

# **INFORMATION SYSTEMS ANALYSIS AND DESIGN**



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Shouhong Wang  
Hai Wang



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*Information Systems Analysis and Design*

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*\*\* Electronic teaching material for this textbook includes model syllabus, sample exams, lecture PPT, and Visible Analyst project artifacts.*



# PREFACE

## **Theme of Information Systems Analysis and Design**

Information systems are vital to business. Information Systems Analysis and Design is one of the core courses in the MIS curriculum. It explains the right process of information systems development for the organization. The course also introduces the tools that can be applied to the information systems development. In the digital era, information technology has become a commodity, and the Information Systems Analysis and Design course has become a widely accepted elective course for all business majors.

The objective of this textbook is to help business students understand the concept of information systems development and develop practical skills of information systems analysis and design. Upon completion of the course, students should be able to analyze and design information systems in a professional manner.

Information systems analysis and design are connected with a wide range of topics. Generally, information systems analysis and design involves two interrelated parts: management of information systems development and techniques of information systems development. The techniques of information systems development include five major interrelated technical components: business process modeling, data modeling and database design, networking design, computer programming, and computer hardware and operating systems. Each of these technical components has its unique and plentiful material to learn. The fact is that a single course or a single textbook is unable to fully cover all these technical components. Commonly, management of information systems development and business process modeling are taught in the information systems analysis and design course, data modeling and database design are taught in the database course, networking design is taught in the data communication and networking course, and computer programming is taught in courses of computer languages. Hence, the primary theme of this textbook is management of information systems development and business process modeling. The secondary topics, including data modeling, networking, computer programming, and computer hardware and operating systems, are discussed very briefly in this textbook when delivering the monolithic concept of information systems development.

### **Unique features of this textbook**

There have been hundreds of textbooks of systems analysis and design on the market. Given the long history of information systems, many information systems analysis and design textbooks were written decades ago and then revised for numerous times. The volumes of those systems analysis and design textbooks are usually huge since they contain many secondary contents that might be useful to know decades ago but are no longer essential for information systems development today. Many of those textbooks contain chapters that are rarely used for teaching and learning in this course. In the history of the management information systems discipline, systems analysis and design has been dominated by the computer software builders-centered approaches which were borrowed from the software engineering discipline. For instance, countless textbooks of systems analysis and design on the market still describe structured computer program design in great detail. In fact, structured program design was a major topic of systems analysis and design before the 1980s, but is no longer significant for systems analysis and design today. On the other hand, the fast growth of ERP systems and commercialized business software packages on the software market has shifted the strategies of information systems development from systems construction to systems acquisition in ordinary business organizations. Contemporary topics such as systems design for systems acquisition and acquisition decision making are lacking in the existing textbooks. This textbook emphasizes the concept of business-centered systems acquisition by including the contemporary topics, and aims to enhance students' practical skills of systems analysis and design.

This book maintains a good balance between the core concepts and the secondary concepts, as well as a good balance between the basic knowledge and the practical skills in systems analysis and design. The unique features of this textbook are summarized as follows.

#### *(1) Emphasizing information systems acquisition instead of systems construction*

The strategies of information systems development in the ordinary business organizations have been changed over the past several decades. Nowadays, except for software companies, few business organizations build their information systems

by doing programming and testing, because commercialized off-the-shelf software packages, services online, and ERP systems are widely available at low costs. This textbook emphasizes information systems acquisition, and provides a synopsis of information systems construction as supplementary knowledge. In presenting its contents, the textbook clearly distinguishes the two different systems development strategies.

*(2) Emphasizing the systems acquisition tools instead of the system construction tools*

Many tools for information systems analysis and design have been invented during the past several decades. The most commonly used tools in this field are: Data Flow Diagram (DFD), the Unified Modeling Language (UML), and Business Process Modeling Notation (BPMN). According to our experiences of teaching information systems analysis and design for longer than twenty five years as well as the research findings, we consider that the UML is a good set of software engineering tools for systems construction, but is difficult to use in the systems acquisition cases. Similarly, BPMN is a good tool for describing a business process at a detailed level for system construction, but provides little system perspective. DFD has been with us for a long time. DFD is not perfect, but is an excellent tool for students to develop system thinking skills for information systems analysis and design. As explained in the textbook, DFD is particularly powerful in the context of information systems acquisition which is much relevant to today's information technology environment of business.

*(3) Emphasizing contemporary contents instead of legacy contents*

Since the focal point of information systems analysis and design has been shifted from system construction to system acquisition in the contemporary information technology environment, this textbook eliminates legacy contents, such as structured programming design, which might be worth knowing for system construction but are no longer essential for business students. On the other hand, this textbook emphasizes contemporary contents such as selection of commercial software products.

