

THE CONCEPTUAL DESIGN OF A COMPUTERIZED
FINANCIAL INFORMATION SYSTEM
FOR SMALL BUSINESSES

By

LARRY D. ZIMMERMAN

Bachelor of Science

Oklahoma State University

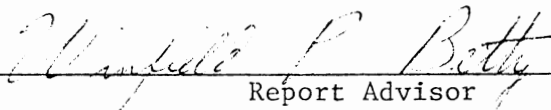
Stillwater, Oklahoma

1972

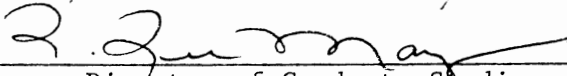
Submitted to the Graduate Faculty of the
Department of Economics and Finance
College of Business Administration
Oklahoma State University
in partial fulfillment of
the requirements for
the degree of
MASTER OF BUSINESS ADMINISTRATION
December, 1980

THE CONCEPTUAL DESIGN OF A COMPUTERIZED
FINANCIAL INFORMATION SYSTEM
FOR SMALL BUSINESSES

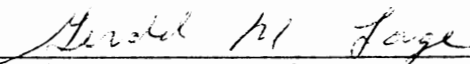
Report Approved:



Report Advisor



Director of Graduate Studies



Head, Department of Economics and Finance

PREFACE

This paper is concerned with the conceptual design of a computerized financial information system for small businesses. Computer and information processing concepts and a survey of information methods, models, and systems are presented as a prelude to the small business financial information system.

I wish to express my appreciation to Dr. Winfield P. Betty for his assistance in the development of this paper.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
Purpose	1
Approach	2
Summary	3
II. COMPUTER CONSIDERATIONS AND INFORMATION PROCESSING CONCEPTS AVAILABLE TO SMALL BUSINESSES AND FIRST TIME COMPUTER USERS	4
Introduction	4
Computer Considerations	4
Historical Overview of the Computer Development	5
Hierachy of Computer Systems Available to Small Businesses	8
Considerations Concerning Input/Output Devices, Storage Media, and Additional Memory	11
Current Equipment Trends and Developments	12
Information Processing Concepts	13
Key Management Factors that Make Computer Opera- tions More Successful	13
Guidelines for First Time Computer Users in Dealing and Contracting with Hardware Manu- facturers and Vendors	14
Methods of Obtaining Computer Services	17
The Software Applications Area	18
Programming Considerations	19
Summary	20
III. A SURVEY OF INFORMATION METHODS, MODELS, AND SYSTEMS	21
Introduction	21
Accounting Models	22
Bookkeeping Model	22
Accounts	23
Cost-Volume-Profit Model	24
Budget and Performance Analysis Models	25
Payoff Graph Analysis Model	26
Net Present Value Model	26

	Page
Additional Models	27
Contribution-By-Value Analysis Model	27
Forecast Models	28
The Least Squares Model	29
The Exponential Smoothing Model	30
Inventory Control Model	31
Replenishment, Lead Time, and Safety Stock . .	32
The Problem of How Much to Order	32
Material Yield Analysis Model	34
Quality Control Analysis and Reporting	35
Network Model	36
Expected Time	36
Probability and Statistical Models	37
Probability Concepts	38
Statistical Concepts	39
Basic Queuing Models	40
Simulation Models	41
Linear Programming Model	42
Overall Systems	43
By Industry	43
By Function	43
Summary	44

IV. THE CONCEPTUAL DESIGN OF A COMPUTERIZED FINANCIAL INFORMATION SYSTEM FOR SMALL BUSINESSES 45

Introduction	45
Systems Work and the Information Systems Development	
Methodology	45
Systems Analysis	46
General Systems Design	48
Systems Evaluation and Justification	49
Detail Systems Design	51
Systems Implementation	52
Management Considerations of the Information System	54
The Financial Information System	55
Output Considerations and Format	56
Historical Balance Sheets	58
Historical Income Statements	59
Sources and Uses of Funds Statement	60
Ratio Analysis Reports	61
Pro forma Balance Sheets and Income Statements	62
Monthly Cash Budget	63
Input Considerations	63
From Input to Output	65
Overview of the System	67
Summary	69

V. SUMMARY AND CONCLUSION 70

	Page
System Values	70
Implications for Further Design	70
BIBLIOGRAPHY	72
APPENDIX A - INPUT PROGRAM STATEMENT LISTING	76
APPENDIX B - EXAMPLE EXECUTION OF INPUT PROGRAM	80
VITA	100

TABLE OF EXHIBITS

Exhibit	Page
1. Major Developments in the History of Computers	6
2. Output Statements	57
3. Overview of System	68

CHAPTER I

INTRODUCTION

A high percentage of small business failures are attributed to the lack of use of financial information. [13] One reason for this is that many businesses do not have any kind of models or systems to gather their raw data, condense and summarize that data, and report it in a useful format for decision-making. It is felt that an investigation resulting in the conceptual design of a computerized financial information system for small businesses should contribute favorably to the above problem.

Purpose

The purpose of this paper is threefold: First, information processing concepts and computer considerations applicable to small businesses and first time computer users are presented. Knowledge of these concepts and considerations should help provide small users with the ability to deal with computer equipment and systems manufacturers and vendors. Secondly, a survey of information models and systems is presented. These models and systems are applicable to all organizations, large and small, and should provide insight into potential techniques that can be incorporated into a small business information system. Finally, an information systems development methodology and the conceptual design of a computerized financial information system for small businesses are presented and discussed. The systems development methodology gives a structured ap-

proach to systems design and implementation in any type of organization and can serve as a guide for the development of small business information systems. The small business financial information system presented provides a method of using the computer to input the historical data of small businesses and output relevant information and statements in a useful format in order to assist the user in decision making. Thus, the intent of this paper is to present information processing concepts, computer considerations, information models, and a design methodology useful to the small business user and to provide a conceptual financial information system to assist in assembling use information for decision-making.

Approach

In investigating the area of small business information processing and systems, the following sequence of topics is covered. In this, the first chapter, the need for small business information systems is noted. The purpose and approach is also presented.

Chapters two and three are concerned with surveying information useful to small businesses and providing a background for development of the small business information system. Chapter two discusses information processing concepts and computer considerations applicable to small businesses and first time computer users. A knowledge of this area may assist in preventing some of the common pitfalls of first-time users. Chapter three looks at a number of information methods, models, and systems that small businesses may reasonably be expected to incorporate in their information systems.

Chapter four first presents a structured systems development methodology that could be used to assist a small business in designing its own

information system or having it designed by outsiders. This chapter also presents, with the aid of flowcharts, the conceptual design of a computerized financial information system for small businesses.

Finally, chapter five concludes with comments on the value of the information system presented, implications for further research, and summary remarks.

