering Process*. For our discussion's sake, we differentiate SAD and Software



Engineering. The former is restricted to Information System development while the latter is much

more general and exhaustive with the entire spectrum of software development coming under its domain.

ISAD is always looked at from an organizational perspective, and is therefore an organizational improvement process.



2.2 Systems Development Methodology

A standard process followed in an organization to conduct all the steps necessary to analyze, design, implement and maintain ISs.

One of the earliest methodologies used to develop, maintain and replace ISs is the System Development Life Cycle (SDLC). It has many variations which have evolved over time to suit different needs.

The first phase of the SDLC is *Project Identification & Selection*, in which an organization's total information system needs are identified, analyzed, prioritized and arranged. The second phase is *Project Initiation & Planning*, in which a potential IS project is explained and an argument for continuing with the project is presented; a detailed plan is also developed for conducting the remaining phases of the SDLC with respect to the proposed system. The third phase is *Analysis*, in which the current system is studied and alternate replacement systems are proposed.

The fourth phase is *Design*. Here, a description of the recommended solution is converted into logical and then physical system specifications. The *Logical Design*, also called the Blueprint is the part of the design phase of the SDLC in which all functional features of the system chosen for development in analysis are described independently of any computer platform. The *Physical Design* is the part in which the logical specifications of the system from the logical design are transformed into technology-specific details from which all programming and system construction can be accomplished.

The fifth phase is the *Implementation* where the IS is coded, tested, installed and supported in the organization. The final phase is the *Maintenance* in which an IS is systematically repaired and improved.

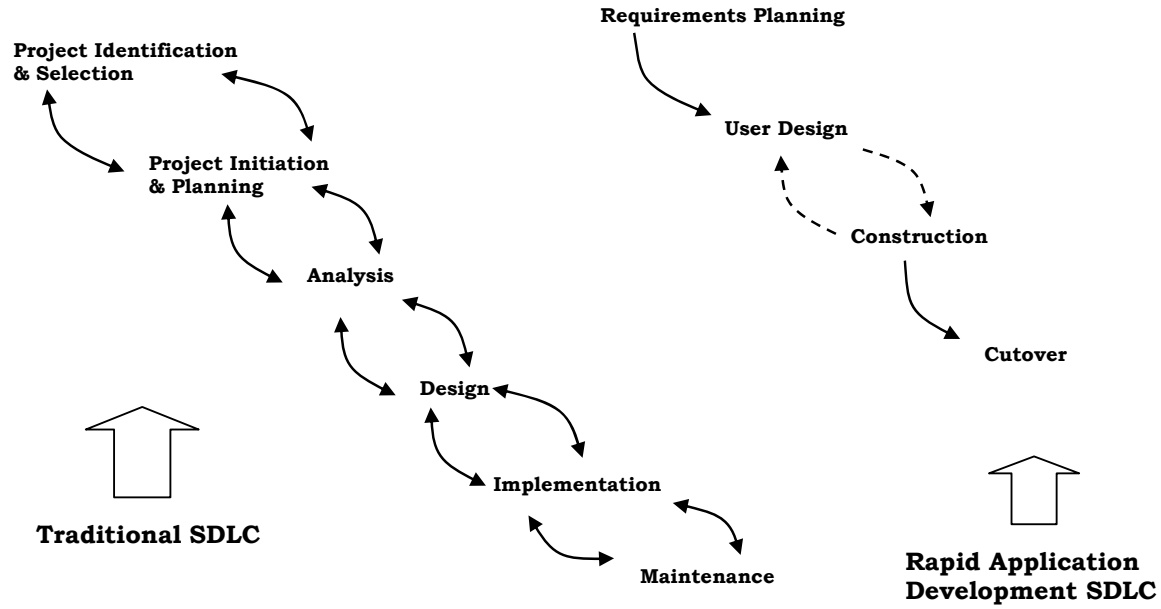
Many deficiencies have been noted in SDLC, some of which are:

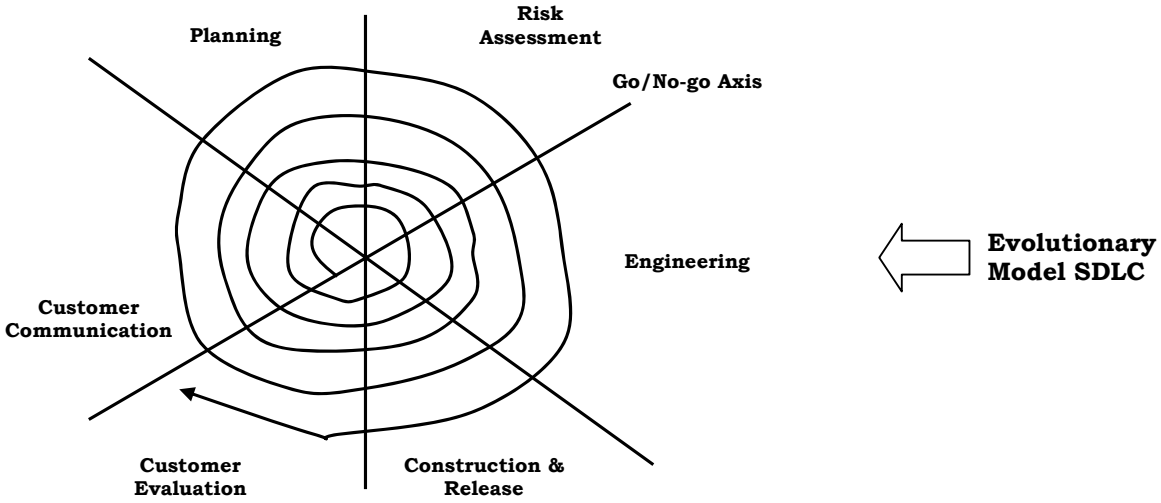
1. Overlapping of phases ignored, when in practice, this is the case. A new phase started once the preceding phase has been deemed to be completed.
2. Designs are frozen at a particular point. This meant that the SDLC has the property of locking in users to requirements that had been previously determined even though these requirements might have changed.
3. Less time devoted to good analysis and design, with too much time on maintenance.

The deficiencies have led to the evolution of newer methodologies although much of the core elements have remained. In the early 70s, Ed Yourdon and his colleagues developed the Structured Analysis and Structured Design methodology. The salient features of which are:

1. It is more of an engineering like activity through use of tools such as Data Flow Diagrams (DFDs) and transform analysis.
2. The analysis and design phases were given maximum importance.
3. More emphasis placed on modular development – dividing a problem into smaller, more manageable units and demarcating between physical and logical design.

In recent years, Object Oriented Design and Analysis have gained prominence which is a set of methods and techniques based on objects rather than data or processes.





2.3 Systems Development Approaches

SDLC in its pure form constitutes the traditional approach. Rapid Application Development (RAD), also called *prototyping* which is a variation of the SDLC only is an approach frequently followed which is an iterative process of systems development in which requirements are converted to a working system that is continually revised through close interactions between an analyst and users. Joint Application Design (JAD) is a structured process in which users, managers, and analysts work together for several days in a series of intensive meetings to specify or review system requirements.

2.4 Project

A project is a planned undertaking of related activities to reach an objective that has a beginning and an end. *Project management* is a controlled process of initiating, planning, executing and closing down a project; each of which are sequential phases in a project. A project is handled by a *project*

manager who is generally a systems analyst with a diverse set of skills – technical as well as managerial and who is responsible for *initiating*, *planning*, *executing* and *closing down* a project.

2.4.1Project Initiation

Activities are performed to assess the size, scope, and complexity of the project and to establish procedures to support later project activities. The main activities in this phase are -

- Establishing the project initiation team
- Establishing a relationship with the customer
- Establishing the project initiation plan – creation of the System Service Request (SSR) form
- Establishing management procedures
- Establishing the project management environment and project workbook

The project workbook is an online or hard copy repository for all project correspondence, inputs, deliverables, procedures and standards that is used for performing project audits, orienting new team members, communicating with management and customers, identifying future projects, and performing post project reviews.