### *(4) Emphasizing project skills*

This textbook emphasizes the practical project skills. It provides a methodical guideline for information systems analysis and design projects, and describes the tools and techniques used for information systems analysis and design in a systematic way. This textbook is actually a comprehensive guideline for practical systems analysis and design projects. As specified in Appendix A, the general requirement for students, who learn information systems analysis and design using this textbook, is a real-world information system analysis and design project.

### *(5) Eliminating secondary material*

This textbook eliminates secondary material that is not essential to business students for learning information systems analysis and design. It has little overlap with other independent information systems textbooks such as database design and implementation, data communication and networking, and computer programming languages. All chapters and appendices of this textbook are necessary for the systems analysis and design course.

### **The organization of this textbook**

The textbook has seven chapters, plus appendices. Chapter 1 introduces students into the information systems analysis and design field, and discusses the roles of systems analysts in business organizations. Chapter 2 discusses information systems development strategies, and presents a general overview of the project management for information systems development. Chapter 3 explains the systems planning phase. Chapter 4 provides details of the systems analysis process and DFD, a powerful tool for systems analysis. Chapter 5 presents details of the systems design process. Chapter 6 explains the systems implementation and conversion process. Chapter 7 is an overview of post-project activities and information systems maintenance. Each chapter includes a list of key terms that convey the important concepts of information systems analysis and design. Exercise instructions for course projects are also listed at the end of each relevant chapter. The book includes four appendices that are relevant to the course project of systems analysis and design. Appendix A provides a thorough guideline for the course project of

information systems analysis and design. Appendix B is a short tutorial of CASE tool Visible Analysis. Appendix C is an example of systems analysis and design case. This example is not a complete project report, but provides the key features of a typical information systems analysis and design project for small business. Appendix D exhibits an example of open source ERP system. The samples of user interfaces are useful for students to learn how to examine application software products for system acquisition. Finally, this textbook includes a set of PPT slides handouts for students to review the textbook material conveniently.

In summary, this textbook is designed for business undergraduate students in all majors who study information systems analysis and design for business organizations.

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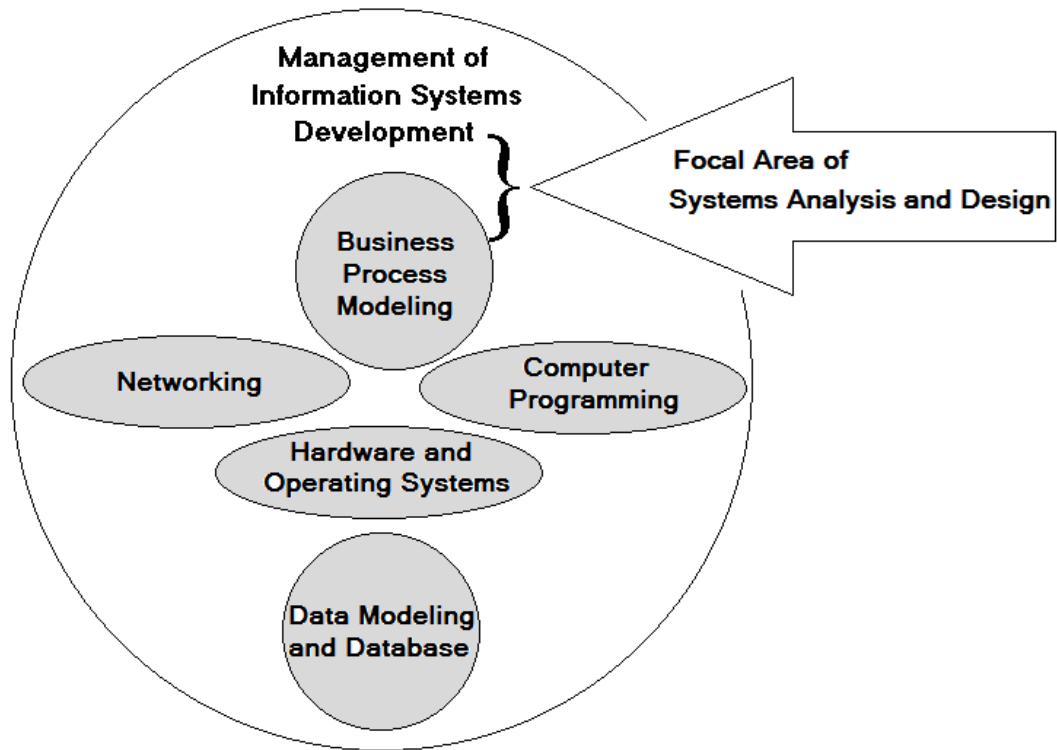


# CHAPTER 1. INTRODUCTION

## 1.1. Context of Information Systems Analysis and Design

An **information system** is an organized collection of people, information technology, information resources, and all coordinated activities to achieve certain objectives in the business organization. Conceptually, an information system may or may not be computerized. For instance, in a manual inventory process system, the set of the inventory bookkeepers, calculators, and pencil and paper are the information system. Practically, nowadays computers have become an indispensable element of contemporary information systems. As information technology is essential and vital to business, the development of an information system in the organization becomes crucial for the success of the organization. This textbook disseminates theories and methodologies of the process of information systems development.