Summary

This chapter has stated a need for the development of small business information systems. The purpose of this paper has been stated, basically, to provide an information system to satisfy that need. Also, the approach of this paper has been presented to assist the reader in understanding its organization. The following chapters present useful information that can assist small businesses in their information and decision making needs.

CHAPTER II
COMPUTER CONSIDERATIONS AND INFORMATION
PROCESSING CONCEPTS APPLICABLE TO
SMALL BUSINESSES AND FIRST TIME
COMPUTER USERS

Introduction

In order to successfully lease or purchase and operate a computer system, a first-time computer user should be familiar with fundamental computer considerations and information processing concepts. The purpose of this chapter is to present some of these considerations and concepts.

This chapter first presents a brief overview of the computer's development, a look at the hierarchy of computer systems, and equipment trends and developments. Then it discusses managerial factors in operating a computer system, guidelines for contracting with computer manufacturers, alternative methods of obtaining computer services, the software applications area, and programming considerations.

Computer Considerations

Long ago, it was predicted that computing power would one day become economical enough to be used in the small business environment. Advances in technology, along with dynamic competition among computer manufacturers, vendors, and service agencies, have created a broad range of data processing systems that small businesses can afford.

Today, more than ever, small businesses are interested in gaining the benefits of computerizations at the least cost. Next, will be presented a look at the historical overview of the computer's development as well as some of the computer equipment considerations applicable to small businesses and first-time computer users.

Historical Overview of the Computer's Development

The computer industry is a relatively young one which has experienced tremendous growth. It is important that small businesses and first-time computer system users understand the implications of the tremendous growth and technological development of the industry. The purchaser of a computer system takes a technological obsolescence risk unique to the industry. The best way to emphasize the ever present changes that take place in the industry is to look back at the historical development of the computer. This overview will be presented both through a brief discussion and through Exhibit 1 which shows a time line and some of the major developments over the short history of the computer. [51]

The first commercial use of data processing occurred about 1880 when Herman Hollerith developed some simple punched card equipment to help with the taking of the census while employed by the census bureau. Punched card equipment involves the use of several wired panels which are changed to perform different tasks. This equipment marked the beginning of data processing activities and was used productively for many years.

In 1925, a corporation was formed that later would dominate the computer industry. Thomas Watson, along with some of the early systems personnel from the Census Bureau, formed International Business Machines, the company we are all so familiar with today.

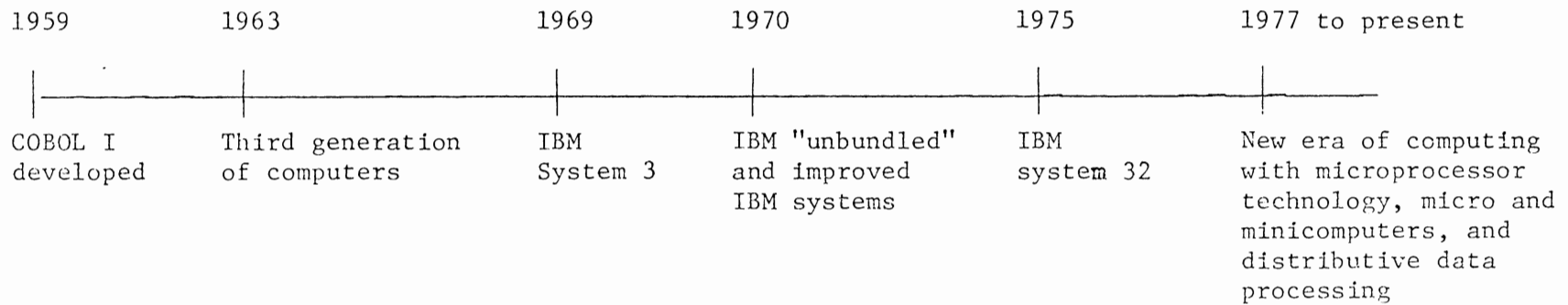
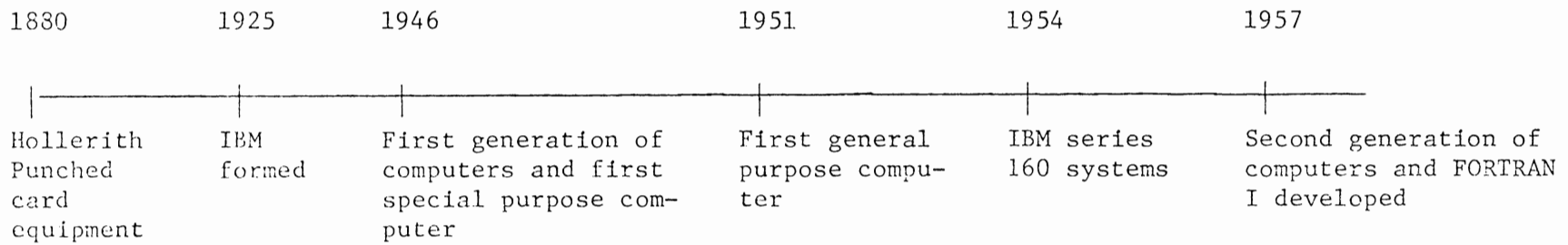


Exhibit I

1946 marks the beginning of what is referred to as the "computer age." This date also marks the introduction of the first generation of computers, 1946-1957. This period was generally characterized by continued computer equipment developments. The equipment itself worked through the use of vacuum tubes and could operate in milliseconds or a thousandth of a second. Also, in 1946, the first special purpose electronic digital computer was developed and used by the government to calculate ballistic tables. This was followed, in 1951, by UNIVAC I, the first general purpose electronic digital computer, which was delivered to the Census Bureau for public use. Next came the beginning of IBM's domination, when it released its first 160 series system, in 1954. General Electric was the first purchaser of this system but many commercial users immediately followed.

The most significant technological advance to that date occurred in 1957 when the second generation of computers was introduced by IBM. This generation, 1957-1963, was generally characterized by an applications explosion, or new ways to program computers. Also the equipment of this generation operated on transistor components and operated in microseconds, or a millionth of a second. Until this point, the computers were programmed using assembly or machine level languages that few could understand. In 1957, FORTRAN I, a higher level scientific-oriented language was developed; followed, in 1959, by the development of COBOL I, a higher level business-oriented language, making it easier to program computers and contributing to the applications explosion of that period.

1963 marked the introduction of the third generation of computers. The equipment of this generation operated through large scale integrated circuits operating in nanoseconds, or a billionth of a second, and was responsible for easing the cost of computer equipment. The applications

development continued during the period. The hardware development had exceeded the applications development and numerous attempts were made to find better ways to utilize the computers. During this period, IBM was the major innovator and introduced its small computer system 3, in 1969, and its system 32, in 1975. During 1970 IBM also released its series 370 large scale computer, to upgrade from the system 360 series. During that same year IBM "unbundled," allowing for separate pricing for its hardware, maintenance, programs, systems engineering support, etc., which was followed by several vendors, and increased the total cost of computing systems. Highlights of the most recent era of computing is discussed in this chapter's section, Current Equipment Trends and Developments.

