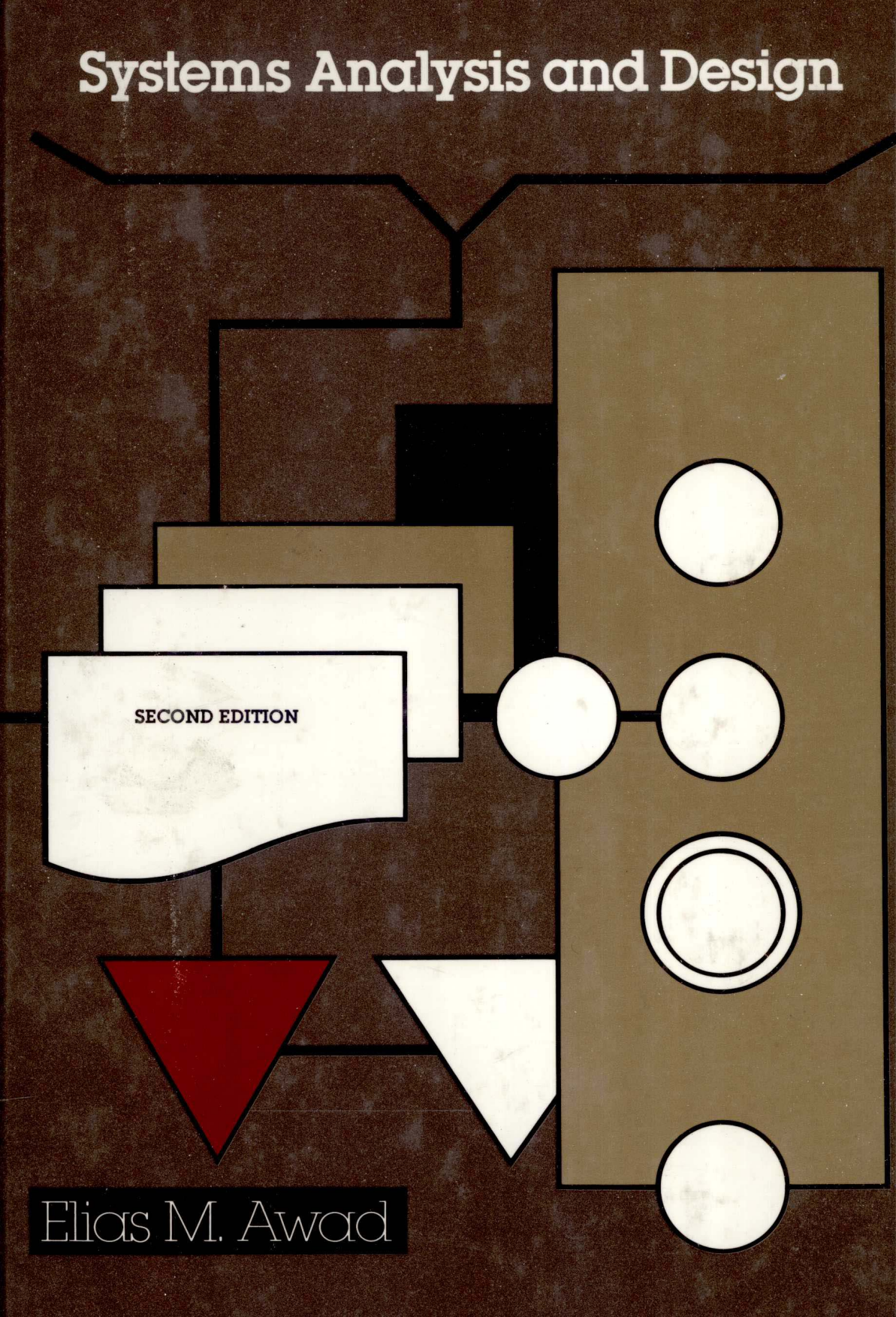
Systems Analysis and Design



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Systems Analysis and Design

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Preface

A major contribution of the first edition was to conceptualize and define the scope and domain of systems analysis and design. The text was well received by the information systems academic community. Today's fast-paced technology, however, makes it difficult for most publications to stay up-to-date. This edition is virtually a new book. It is a major update of the first edition of *Systems Analysis and Design*, which focuses on the system development life cycle using conventional and structured tools. The material goes beyond the classroom theory and concepts. It is practice oriented with examples and applications that *demonstrate* systems analysis and design. The coverage meets the curriculum recommendations for the systems analysis course for the Data Processing Management Association (CIS-4) and the Association for Computing Machinery.