**Information systems analysis and design** refers to the process of completing an information system development project. **Information systems development** covers a wide range of technical areas including business process modeling, data modeling and database design, networking design, computer programming, and computer hardware and operating systems. Each of these areas discusses its subjects of information systems in addition to information systems development, and has rich and unique material to learn. For instance, the theories of data modeling and database design can be applied to data resource management and business intelligence in addition to information systems development. The fact is that it is impossible for a single course or a single textbook to fully cover all these areas. Practically, the information systems analysis and design course and its textbook focus on two components: management of information systems development and business process modeling, and touch on other technical areas very briefly when delivering the monolithic concept of information systems development. The context of the information systems analysis and design course is depicted in Figure 1.1.



**Figure 1.1. Context of Information Systems Analysis and Design**

## 1.2. Central Objective of Information Systems

The central objective of an information system is to create **value** for the organization by using information technology. For most business firms, value means more profits. For non-for-profit organizations and government agencies, value can mean much more than monetary measures.

In the information systems literature and on the Web, you can find countless success stories of information systems development, and you can also read many failure cases of information systems development. There are many factors that can

have impact on the outcomes of information systems development. The commonly considered **success factors** for the information systems development are:

- Top management support;
- User involvement;
- Alignment of the business strategy and the project strategy;
- Effective project management;
- Organizational collaboration; etc.

Clearly, in terms of success factors, an information systems development project is not much different from any types of projects such as highway projects and green energy projects. However, an information systems development project is significantly different from other types of projects in that the value created by the information system is difficult to measure before the information system actually takes place. On the other hand, to justify an information system development project, the organization must estimate the potential value produced by the information system. The process of information systems analysis and design is to provide an accurate estimation of the potential value of the information system and to ensure the potential value of the new information system.

### 1.3. Systems Analysts

A **systems analyst** is a person who is responsible for the development of an information system. A systems analyst must understand the three aspects of information systems development: the business, information technology, and the people. She/he must possess business skills, information technology skills, and human interaction skills to fill her/his job responsibilities.

#### 1.3.1. Business skills

The systems analyst must have a clear vision of the business environment and the business strategy of the organization. She/he must understand the nature of the business and the business processes in the organization. When working on the

system development, the systems analyst must consider the various factors of the business environment and an alignment of the information system with the business strategy.

### **1.3.2. Information technology skills**

The systems analyst must have solid knowledge of contemporary information technology, as well as fluent practical skills of systems analysis and design. The team of systems analysts of the organization possesses the best knowledge about how the organization can apply information technology to support the day-to-day operations and decision making at all managerial levels to achieve the organization's goal.

### **1.3.3. Human interaction skills**

The systems analyst must understand the users' needs for the information system and be able to involve the users in the information system development process. Dealing the relationships with users, training users, and conducting surveys and interviews are an important part of the job of the systems analysts.

### **1.3.4. Managerial skills**

The systems analyst needs to manage people, pressure, and risks. She/he must demonstrate the leadership in the project team as well as the analytical capability of problem solving. The systems analyst must deal with co-workers, managers, and systems users fairly, honestly, and ethically.

Apparently, the skills set of systems analysts is an integration of soft-skills (e.g., human interactions) and hard-skills (e.g., systems analysis and design). The job titles of systems analyst vary depending on the focal skills needed for the special programs. Business analyst, program analyst, change management analyst, and information technology specialist are the alternative job titles of systems analyst. A business analyst focuses on the business issues surrounding the information system. Program analyst is a broad job title. If a position of program analyst is set for information systems development, the program analyst focuses on the business process and the coordination among functional areas in the course of information systems

development. A change management analyst focuses on the issues of changes caused by the new information system, including the new policies, new procedures, user training, and system support in the organization. Information technology specialist is another broad job title for specialists of modern digital technology. Upper management positions in the career path of systems analyst include information systems project manager, information systems manager, and chief information officer (CIO).

### **Key Terms**

Information system

Information systems analysis and  
design

Information systems development

Value

Success factors for information  
systems development

Systems analyst

Skill set of system analyst



## CHAPTER 2. INFORMATION SYSTEMS DEVELOPMENT

This chapter provides an overview of the systems development life cycle model and an overview of information systems development project management. It discusses three fundamental information systems development strategies: systems acquisition, systems construction, and outsourcing.