Hierarchy of Computer Systems Applicable to Small Businesses

When a small company considers a computing system it generally can select from the following, ordered in decreasing size: a medium scale computer, a small business computer, a minicomputer, or possibly a programmable calculator. [40] Because the costs vary significantly between the alternatives, the choice is important, and warrants a look at some of the considerations in each case.

The high cost and experience required to obtain and operate a medium scale computer limits its use to only the largest of the small businesses and should not be considered by a first time computer user. The small business that decides to use a medium scale computer has the expertise available to utilize this size of system in a cost effective manner. This would require a separate data processing department and sufficient applications to efficiently utilize the system. These requirements are rarely satisfied in a small business so we will turn our attention to the other

alternatives now frequently used for small businesses.

In the past decade, programmable calculators have grown from fancy adding machines which had a few special function keys to very powerful and flexible interactive calculating systems. Like computers, they now have available to them a wide range of peripheral devices such as plotters, card and tape recorders, and punches. But even though a programmable calculator will do many things, a very small computer can do, and may cost nearly as much, it is not a computer.

Programmable calculators are designed to do calculating and problem solving. Computers, on the other hand, are very versatile and are capable of doing many data processing tasks. The decision whether to use a calculator or a computer must depend on the type of applications desired and the situation at hand. In particular, it depends on the need for a general device, on the users knowledge of computers and computing, on the time and manpower available, and of course, the cost.

Prices of programmable calculators vary with the size of the memory and the sophistication of their input-output devices. A unit with a relatively large memory, a built-in alphanumeric printer, and a magnetic card recorder may cost between \$3,000 and \$5,000. A calculator with a smaller memory could cost under \$1,000. In essence, if a small business needs a system for calculations and problem-solving, a programmable calculator may satisfy this need, but something more is needed for data processing activities.

Early applications of minicomputers included instrumentation, test, and control systems; data acquisition and reduction, communications, and education. [22] The range of applications has recently widened considerably with the emphasis on business-oriented functions. Minicomputers are

now used in business not only as general purpose small machines, but also in word processing, data entry and collection, retail systems, accounting systems, insurance applications, and many others.

As the minicomputer industry has matured and proliferated, more emphasis has been placed on the offering of a complete system; that is, both hardware and software. Manufacturers have concentrated on providing powerful and flexible systems which include higher order languages, such as COBOL, PL1, FORTRAN, RPG, etc., and data base management systems. Thus for those small businesses that have limited data processing needs and financing, the minicomputer may be a satisfactory alternative.

From programmable calculators and minicomputers, we move up in technology, power, and price, to what is commonly termed the "small business computer." A small business computer can be defined as a computer with a user-programmable system with programs available for processing commercial applications like payroll, accounts receivable, inventory, billing, etc. It should also have the ability to handle some form of management information system.

This type of system is typified by popular models such as the IBM System 3 and the IBB System 32. The monthly rental prices are usually near \$2,000 and selling prices are in the range from \$30,000 to \$150,000. There are over thirty firms supplying equipment which fits these criteria.

The small businessman who should be concerned with this class of computer is one who probably already has some accounting machines to help out with billing functions. Although different businesses have different requirements, in general, companies with about 200 employees and around \$300,000 capital may be able to justify the cost of their own small business computing system.

Methods of obtaining computing services other than purchasing or leasing your own computer equipment will be discussed later in this chapter under information processing concepts.

Considerations Concerning Input/Output Devices, Storage Media, and Additional Memory

In purchasing a computer system many small businesses thoroughly investigate the CPU (central processing unit) but fail to get available savings through the purchase of peripherals (input/output devices, storage media, and additional memory) from independent peripheral equipment companies. [6] In addition, the proper use of peripherals can make the CPU more efficient and delay upgrading. Failing to understand and investigate these peripheral considerations is a costly fault of many first-time users.

In the 1970's, IBM "unbundled" allowing for separate pricing of the CPU's and peripheral equipment. This provided the upsurge of the independent peripheral equipment companies. The unbundling forced users to consider the price of peripheral equipment separately and encouraged them to look at the alternative of the independent where they found lower prices. Today, savings can be found, in many cases, by purchasing from large independents equipment such as card reader/punch units, printers, paper tape input/output devices, console typewriters, and storage devices. Perhaps the best buys from the independents are additional "add-on" memory and the fast magnetic disk drives. These items can be added to the CPU to make it more efficient and create savings by delaying upgrading to larger CPU's, something small businesses should consider.

Another peripheral consideration that small businesses can save on is buffers with input/output control units and channels to make the system

more efficient and delay upgrading. Systems often become "input/output bound" because the CPU is tremendously fast in comparison to the input/output devices and literally has to wait for these devices to perform tasks at slow speeds before it can do its work at the high speeds. By adding additional memory or buffers to the input/output control unit and channels, this problem can be reduced. Then when an input/output instruction is encountered in a program, the CPU "iterates" a channel program which is stored in the buffer, and goes on to performing other work. Meanwhile, the channel completes the input/output operation and interrupts the CPU when the task is complete.

All of these peripheral considerations can create savings for small business users. They can make the system more efficient, and therefore, delay additional costs of upgrading to larger systems.

Current Equipment Trends and Development

It is important for computer system users to be familiar with computer equipment trends and developments. New developments come rapidly in the computer industry and can make a user's system obsolete and worthless in a short period of time.

Several developments have lead to smaller, faster, and less expensive computer systems. A few of these developments follow. [42]

Microprocessor technology has made an impact on all computing systems. [45] The microprocessor is a miniature panel that has the memory capability and speed of full size 1950 systems. The increased development and use of microprocessors has stimulated a new era of computers.

Another relatively important development is magnetic bubble memory. [31] This device is capable of storing one billion bits of information per square

inch. Because of its solid state nature it has no moving parts and needs very little maintenance.

Fiber optics, another important development, are coated filaments of glass that conduct bursts of light and connect terminals to computers over space. The transmission travels at the speed of light and is unbothered by the environment.

These are a few of the important developments in the computer industry. Each offers advantages that have caused new computing systems to replace old ones. If the system users can understand new developments, he may be able to make a better transition to newer systems.

Information Processing Concepts

The first part of this chapter deals with considerations related to computer equipment for small businesses. Next, attention turns to concepts that small business management can be aware of in operating computer systems and in dealing with information processing. Knowledge of these concepts can save time and money by avoiding some of the more common errors.