The text goes beyond the mechanics of systems development. It addresses the broader information systems environment of the 1980s, such as the use of data bases for the microcomputer, quality assurance, systems auditability, prototyping, disaster recovery planning, and ethics in systems development. These are important issues requiring special treatment. The coverage trains persons in the what, why, and how of systems analysis and design. The tools and techniques are current, and the illustrations and cases ending each chapter are based on real installations. A safe deposit tracking system installed for a commercial bank is presented in modules in the life-cycle chapters, 4–12.

Important features of the text are:

1. Eleven chapters dealing with topics such as the role of the analyst, the tools of structured analysis and design, data base design, and hardware/software selection improve the student's understanding of the systems development life cycle and provide a comprehensive framework for systems development.
2. "At a Glance" provides a brief preview of the material covered in each chapter.
3. A summary of the main points, key words, and review questions follow each chapter.
4. Case studies at the end of each chapter are business situations which the author has been involved in as a consultant or analyst. Working through the cases will help you acquire the principles and gain experience in making decisions that can be useful in similar situations in the future.

The new chapters cover the following:

1. Chapter 2 reviews the systems development life cycle.
2. Chapter 3 elaborates on the multifaceted role of the systems analyst and the requirements for success in the field.
3. Chapter 4 discusses the importance of planning and the major steps in launching an initial investigation.
4. Chapter 6 describes the tools of structured analysis. They are the data flow diagram, data dictionary, decision tree, and structured English.
5. Chapter 7 explains the steps in feasibility analysis and the feasibility report.
6. Chapter 8 is a completely revised section on cost/benefit analysis focusing on the procedures for cost/benefit determination and alternative evaluation methods such as net present value, payback analysis, and cash flow analysis.
7. Chapter 9 focuses on design methodologies—structured design and the structure chart, IPO charts and structured walkthrough. Audit trail and documentation control are also discussed.
8. Chapter 11 is a review of file organization methods and data base organization. A data base software package for the microcomputer is available to support the chapter.
9. Chapter 14 deals with the procedure for hardware/software selection, financial considerations in selection, and how to negotiate a computer contract.
10. Chapter 15 is about project management and the use of planning tools and project management software for system installations.
11. Chapter 16 caps the systems development life cycle by discussing the various threats to system security, how to do risk analysis, the impor-

tance of disaster recovery planning, and the role of ethics in system development.

The text is designed to be used in a semester or a quarter course in systems analysis and design. Although no specific background is required, a student should have had a course in Introduction to Computers and a general understanding of business organizations. The text is written in a manner that is logical to the student. The early chapters focus on user need determination and feasibility studies, and the latter chapters discuss systems design specifications, file organization, and system implementation.

As part of the revision, a bimonthly newsletter containing new articles, case situations, and news related to the system development area is planned. These should be used to supplement the material in the text or the lectures, where appropriate. The newsletter will be available to instructors by writing me directly at the McIntire School of Commerce, University of Virginia, Charlottesville, VA 22903.

ACKNOWLEDGMENTS

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Elias M. Awad

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Systems Analysis and Design

Part One

Overview

1 SYSTEMS CONCEPTS AND THE INFORMATION SYSTEMS ENVIRONMENT
2 THE SYSTEM DEVELOPMENT LIFE CYCLE
3 THE ROLE OF THE SYSTEMS ANALYST

Chapter 1

Systems Concepts and the Information Systems Environment

Introduction

The Systems Concept

DEFINITION

Characteristics of a System

ORGANIZATION

INTERACTION

INTERDEPENDENCE

INTEGRATION

CENTRAL OBJECTIVE

Elements of a System

OUTPUTS AND INPUTS

PROCESSOR(S)

CONTROL

FEEDBACK

At a Glance

Systems analysis is the application of the systems approach to problem solving using computers. The ingredients are systems elements, processes, and technology. This means that to do systems work, one needs to understand the systems concept and how organizations operate as a system, and then design appropriate computer-based systems that will meet an organization's requirements. It is actually a customized approach to the use of the computer for problem solving.

By the end of this chapter, you should know:

1. The primary characteristics of a system and the importance of the systems concept for developing information systems.
2. How the various elements of a system work together to interface with the end user.
3. How physical systems differ from abstract systems.
4. The unique features of formal and informal information systems.
5. The makeup of management information systems.
6. How decision support systems help in decision making.