2.4.2 Project Planning

It focuses on defining clear, discrete activities and the work needed to complete each activity within a single project. The activities are –

- Describing project scope, alternatives and feasibility
- Dividing the project into manageable tasks (we get what is called a work breakdown structure which is the definition of tasks and their sequence – logically ordering them to ensure a smooth evolution of tasks) – the Gantt Charts
- Estimating resources and creating a resource plan
- Developing a preliminary schedule – PERT charts
- Developing a communication plan
- Determining project standards and procedures
- Identifying and assessing risks
- Creating a preliminary budget
- Developing a statement of work
- Setting a Baseline Project Plan (BPP)

2.4.3 Project Execution

The plans created in the prior phases are put into action. The activities are –

- Executing the baseline project plan
- Monitoring project process against the baseline project plan
- Managing changes to the baseline project plan
- Maintaining the project workbook
- Communicating the project status

Communicating Methods		
Procedure	**Formality**	**Use**
Project workbook	High	Inform, Permanent records
Meetings	Medium – High	Resolve issues
Minutes of meetings	High	Inform, Permanent records
Status reports	High	Inform, Permanent records
Hallway discussions	Low	Inform, resolve issues

2.4.4 Project Closedown

The final phase that focuses on bringing a project to a *successful* end. The activities are –

- Closing down the project
- Conducting post project reviews
- Closing the customer contract

2.5 Project Feasibility

Most feasibility factors are represented by the following categories –

(1) Economic (2) Technical (3) Operational (4) Schedule (5) Legal & Contractual
(6) Political (7) Behavioural

2.5.1 Economic Feasibility

A process of identifying the financial benefits and costs associated with a development project. The benefits may be tangible or intangible.

- Tangible – A benefit derived from the creation of an IS that can be measured in terms of money and with certainty.
- Intangible – A benefit derived from the creation of an IS that cannot be easily measured in terms of money or with certainty like increased competitiveness, more timely information, improved organizational planning and increased organizational flexibility, promotion of organizational learning and understanding, availability of new, better or more information, ability to investigate more alternatives, faster decision making, information processing efficiency, improved asset utilization, improved resource control, increased accuracy in clerical operations, improved work processes that can improve employee morale, positive impacts on society, etc.

An important exercise in determining economic feasibility is determining project costs. Costs can be tangible (can be measured with certainty in terms of money) or intangible (cannot be measured…). They can also be classified as one-time or recurring. One-time costs are associated with project start-up and development or system start-up. Recurring costs results from the ongoing evolution and use of a system.

Most techniques used to determine the economic feasibility encompass the concept of 'time value of money' (TVM). TVM refers to the concept of comparing present cash outlays to future expected returns. Other techniques are Return on Investment (ROI) and Break Even Analysis (BEA).

Building up the economic case for a systems project is an open ended activity; how much analysis needs to be done depends on a particular project, stakeholders and business conditions. Also, conducting economic feasibility analyses for new ISs is often very difficult.

2.5.2 Technical Feasibility

A process of asserting the ability to construct a proposed system. The analysis includes the assessment of the development group's understanding of the possible target h/w, s/w and operating environments to be used as well as system size, complexity and the group's experience with similar systems. The assessment is well done through evaluating the project risk factors. There are four primary risk factors – project size, project structure, the development group's experience with the application and technology area, and the user group's experience with development projects and application area.

2.5.3 Operational Feasibility

The process of assessing the degree to which a proposed system solves business problems or takes advantage of business opportunities.

2.5.4 Schedule Feasibility

The process of assessing the degree to which the potential time frame and completion dates for all major activities within a project meet organizational deadlines and constraints for affecting change.

2.5.5 Legal & Contractual Feasibility

The process of assessing potential legal and contractual ramifications due to the construction of the system.

2.5.6 Political Feasibility

The process of evaluating key stakeholders within the organization and their assessment of the proposed system.

2.5.7 Behavioural Feasibility

The process of assessing the degree to which users would adapt to the proposed system.

Baseline Project Plan Report

1. Introduction

1.1 Project Overview

(Executive Summary, project's scope, feasibility, justification, resource requirements, constraints and schedules plus the problem outline)

1.2 Recommendation

(Important findings from the planning process and recommendations for subsequent activities)

2. System Description

2.1 Alternatives

2.2 System Description

3. Feasibility Analysis

3.1 Economic Analysis

3.2 Technical Analysis

3.3 Operational Analysis

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4. Management Issues

4.1 Team Configuration and Management

4.2 Communication Plan

4.3 Project Standards and Procedures

4.4 {Other Project Specific Topics}

Reference:

- Modern Systems Analysis and Design, 3rd Edition, J A Hoffer, J F George, J S Valacich, Pearson