Key Management Factors that Make Computer Operations More Successful

There are many small businesses that install computer systems, but for a variety of reasons are unsuccessful in recovery of the systems high cost through its utilization. A survey of one hundred and two companies, by the British Institute of Management, led to numerous of general management factors that make computer operations more successful. [18] Some of the suggestions offered include the following:

- (1) You should not just look at computers, but should look harder at your business. Do not regard the computer as a panacea for the problems of the organization.

- (2) Do not rush it, be prepared to creep, crawl, walk, and then run, in that order, into computerized systems.
- (3) Spend as much time as possible on a feasibility study to determine the problems and likely benefits, and to establish the priority areas for computer applications.
- (4) Ensure top management appreciation, interest, backing, and responsibility for systems.
- (5) Spend plenty of time on training and educating all levels of the staff. Dispel the myth of the "black box" as early as possible.
- (6) Make sure you understand the potential user's anxieties and problems. Gain confidence of your staff by early involvement and discussions. The ultimate success of the system may depend on good human communication and understanding.
- (7) Recruit first class data processing people, some internally if possible.
- (8) Use a business-oriented data processing manager, not a technician uneducated in business, and give him appropriate authority.
- (9) Do not underestimate the time and costs involved in developing systems and programs.
- (10) Analyze systems and potential applications to make sure that the data used is reliable and consistent.
- (11) Keep systems as simple as possible and make sure they are all cost justified.
- (12) Lay down strict and clear standards for systems, programming, and operating.

The small business that attempts to follow these suggestions will have made the first step toward efficient use of its computer system.

Guidelines for First Time Computer Users in Dealing and Contracting with Hardware Manufacturers and Vendors.

Once the appropriate computer selection has been made and negotiations begin for obtaining the right to use the computer system, it is essential for the first time user to analyze the factors and considerations of the commercial computer contract. [43] Because of IBM's "unbundling," requiring separate pricing and contracting for equipment,

maintenance, systems engineering, etc., users now must negotiate several complex contracts to obtain a total system and accompanying services. The following terms in the standard computer-related contracts have been called "the most offensive clauses included in business contracts today."

[9] The standard contracts the user usually is required to negotiate include the following: a rent/lease/purchase equipment contract, a license agreement for program products, a systems engineering agreement, and a maintenance contract.

It is important to emphasize to the small business system purchaser that the "offensive" terms of these standard computer contracts are negotiable. To negotiate these terms it is suggested that a committee of a lawyer, a data processing expert, and a member of management be formed. Several of the most important negotiable clauses in the standard computer contracts are identified below with suggested alterations that should place the first time user in a better contractual position. [43]

In the standard computer contract a scope of agreement clause is found which excludes from the contract any statements made by the vendor in the proposal for computer service to the user. The user should negotiate to have the proposal made a part of the contract since management relies on the proposal in determining if the system will meet its needs.

When leasing a computer system a standard clause restricts the use of the system to one shift, or a limited number of hours per day, in return for a basic monthly rental fee. The small business user should have unlimited use of the system. Numerous problems exist if the user is required to get all of its data processing activities accomplished in a limited period during each day.

Another offensive standard clause requires the system leasor to pay for transportation of the computer to and from his business. This results in both the previous and new leasor paying for the transportation charges, which should be split between them. Alteration of this term can result in considerable transportation saving on the bulky and heavy computers.

A "hell or high water clause" requiring that the system user continue to pay the rental charges under all conditions should be removed. If the clause is not removed, the user could be required to continue paying the rental charges even after discontinuing use of the system during a legal dispute with the equipment vendor.

Another clause in the standard contract places a time limitation on the user for initiating legal action which is often less than the statute of limitations. The user should insist on a time limitation at least equal to its state's statute of limitations period to protect his rights.

Also, the computer vendor often attempts to insure that the laws controlling the contract are the ones in the vendor's home office state. The user would be wise to require that the laws of the state where the contract is executed, the user's state, govern the contract. It is more sensible to require the vendor's large legal staff to be familiar with the laws of the user's state, than to require all the small users to be governed by the vendor's state laws.

Knowledge of these standard computer contract clauses and how to negotiate them can provide important savings to small and first time users, both in terms of security and money.

Methods of Obtaining Computer Services

So far, we have concentrated on discussing how small businesses and first-time users can obtain computing services through the lease or purchase of a number of alternative computers. Because of the large capital requirements and the need for data processing experience, small businesses may not find it feasible to lease or purchase their own computer. It may be wise for small businesses to investigate alternative methods of obtaining computer services. Two popular alternatives are the use of data processing service centers and timesharing facilities. [44]

There are about 1,500 companies nationwide that can be classified as service centers. An organization of this type generally owns or leases its own computer and then provides, for a fee, for the various computing needs that a small company might have. Some service centers specialize in the legal area, some in the accounting or taxation, some in the medical professions computing demands, but most provide a wide range of business or commercial applications. With their analysts, experts and packaged programs, the service centers are an attractive and viable entry into the world of computerization for small companies.

Another alternative for the small company to obtain computing services is through a timesharing company. The timesharing arrangement can be described as a computer system, owned by the timesharing company, in which a great many users, for a fee, have access to the central processing unit on a timed, rotating basis through remote terminals and batch processors. [17] The main distinction between the timesharing and service center alternatives is that the user company performs its own data processing activities in the former situation, but in the latter the service center performs these activities.

Small companies should investigate the data processing service center and timesharing companies for obtaining computing services before leasing or purchasing a computer system that requires a large capital outlay and data processing experience.

The Software Applications Area

Software is commonly referred to in two ways. Software can be defined restrictively as the programs required to operate a computer, or generally, to include all considerations required in a computer system, excluding the equipment. These items would include the programs, data processing personnel, supplies, and maintenance and engineering services.

A major problem for first time computer users is in underestimating the total cost of computing because of failure to comprehend the high costs of the general software items. [30] Actually, the software items average two-thirds of the total computing costs, while the hardware equipment represents only one-third. Computer programming costs and data processing personnel costs represent the largest software costs and are consistently underestimated by first time users.

Another problem area concerning software is how program development has lagged behind equipment development. In order to make the computer worth its expenditures, it normally must be used for high payoff applications in addition to the lower payoff applications. High payoff programs are considered to be those which provide management with new information for decision making. Low payoff applications are accounting and routine programs, such as payroll programs. The problem for small businesses is that they generally use the computer for low payoff accounting applications and find it difficult to utilize their system profitably.

Small companies also should be aware of the ways and sources of acquiring software applications. The most expensive way usually is to develop them internally. Alternatively, the company may hire outsiders to write the custom applications or lease or purchase prewritten packages. These packages can be obtained from computer vendors and manufacturers, software houses, software brokers, certain government agencies, and independent users attempting to recover their development costs.

Small business users should understand that the software considerations are equally important and usually more costly than the hardware considerations. Knowing this will assist them in avoiding some of the software problems discussed above.