### 2.1. Systems Development Life Cycle

The **systems development life cycle (SDLC)** is a conceptual model of the phases an information system goes through. The typical systems development life cycle model suggests five fundamental phases of information systems development process: planning, analysis, design, implementation, and maintenance, as depicted in Figure 2.1.

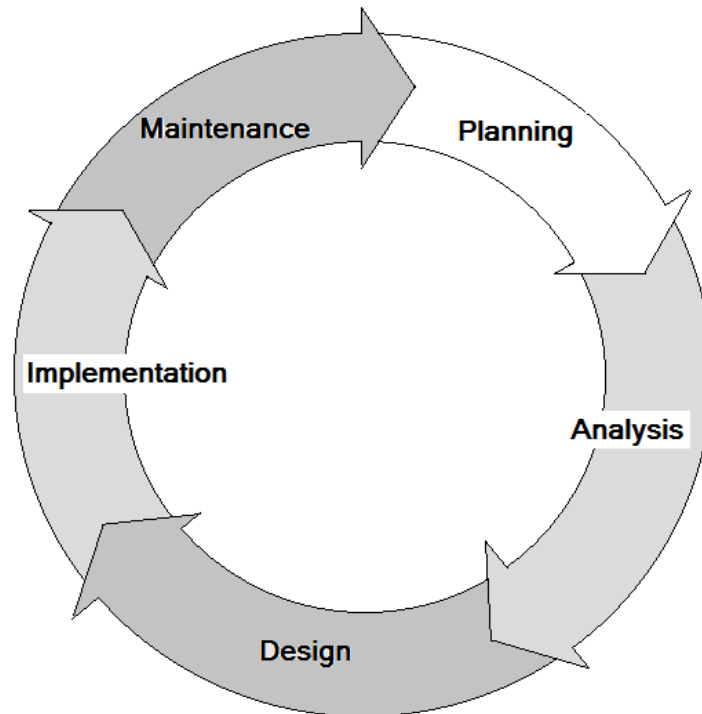


Figure 2.1. Systems Development Life Cycle (SDLC)

The SDLC model provides a general guideline for the information systems development in two aspects.

(1) The system development process of an information system must move through these five phases. Although the pattern of how an information system goes through these phases depends on the approach used for the information system development, as discussed in detail in the following chapters of this book, a successful information systems development process can never omit any of these five phases.

(2) Each of these five phases produces a set of products, called **deliverable**, which is used as the input to its successor phase. Each phase elaborates on the work of its predecessor phase. The structures and forms of the deliverables of each phase can vary depending on the approaches used for the information system development. The quality of the deliverables affects the quality of the entire information system development project.

The **planning phase** is the process of preliminary investigation to understand *why* a new information system should be created for the organization. The deliverable of the planning phase includes a report of the feasibility study and the workplan for the new information system development project. Once the organization decides to create a new information system, a full-scale project of information system development is then started.

The **analysis phase** is the first stage of the full-scale information system development project to investigate *what* the new information system will do. In this phase, the project team fully investigates the current information system (or the **as-is** system) of the organization and the specific business needs (or the **system requirements**) for the new information system. The new information system that meets the system requirements is called the **to-be** system. The deliverable of the analysis phase reports on the following major system analysis results.

- The differences between the as-is system and to-be system;
- The system requirements for the to-be system;
- The strategy of system development for the design phase.



The deliverable of the system analysis phase actually presents a blueprint for the new information system.

The **design phase** determines *how* the to-be system will be created and *how* it will operate in terms of hardware, software, networking, system personnel, and operational procedures. The deliverables of the design phase are the detailed **system specifications** of system infrastructure, hardware, software, and networking for the implementation phase. The design phase actually provides the solution to the to-be system.

The **implementation phase** builds the new information system based on the system specifications provided by the design phase. The methods applied to the system implementation phase vary depending on the strategies of systems development, as discussed in detail later in this book. By the end of the implementation phase, the new information system replaces the old information system.

The business environment changes constantly. Also, the newly built information system might need improvement. The **maintenance phase** improves the new information system. Because of the innovation of information technology and significant changes of the business environment, the cost of system maintenance eventually becomes unjustified at a certain point. The next generation of information system in the organization will be inevitable. The information system development starts a new cycle.

## 2.2. Management of Systems Development Project

The management of information systems development projects has unique characteristics in some aspects in comparison with the management of other types of projects, as discussed below.

### 2.2.1. Project sponsor and project approval

An information system project in the organization must have its **project sponsor** who holds a top position in the organization (e.g., VP). The project sponsor has an interest in the project and is involved in the entire project duration. An information system project must be approved by the organization which will commit the