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Designed for Decision Support

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PREFACE

In business, information is more important than money. The right information given to the right people at the right time can increase sales, reduce costs, produce new products, secure new financing, obtain government approval, or resolve employee conflicts.

Business executives, current and future, need an understanding of the systems that can provide the right information at the right time. Modern electronics makes possible systems that store, process, and communicate data in any manner desired. The manager who understands the functional capabilities of these available electronic systems and the nature of business information is in a position to evolve systems that will produce data when and where it has informational value.

What constitutes an adequate understanding of electronic systems and the nature of business information for business executives? A good educational question! This book was written because existing answers to the question seemed unsatisfactory.

In the 1960s and 1970s, many excellent introductory texts were published on business computer systems. They described the electronic hardware and its functional capabilities in terms that the student of business could understand. They also introduced the reader to the more widely used computer programming languages and described common business applications, such as payroll preparation and inventory record keeping. These texts served to demystify the computer and gave the student a basic idea of how computers perform routine clerical tasks and computations. They did not enable their readers to actually develop, use, or manage computerized business information systems, however.

In parallel with these introductory texts, a second category of texts developed that concentrated on the process of building data processing systems. These books on systems analysis and design combined industrial engineering material on forms design and system specification with the "know-how" that evolved out of early computer system develop-

ment projects. The knowledge presented was very practical and useful to those engaged in building custom-designed data processing systems, but it did not tell the business executive what kind of system to ask for nor did it tell the designer how to build a system that would efficiently produce data that had informational value to managers.

Another category in the business information systems literature is the text that focuses on the nature of business information and takes electronic systems for granted. In this approach the information needs of management are carefully analyzed and management information systems are described in general terms. The task of relating the general system concept to specific electronic gear, computer programs, and databases is left to the reader.

This book provides an overview of electronic systems from the user's viewpoint. The technology of teleprocessing systems is described in nontechnical terms. This should enable business executives to intelligently discuss alternatives with sales representatives, systems designers, and other executives. Database management concepts and techniques are described from the user's perspective. The possibilities of using computing systems to analyze management problems are explained.

These explanations of computer technology in Part II may be too advanced for the reader who has no prior exposure to computers and programming. They are geared to the student who has studied one of the introductory texts previously mentioned, or who had computer programming in high school.

In Part III of this text, the information needs of business are described and specific systems designed to meet those needs are defined in terms of the files, procedures, and teleprocessing system required. The needs covered range from simple clerical processes to advanced decision analyses. By systematically reviewing the whole range of business information systems, the way in which low-level clerical systems support high-level decision support systems is made clear. At the same time, the independence of certain strategic planning systems from other data systems is established; this has important implications for systems development planning.

For inexperienced students, this book should serve to separate systems design from programming. Developing computer programs is not even discussed in this text. Programming is to data systems design as carpentry is to architecture. Programming is a separate field that puts limits on what is practical but does not shed much light on the ideal system design. As computer system capabilities become better suited to business needs (as opposed to scientific needs) and as electronic system costs decline, the limitations imposed by programming considerations will become less significant.

The coverage of information systems design in this book is by no means complete. The book is intended to be an introduction to the subject. It concentrates on the basic architectural factors that should influence the design of information systems. The importance of giving users systems that they can control is emphasized. The value of standardized approaches to data management and computing systems is brought out. The interdependencies between certain common business data systems are clearly defined. Ways of classifying data systems to better understand how the parts fit together to create a complete information system are given. The more detailed aspects of developing system specifications and evaluating design alternatives are left to more advanced treatments of the subject.

Information systems design is an emerging profession. Its development has been hindered by confusion concerning the distinction between programming and system design and by the attempts of programmers to function as system designers. This book puts a vast distance between programming and system design. It also separates information systems design from computer science. It begins to identify a body of knowledge that system designers should be required to master. This body of knowledge overlaps that of computer science to a minor extent. The central concern in computer science is design of computer hardware and system software. An information systems designer needs to know of this about as much as a car buyer for a car rental agency needs to know about the designing of automobiles. It is of peripheral interest. The central issue in information systems design is how to efficiently deliver data that has informational value. The main qualifications for dealing with this issue have to do with an understanding of the goals and practices of business, and of the application programs and teleprocessing systems that are available or can be developed.

A second prerequisite for the reader of this book is an understanding of the rudiments of business. A general knowledge of accounting, marketing, production, and business organization is assumed. The discussions of Part III take for granted the reader's understanding of the basics of business practice. Again, there are many fine introductory texts on these subjects for the reader who finds the Part III material difficult because of unfamiliarity with the business functions involved.

There are review questions at the end of each chapter. These are for the reader to use in measuring his or her comprehension of the material in the chapter. There are only enough questions to cover main points once, so a score of less than 90 percent on the set of questions at the end of a chapter probably means that major points have been missed.

The thoughtful consideration and suggestions that colleagues, students, reviewers, and editors have given along the way have been most

welcome. In particular, the confidence expressed by William B. Gruener has been very helpful. The skill, patience and perseverance of Peggy Friberg in typing the many revisions of the manuscript have also played a vital role in bringing the project to a successful conclusion.

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PART I

Basic Concepts

INTRODUCTION

Business information systems supply the data required by participants in a business, including workers, customers, stockholders, vendors, and tax collectors. Note the elements of an economy that are present in this activity. There is a product—data. The participants in the business are the consumers of the product. These "consumers" are usually called "users." Data systems experts are, together with their data systems, the producers in this subeconomy.