Programming Considerations

There are two major areas concerning programming where small businesses should take extra concern. These areas are language selection and use, and potential error situations in the programming cycle. [36]

The three general levels of program languages are machine language, assembly level language, and general purpose compiler level languages. Machine language is the most efficient language level, the instructions being written in binary code. Its difficulty restricts its practical use. The assembly level languages use symbols substituted for the binary code. It is one step down in efficiency and is used on a limited scale for business programming. The general purpose compiler level languages are the least efficient in regard to machine utilization but are the easiest to use. The majority of applications programs are written in the following general purpose languages: FORTRAN, a scientific-oriented language; COBOL, a business-oriented language; PL1, a general purpose, business-oriented language; and RPG, a business report writing language.

CHAPTER III

A SURVEY OF INFORMATION METHODS, MODELS, AND SYSTEMS

Introduction

A high percentage of small business failures are attributed to the lack of use of financial information by these companies. [13] One reason for this is that many businesses do not have any kind of models or systems to gather their raw data, condense and summarize that data, and then report it in a useful format for decision making.

The purpose of this chapter is to present the basic characteristics of some traditional information methods, models, and systems that are used by businesses of all types, large and small. An understanding of these items can provide a basis for determining techniques and statements which may be useful in the designing of financial information systems that fulfill the needs of small businesses.

A few of the accounting models used most frequently by small businesses are presented first. Then additional models are illustrated which are not frequently used by small companies, but should be considered in planning a financial information system. Finally, attention moves to overall systems, by industry and by function, which are available. These systems are of a standard form, but could be considered with modifications to meet the needs of particular companies.

Each category represents some financial amount at some point in time. All transactions are classified and recorded in such a way that the total assets equal the sum of liabilities, contributed capital, and retained earnings.

Retained earnings at some point in time, usually stated at the end of an accounting period are, RE_{t-1} , the earnings for the period are, $E_{t-1/t}$, and the dividends declared during the period are, D . This equation is stated as $RE_t = RE_{t-1} + E_{t-1/t} - D$.

Earnings are determined by matching the inputs, for the period, with the outputs, for the period. In business organizations the inputs are measured in terms of sales revenue (R) and the outputs are measured in terms of expenses (EXP) required to generate this revenue. Income tax (TAX) is not recognized as an expense but as a social cost of doing business. The equation for earnings is stated as $E_{t-1/t} = R_{t-1/t} - EXP_{t-1/t} - TAX_{t-1/t}$.

Accounts

Accounts are set up which represent categories of transactions. The accounts are merely a place to receive transactional data, and to show increases or decreases where, at certain periods, the current amount balance of an item is available. All accounts can be algebraically summed, in accordance with the procedures dictated by equations, to provide financial statements whenever needed.

These accounts take a variety of forms, depending on whether they are recorded on paper for manual data processing methods, or recorded on punched cards, magnetic tape, magnetic disk, etc., for computer processing. The basic procedures in classifying, recording, and reporting are the same whatever data processing method is used.

The rules for recording are as follows: [47]

- (1) Debits increase asset items and decrease liabilities, contributed capital, and retained earnings.
- (2) Credits decrease asset items and increase liabilities, contributed capital, and retained earnings.

Retained earnings represent the meter for earnings, i.e., revenue increases retained earnings, therefore, a credit increases a revenue account. Conversely, an expense decreases retained earnings, so a debit increases an expense account.

Cost-Volume-Profit Model

Costs react on the basis of activity, time, or a combination thereof.

We can categorize costs into four basic behavior patterns, which are: [14]

- (1) Variable cost behavior, where costs react in direct proportion to changes in activity.
- (2) Nonvariable cost behavior, where costs remain the same no matter what the level of activity, as these costs are strictly a function of time.
- (3) Semi-variable cost behavior, where costs are basically nonvariable at low volume of activity, but at higher volumes of activity they tend to exhibit characteristics of variable costs.
- (4) Semi-fixed cost behavior, where costs are nonvariable over some period of time but change to a new level at the end of the relevant time period. For example, this year's rent is \$12,000, next year it will be \$18,000.

In knowing cost behavior, small businesses can simulate those profits which might be obtained with changes in volume or activity. The measure of volume can be number of units sold, or it can be sales revenue. At lower volumes, a loss is expected; at higher volumes a profit is expected; somewhere in between a breakeven point exists where cost equals revenue.

The cost-volume-profit relationship provides a useful way for simulating the profit factors of any organization. The factors that increase

profits are increased selling price per unit, decreased variable cost per unit, decreased nonvariable cost, and increased volume.

Budget and Performance Analysis Models

"A budget is a plan of action, expressed in quantitative terms, which covers some specific time period." [16] The key concept of a budget is to structure it in terms that equate to the responsibility of those who are charged with its execution. In this way, the budget is used not only as a planning device but also as a control device. Budgets are of several types:

- (1) An operating budget, which shows planned operations for the forthcoming period.
- (2) A cash budget, which shows the anticipated sources and uses of cash.
- (3) A capital budget, which shows planned changes in a variety of resources in addition to cash.

The budgeting process involves a planning-control-planning life cycle, which is described as follows:

- (1) Planning, which entails selecting objectives and means for their obtainment.
- (2) Controlling, which encompasses two activities, the translation of objectives into units of output and the determination of specific inputs to generate outputs, and the comparison of actual operations with budgeted operations.
- (3) Planning, at this stage uses performance reports for evaluating past operations for planning future operations.

Budgets can also be viewed as being prepared for different levels of the organizations. Budgets can relate to the entire organization (master budget), the division, the department, and any subunit.

Budget is a macro concept whereas standards are a micro concept. For example, the standard cost per labor hour may be \$5. The budget for 20,000 manhours would show a total labor cost of \$100,000. The standard

itself is a predetermined estimate of what performance should be under stated conditions. In preparing performance information based on standards, we can use these models:

$$(1) \text{ Quantity Variance} = (\text{Actual Quantity} - \text{Standard Quantity} \times \text{Standard Cost})$$

$$(2) \text{ Cost Variance} = (\text{Actual Cost} - \text{Standard Cost} \times \text{Actual Quantity})$$

$$(3) \text{ Total Variance} = (\text{Quantity Variance} + \text{Cost Variance})$$

These variances provide small businesses with measures of performance and aids for control.

Payoff Graph Analysis Model

The payoff graph is a tool that can be effectively used by the analyst to enhance the information received by management. Payoff analysis is a simple, straightforward technique which can be used by analysts to compare costs and savings of alternative systems. [23]

The model can use data such as the cost of a present system compared with the cost of a proposed system. The savings are calculated by subtracting the proposed systems costs from the present systems costs. The net accumulated annual savings is then plotted on the graph for analysis. Although this is a useful model in making gross estimates, it ignores the time value of money and a desired rate of return on investment for these considerations the next model can be helpful.