ENVIRONMENT

BOUNDARIES AND INTERFACE

Types of Systems

PHYSICAL OR ABSTRACT SYSTEMS
- **Systems Models**
- Schematic Models
- Flow System Models
- Static System Models
- Dynamic System Models

OPEN OR CLOSED SYSTEMS

MAN-MADE INFORMATION SYSTEMS
- **Formal Information Systems**
- Categories of Information
- **Informal Information Systems**
- **Computer-Based Information Systems**
- Management Information Systems (MIS)
- Decision Support Systems (DSS)

Illustration—A Dynamic Personnel Information System Model

INTRODUCTION

It's a typical day. The car starts OK, but you think with a flash of irritation that it really shouldn't take that long to get the air conditioner going. Only an hour to catch the plane, and cars are piled up on the expressway as far as the eye can see. You begin to wonder if there isn't a way to allow airport traffic to move faster. You get to the parking lot and have to walk half a mile to the plane. Where is the shuttle? Why so long a wait? Why so many obstacles?—the ticket counter, the X-ray machine, the gate attendant, etc. Each one is a system in itself, yet they are all part of the transportation system.

This book is about systems analysis and how it relates to shaping organizations, improving performance, and achieving objectives for profitability and growth. As our scenario suggests, the emphasis is on systems in action, the relationships among subsystems, and their contribution to meeting a common goal—in this case, flying passengers to destinations on time. Looking at a system and determining how adequately it functions, the changes to be made, and the quality of the output are parts of systems analysis.

Systems analysis as used in this text is the application of the systems approach to the study and solution of problems using computer-based systems. Systems thinking is integral to systems work. Organizations are complex systems that consist of interrelated and interlocking subsystems. Changes in one part of the system have both anticipated and unanticipated consequences in other parts of the system. The systems approach is a way of thinking about the analysis and design of computer-based applications. It provides a framework for visualizing the organizational and environmental factors that operate on a system. When a computer is introduced into an organization, various functions and dysfunctions operate on the user as well as the organization. Among the positive consequences are improved performance and a feeling of achievement with quality information. Among the unanticipated consequences might be (1) a possible threat to employees that their work no longer "measures up," (2) decreased morale of personnel who were not consulted about the installation, and (3) feeling of intimidation by users who have limited training in the new computer. In assessing these consequences, the analyst's role of alleviating fears and removing barriers for the user is extremely crucial for the system's success.

Systems analysis and design focus on systems, processes, and technology. Having a firm grasp of the makeup of the system in question is a prerequisite for selecting the procedure or introducing the computer for implementation. In our airport scenario, knowledge of the traffic flow, the strategic location of the airport, and how a given change will speed up airport traffic is important in deciding on improvements such as special shuttles, helicopter service, or more airport limousines to solve the problem. Thus, a background in systems concepts and a familiarity with the ways organizations function are helpful. This chapter discusses the systems

concept, elaborates on the types of systems that are relevant to systems analysis, and illustrates the relationship between the knowledge of systems concepts and systems analysis.

THE SYSTEMS CONCEPT

Scholars in various disciplines who are concerned about the tendency toward the fragmentation of knowledge and the increasing complexity of phenomena have sought a unifying approach to knowledge. Ludwig von Bertalanffy, a biologist, developed a general systems theory that applies to any arrangement of elements such as cells, people, societies, or even planets.[1] Norbert Wiener, a mathematician, observed that information and communications provide connecting links for unifying fragments or elements.[2] His systems concept of information theory, which shows the parallel between the functioning of human beings and electronic systems, laid the foundation for today's computer systems. Herbert A. Simon, a political scientist, related the systems concept to the study of organizations by viewing an ongoing system as a processor of information for making decisions.[3]

Systems analysis and design for information systems were founded in general systems theory, which emphasizes a close look at all parts of a system. Too often analysts focus on only one component and overlook other equally important components. General systems theory is concerned with "developing a systematic, theoretical framework upon which to make decisions."[4] It discourages thinking in a vacuum and encourages consideration of all the activities of the organization and its external environment.[5] Pioneering work in general systems theory emphasized that organizations be viewed as total systems. The idea of systems has become most practical and necessary in conceptualizing the interrelationships and integration of operations, especially when using computers. Thus, a *system* is a way of thinking about organizations and their problems. It also involves a set of techniques that helps in solving problems.

Definition

The term *system* is derived from the Greek word *systema*, which means an organized relationship among functioning units or components. A system

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[1] Ludwig Bertalanffy, *General Systems Theory* (New York: George Braziller, 1968).

[2] Norbert Wiener, *Cybernetics* (New York: John Wiley & Sons, 1948).

[3] Herbert A. Simon, *The Shape of Automation for Men and Management* (New York: Harper & Row, 1965).

[4] Richard A. Johnson; Fremont E. Kast; and James E. Rozensweig, *The Theory and Management of Systems* (New York: McGraw-Hill, 1973), p. 6.

[5] See Vincent P. Luchsinger, and Thomas V. Dock, *The Systems Approach: An Introduction*, 2d ed. (Dubuque, Iowa: Kendall/Hunt Publishing, 1982), p. 12.