This presentation of basic concepts begins with a discussion of the product, data. It then proceeds with a definition of "users" and the types of data they need. Next the spotlight is turned to the systems that produce data. Three basic data production techniques are briefly described. The final section categorizes business data systems and explains the organization of the remainder of the book.

Chapter 1

CONCEPTUAL FRAMEWORK

1.1 THE PRODUCT

There are several different descriptions of what an information system produces. This is not surprising. There are different concepts of what the automobile industry produces. Some say it sells fabricated steel. Others see it as selling status symbols, and there are many views in between these two.

From one viewpoint, an information system is a symbol processing system. It receives symbols, stores them, transforms them, transmits them, and prints alphabetic, numeric, and pictorial symbols. This view focuses on what a physical system *can* do. A system can process symbols. To the extent that symbols may be accepted as data and the data qualifies as information, the system produces information.

Another view ignores what is literally going on and focuses instead on what the system should at a minimum provide, namely, data. In this view the product is understandable, factual data, conveyed through symbols. Unfortunately, this view has led many to accept computer output as accurate when it is actually inaccurate. For many reasons, garbled versions of observable or measurable phenomena may be printed. The intent, nevertheless, is to produce data that presents facts accurately.

Is it sufficient to simply produce accurate data? No. The facts must be *relevant* and *newsworthy* to justify the system. They must relate to the needs of the manager to be viable products in the business data system economy. Data that is relevant and news to the user is "information." In other words, data has informational value when it is taken to be relevant and news by a user.

The informational value of data depends on how much more effective it makes the user. This is difficult to predict. Managers may recognize information when they see it but may not know how to define it so that a data system can generate it efficiently. Data systems experts know how to develop systems that produce data efficiently, but they often have difficulty identifying the information, if any, in a data set. Frequently,

the value of a painting at an art auction is more predictable than the value of data generated for business managers.

It should be noted that a business data system is not the only source of information managers need or have available. The *American Heritage Dictionary* contains this definition: "Inform . . . To give form or character to; be the formative principle of." Data on a business activity certainly can sharpen the image of that activity and clarify what is going on. It is information to the one for whom it has that effect. This is not to say it is the only source of information on the business. One can also learn much by inspecting the business operations or using its products and services. Data is simply one potential source of information.

To summarize, the product of business data systems is symbols that present data that has informational value to a manager. The informational value of data derives from the relevance of the data to the concerns of the manager *plus* the fact that the data is *news* to the manager. If the data is not news, it has no informational value even though relevant to management concerns. If the data is not relevant to the concerns of management, it has no informational value even though it may be news. Data must be both *relevant* and *newsworthy* to qualify as information.

The phrases "business data system" and "business information system" are virtually interchangeable. Their difference is similar to the difference between "hairdresser" and "beautician." Data is what a well-organized system can produce. Information is what the user hopes and tries to get from the system.

The mathematical theory of information was developed to aid in designing communications systems. This theory defines a quantitative measure of information. It proposes that information be measured in terms of the reduction in uncertainty that it brings. This is analogous to measuring light by the reduction in darkness that it causes. It has proven useful in the design of message transmitting systems. The fact that a reduction in uncertainty can be translated into an economic value in many specific business situations is a basis for speculation that the data system product will eventually be as measurable as that of a factory.

When we recall that information is "formative power," however, the problem of measuring the value of the output of a data system becomes more difficult. What is taking the place of uncertainty? In what sense is it true? A dictatorship can replace uncertainty with an arbitrarily defined order and maintain that order for a period of time through control of the press and other means.

One limit on the information production possibilities of data systems is the range of symbols the system can manipulate. This limit becomes clear when data system outputs are contrasted with the outputs of the arts. Art uses a wider range of symbols than do management data systems. Painting, music, dance, literature, decorating are all concerned with conveying meaning through symbols. This wider range of symbols

is used to explore a more comprehensive concept of information. A painting may convey a spiritual message, concerned with appreciation, awareness, feelings. The management report usually conveys an intellectual message, concerned with fact, quantity, definition. Intellectual myopia produces a limited concept of information. Good art eliminates this bias.

Artists sometimes forget that a symbol contains no inherent information and concentrate all their attention on technique. The result is a laborious creation that conveys little information. In the same way, impressive management reports are produced by expensive data processing equipment that all too often have no value for any manager. A business data system that produces information of value to managers has something in common with a good work of art.

1.2 THE USER

The "user" is the one for whom the data system produces information. In business, it is the individual that uses the data system as a tool in performing a function or job.

For example, consider a data system that has terminals at teller stations in a bank at which the bank tellers enter customer transactions —deposits, withdrawals and so forth. The user in this case is the bank teller or, more broadly, the branch banking department of the bank. The user is *not* the bank's customer. The customer is the individual for whom the transaction is processed, but it is processed by the teller who uses the data system as a tool.

In other systems, such as pay-by-phone systems in which customers give instructions to the bank computer by phone, the customer may be considered to be a "user."

The term "user" may also be applied to the manager who authorizes the development or purchase and installation of a data system. In this sense, it refers to the owner of the system. This owner, or responsible manager, may not use the system directly but others working for, or with, the system owner do use it.

1.2.1 System Users versus Developers

The term "user" is most commonly employed by data processing specialists who are developers, maintainers, and operators of data systems. It serves to distinguish those for whom the system exists from those who develop and, to varying degrees, operate the system. These data processing specialists are often in a separate information systems department and they view users as their customers.

Will this distinction between user and system developer persist? Two reasons it may not persist are the difficulty of producing data that has informational value and the declining cost of data processing sys-