Net Present Value Model

The net present value model can be used to help management make decisions about investment proposals if such a proposal can be reduced to monetary amounts. "Stated simply, neglecting nonmonetary considerations, an investment proposal is accepted if the present value of its earnings or

cost savings equals or exceeds the amount of the investment required at some selected rate of return." [32]

For example, suppose that management is thinking of purchasing a computer system for \$380,000. The useful life of the computer is five years. The cost savings for the first year is \$30,000, for the next three years \$100,000, and for the last year \$80,000. The minimum desired rate of return is 10%. Neglecting other quantitative or qualitative considerations, should management purchase the computer?

The net present value is negative \$77,050 and means the investment has not earned what it should at a minimum desired rate of return of 10%. Therefore, the investment is undesirable. If the present value were positive or zero, the investment would be desirable because its return either exceeds or meets the desired minimum. However, this simplistic problem assumes that there are no other investment projects competing for a finite amount of investment funds.

Additional Models

In addition to some of the basic accounting models presented above, there are others which also help managements, small or large, in their planning, controlling, and decision making. In many organizations, the function of management is performed on an intuitive basis. [50] That is, no systematic effort is made to define and measure variables affecting the organization. There are, however, a number of models which help to systematize and quantify certain variables in a manner where small business management can make more knowledgeable decisions.

Contribution-By-Value Analysis Model

A very simple, but quite effective, logical model that can be used

in almost any kind of performance analysis is termed contribution-by-value analysis, also called ABC analysis. The analysis is based on Pareto's Law, which when roughly interpreted is: "an empirical relationship describing the number of objects X whose contribution is Y in the form $X = AY$." [46]

Pareto's Law shows an empirical relationship describing the number of persons X whose income is Y where Y is less than infinity and greater than zero, and A is a constant. The expression $X = AY$ is used to designate any frequency distribution whether related to income or not; that is, the variable Y may be measured from an arbitrary value. To explain in simple terms, Pareto's Law states that in most situations a relatively small percentage of certain objects contribute a relatively high percentage of output. Many systems analysts find that when inventory items are plotted on a cumulative percentage graph, in order of descending value, Pareto's relationship usually exists. Relative to such a phenomenon, one frequently hears a rule of thumb quoted as: "20% of the items in inventory account for 80% of the sales". Such an analysis is quite effective in that it reveals very clearly the performance of most situations analyzed. For sales analysis, the contribution-by-value analysis can be applied to sales by customer, by salesman, by product item, by territory, by warehouse, and so on. However surprising the relationships are on first exposure, they will probably be found in any organization no matter what the situation. It should also be noted that determination of such relationships provides management with valuable information even though the contribution-by-value analysis model is, itself, simplistic.

Forecast Models

Good forecasts are vital to the success of every organization. The sales

forecast, for example, is a key function in planning and controlling inventory systems. [39] Inventory management, production, and procurement generally are geared to the sales activity that transpires in the subsequent period. The sales forecast is the basic information for production, inventory, procurement, and employment plans. Even though there are inherent errors in any forecasting model, an organization that bases its operations on intuitive decision making is ignoring the possibilities for a more efficient operation.

The Least Squares Model. As an extrapolative forecast model, the least squares technique uses historical data exclusively. When a model of this type is used, two basic assumptions must be made: that the recent level of quantity will continue and that the recent rate of change will remain about the same. [34] The least squares line approximating the set of points $(X_1, Y_1), (X_2, Y_2), \dots, (X_n, Y_n)$ has the equation $Y = a_0 + a_1X$ where the constants a_0 and a_1 are determined by solving simultaneously the equations $\Sigma Y = a_0N + a_1\Sigma X$ and $\Sigma XY = a_0\Sigma X + a_1\Sigma X^2$ which are called the normal equations for the least squares line. Here, X is the independent variable and Y is the dependent variable. The constants, a_0 and a_1 , of the above formula, can be found from the formulas

$$a_0 = \frac{(\Sigma X^2)(\Sigma Y) - (\Sigma XY)(\Sigma X)}{N\Sigma X^2 - (\Sigma X)^2} \text{ and}$$

$$a_1 = \frac{N\Sigma XY - (\Sigma Y)(\Sigma X)}{N\Sigma X^2 - (\Sigma X)^2} .$$

The least squares line passes through the point (\bar{X}, \bar{Y}) , called the centroid or center of gravity of the data.

Suppose the value of X represents time, such as months, and the value of Y represents quantities of products sold each month. The value of Y can be extrapolated according to some value of X . In other words, if the

independent variable X is time, the data show the values of Y at various times in the future.

Since Y is estimated from X, \hat{Y} represents the value of Y for given values of X as estimated from the least squares regression line of $Y = a_0 + a_1X$.

From this a measure of the scatter about the regression line of X on Y is supplied by the quantity

$$SY,X = \sqrt{\frac{(Y - \hat{Y})^2}{N}}$$

which is called the standard estimate of Y on X.

The Exponential Smoothing Model. Exponential smoothing is similar to a moving average; however, where applicable, exponential smoothing is normally chosen as a forecasting method for the following two reasons: [34]

- (1) With the moving average all data in the series are weighted equally. In other words, recent data are given the same weight as older data.
- (2) Forecasting by the moving average method requires that a great deal of data be maintained.

Actually, exponential smoothing is nothing more than a form of weighted moving average. All that is needed to use the exponential smoothing model is a smoothing constant, the current forecast, and a new observation.

The computational procedure of exponential smoothing is shown by the formula $\text{New Average} = \text{Old Average} + a (\text{New Demand} - \text{Old Average})$ where a designates a smoothing constant between 0 and 1.

The new average represents the forecast of demand for the subsequent forecast interval. The old average is the new average of the previous forecast interval, and the new demand is the actual demand for the present period.

By controlling the weight of the most recent data, a simultaneously determines the average age. The value chosen for the smoothing constant can be such that the estimate is very stable, or reacts very quickly. For example, $a = .5$ would give a greater weight to the new data than $a = .1$. Regardless of the value of a , the weighting of data follows what is called an exponential curve; therefore, the name exponential smoothing.

One of the crucial questions which arises when one uses exponential smoothing is the size of the smoothing constant that should be used. Conceptually, the answer is simple. There should be enough weight to give the system stability, but it should be small enough so that real, not random, changes in the level of demand will be recognized.

Inventory Control Model

The problem of planning, scheduling, and controlling production in the faces of uncertain market conditions, and of maintaining reasonable levels of inventories, is almost universal. In many organizations with a wide product line, the inventory clerks as well as management may not know with reasonable accuracy what the levels are, and an investigation into the inventory will often indicate a wide variation between the actual conditions, and what is thought to be the inventory. When an inventory item is overstocked, the error may not become evident for a long time, or not at all. When an item is understocked and a stock-out occurs, customer goodwill is reduced. Any organization with inventory problems, therefore, needs an inventory management system that makes certain that approximately all items are available in the correct quantity when they are needed and it prevents an increase of inventory beyond proper limits. [48] Proper inventory management assures that an adequate supply of inventory items be

maintained and required at an optimum balance between shortage and overstock. Too many shortages decrease customer service level. Conversely, an overstock of items ties up working capital that can be used more profitably elsewhere.

Replenishment, Lead Time, and Safety Stock. There are two approaches to replenishing inventories. [14] The first termed a periodic system where an order is placed on a specific date. The disadvantage of this method is that there is a risk of stockouts. The second approach is termed reorder point system in that an order is placed when the inventory level of an item reaches a predetermined level.

The time in the periodic method is always the same, whereas in the reorder point method it is unequal. The method more often used is the second method which consists of placing a constant order quantity when the inventory reaches the reorder level. The reorder level is computed by multiplying lead time by the forecast of demand and adding a safety stock. The safety stock allows for a margin of error in estimating lead time.

The Problem of How Much to Order. There are many different models of determining how much to order. The best known model used in this area is the classic EOQ, economic order quantity model. [23] This model reveals to the inventory clerk how much to buy, or order, when a reorder point is reached.

The order quantity chosen will incur certain costs. Two different sets of cost factors are considered. If a greater or lesser quantity is ordered, some costs will increase, while others decrease. Among those costs which increase are interest, obsolescence, risk, and storage, while the set of decreasing costs includes such items as freight and procurement costs. These costs can be lumped into the cost to purchase and the cost to

carry inventory. The goal is to balance the opposing costs in order to obtain the minimum total.

The total operating cost is the sum of purchasing and carrying costs and it is lowest when these two are equal. There is a relevant range of choices where the resultant total cost is not greatly affected by slight deviations from the best ordering frequency.

The literature normally handles the cost of purchasing as a constant amount for each order placed, and the cost of carrying is lumped into one percentage figure which is represented by P . Let Y designate the expected yearly demand in physical units (determined from the forecast model), let Q be the economic lot size in physical units, C be the unit cost, and S be the cost of purchasing involved in making one order in dollars. Then total annual variable costs (TVC) are expressed as

$$\text{TVC} = \frac{QC}{2} P + \frac{Y}{Q} S .$$

In the absence of safety allowances, inventories vary from Q to 0 . The average values of inventory is therefore $QC/2$ if the new order quantity replenishes stock at the time the inventory is depleted. The $QC/2$ times P represents the annual carrying cost. Y/Q represents the number of times a year that orders are placed. Therefore, $(Y/Q)S$ represents the total annual purchasing costs.

In order to determine the amount of Q which minimizes total cost, the above equation is differentiated with respect to Q and set equal to zero. The following equation is obtained

$$\frac{PC}{2} - \frac{YS}{Q^2} = 0$$

which results in the solution

$$Q = \sqrt{\frac{2YS}{PC}} .$$

"This formula states that Q , the economic order quantity, varies directly with the square root of the forecasted demand and the square root of the purchasing costs and varies inversely with the square root of the cost of carrying." [14]

Material Yield Analyses Model

In a number of industries, particularly of the process type, material yield plays a significant role in effecting cost reduction and production improvement. [48] Material yield standards are generally set for various types of raw material. In most cases the yield standards are based on laboratory tests or company records. A substantial cost reduction is achieved through the improvement of the yield of good products based on proper procurement and production efforts. A variance analysis program pointing out and evaluating causes of low yield aide management in minimizing of shrinkage and waste in purchasing and production. If, for example, the procurement personnel purchase defective raw material, an excess of shrinkage will occur during preparation of this material for processing. Consequently, a yield analysis and reporting system should be installed to determine the degree of shrinkage or waste.

Standards for material usage during the production phase are of great importance to top management. The plant manager and top management personnel need to have feedback which will enable them to detect and measure losses of raw produce during the production process. Not only do the reports of material yield give information to responsible persons, but they insure a significant degree of control of the processing function.

The basic question is whether the standard amount of raw material is used to obtain a given output of the finished product, The difficulty here

is that computation of variances is delayed until the production process is completed.

A yield analysis report does not tell why there is an unfavorable variance in the yield of a particular batch of product. It does however, give feedback to the plant manager, the manager of procurement, the president, and other responsible persons that particular phases in the processing function may be faulty. A retracing of the overall process must be set into motion in order to isolate the cause of the unfavorable variances and take necessary corrective action.

Quality Control Analysis and Reporting

Every organization, large or small, faces the problem of attaining and maintaining satisfactory quality of their output. [5] First, the quality attributes must be identified. Next, accurate standard measurements must be set. Finally, the allowable departures from such standard measurements must be determined. Moreover, satisfactory quality must be obtained at a reasonable and competitive cost level.

Product quality variation arises out of the variables which constitute a given process. The raw materials which enter the process themselves vary in form and composition. The production process itself varies and the resulting output may be below satisfactory quality.

The obvious objectives, therefore, are to reduce the amount of defective raw materials going into production and to eliminate defective finished products. These objectives are never fully possible, but a reduction in the number of defectives in the total operation must be sought. Statistical sampling and control tables can be used effectively in implementing quality control in organizations.

Network Model

PERT (Program Evaluation and Review Techniques) is an example of a network model used for planning and controlling projects with well defined activities and events. [2] PERT is based on a network composed of activities that take time to accomplish. Between the activities are instantaneous events, which designate the completion of each activity. Probably a better interpretation indicates that events represent a start or finish of the activities.

The activities are placed on a network and are represented by arrows. Generally, the arrows or activities flow from left to right. There are several guides helpful to follow when placing an activity on the network:

- (1) A determination must be made to see if any activities logically precede the activity that is under consideration.
- (2) A determination must be made to see if any activities are logically concurrent with the activity under consideration.
- (3) A determination must be made to spot activities which are logically subsequent to the activity under consideration.
- (4) Events must be clearly defined relative to their beginning and end.

Expected Time. The activity time must be estimated by someone knowledgeable about particular processes such as foremen, plant managers, etc.

Three time estimates are usually used:

- (1) Most Likely Time--What time would you expect to complete this particular activity?
- (2) Optimistic Time--If everything progresses normally the first time and there are no difficulties, how much time will it take to complete this particular activity? In other words, what is the minimum possible time in which this particular task or activity can be completed?
- (3) Pessimistic Time--What is the longest time this particular activity or task has ever taken?

The goal in getting three subjective time estimates is to use them to calculate a single weighted average or mean time. The average or mean time is called the expected time of the activity.

The three time estimates can be related to the expected time by the commonly used formula

$$t = \frac{O + 4M + P}{6}, \text{ where}$$

O = optimistic time estimate,

M = most likely time estimate,

P = pessimistic time estimate, and

t = expected time (weighted average).

Critical events on the network are those which have zero slack time. Slack time equals the latest event time less the earliest event time. The latest event time is the latest time that an event can be completed without disrupting the project. Earliest event time is the earliest time that an event can occur. A line connecting these critical events represents the critical path. An increase or decrease in time along this path will increase or decrease the completion date by the same amount.

Probability and Statistical Models

Many data elements which become input into various models are future oriented or they basically represent an unknown quantity. [21] Consequently, estimates must be made. These estimates are often made in the form of a probability distribution and merely represent a formalization of an estimator's judgement. For example, what will the sales revenue be for the next quarter is a typical question management might ask. The estimator can state a range of possibilities together with an estimate of the proba-

bility each will occur. The sum of these possibilities multiplied by the applicable probability equals the expected value of the probability distribution. Some managers rather than stating the estimates in a normal distribution choose to make estimates based on optimistic, most likely, and pessimistic conditions.

A number of probability and statistical concepts, in abbreviated form, are shown below. It is believed that these basic concepts are essential in formulating successful probability and statistical models.

Probability Concepts. Some helpful probability concepts are briefly identified below: [34]

- (1) Probability of an event--The probability that an event, E, will occur is the ratio between the number, n, of cases in which E occurs and the total number, N, of the elementary cases, all equally likely,

$$P(E) = \frac{n}{N}$$

where the assumption of equally likely outcomes describe such processes as tossing coins, rolling a die, and so on.

- (2) Random Variable--A random variable, X, assumes the values X_1, X_2, \dots, X_n with each of these values having a probability of $P(X_1), P(X_2), \dots, P(X_n)$ where $\sum P(X_i) = 1$ and the expected value of X is $E(X) = X_1P(X_1) + X_2P(X_2) + \dots + X_nP(X_n)$.
- (3) Conditional Probability--The probability that an event A will occur, if it is known that event B has occurred and is written: $P(A/B)$.
- (4) Compound Probability--This is the probability that both A and B will occur and is written: $P(A,B)$. Compound events can be shown effectively in tree diagram models. In this case, the probability of a compound event is determined by multiplying branch probabilities.
- (5) Total Probability--This is the probability that A alone, B alone, or A and B together will occur and is written: $P(A+B)$.
- (6) Cumulative Probability--This is the process of accumulating the values of $P(X)$ which results in a cumulative probability function.

- (7) Markov Chain Process--In this process the result of each trial is dependent upon the result of the immediately preceding trial, and only on that result. For each trial there is a finite number of outcomes. A probability is assigned to the outcome C for any trial, given that outcome B immediately preceded it. These probabilities are called transition probabilities.
- (8) The Poisson Distribution--This distribution is used quite effectively in queuing problems where a service utility has a number of arrivals and departures in a continuous time period. Also this distribution is applicable in building a model to determine the probability of n number of defects in a continuous process.

Statistical Concepts. Statistical concepts represent additional methods of manipulating data to provide information. Some of these basic concepts are indicated here: [41]

- (1) Histogram--This is a table showing the number of individual observations falling within each interval or class; this number is called the frequency. Before constructing a histogram, you should determine the limits of the group studies, the data or characteristics measured for each individual, the conditions under which the measurements were made.
- (2) Mean--Given a population consisting of N individuals, the mean, \bar{X} , is given by the formula $\bar{X} = \frac{1}{N} \sum X_i$.
- (3) Mean of the Means--If m measurements are taken in populations of the same nature, the mean of the means is
$$\bar{\bar{X}} = \frac{n_1 \bar{X}_1 + n_2 \bar{X}_2 + \dots + n_m \bar{X}_m}{N}$$
.
- (4) Mode--The mode is the value of X_i for which f_i , the frequency of the variate, is greatest.
- (5) Median--The median is the value of X_i (or lying between two consecutive X_i) for which $\text{cum } f = \frac{1}{2}N$.
- (6) Two measures of Dispersion--The standard deviation, or mean square deviation is
$$a_x = \sqrt{\frac{1}{N} \sum f_i (X_i - \bar{X})^2}$$
 where a = standard deviation, X = observations, \bar{X} = mean, and $(a_x)^2$ = the variance.
- (7) Random Sample--A sample from a population is considered to be drawn at random if the traits that produced the sample are independent, and if the probability distribution function of the random variable connected with each trial remains unchanged throughout the trials.

The basic probability and statistical concepts were only identified here. The referenced source provides more detailed explanations.

Basic Queuing Models

Many types of problems encountered in any organization are described by the buildup of queues of some input to a service facility. The queues result from stochastic phenomena. Inputs arrive at a facility for processing and the time of arrival of individual inputs at the service facility is random as is the time of processing. The randomness of one or more parameters in a queue system is responsible for the uncertainties associated with it. In all organizations, the queuing phenomena is ever present. In production, machines are overburdened or idle. Trucks wait in long lines at loading docks. Management must strike a balance between costs of idleness and costs of overburdened service facilities. Consequently, management must know something about the activity and length of a queue, the demand on the service activity, the capacity of the service facility to handle the random demand, and the time spent waiting in the queue plus the time in the service facility.

There are several basic situations which describe the general conditions of a service facility. [26] The simplest situation is where arriving units from a single queue are to be serviced by a single service facility; for example, a car in a car wash. This structure is called a single-channel, single-phase condition. A simple assembly line has a number of service facilities in series or tandem and represents the single-channel, multiple-phase condition. If the number of service facilities is increased (two or more car washes), but still draws on one queue, this is represented by a multiple-channel, single-phase condition.

Finally, the last structure is a multiple-channel, multiple-phase condition which might be illustrated by two or more parallel production lines.

Simulation Models

In a probabilistic model, some dimensions are known, while the values of others are based on phenomena of a stochastic nature. [33] The randomness of one or more parameters in a system is responsible for the uncertainties which exist. There are random machine breakdowns, customer demand, labor strikes, etc. Normal and Poisson distributions are used in building most probabilistic simulation models.

Simulation models help to organize disjointed data and activities, and illustrates interrelationships previously unknown. The perception of combinational aspects of a complex problem and their effect on a system can in many instances be handled only by a model.

"For example, the problem of smog control is amenable to simulation techniques. A complete understanding of the problem involves the interrelationship of climate, the molecular behavior of gasses, the chemistry of engine exhaust, the number of vehicles, the geographic layout of the city, the availability of alternative means of transportation, the speed of traffic and the timing of traffic lights, the incomes of the population, the chemistry and biology of the lungs and blood stream, problems of microbes and virus growth under chemical, light, and temperature conditions produced by smog--among other problems." [27]

The above smog control problem can be attacked through the use of simulation. Decision makers can see more clearly the aspects of the problem and how they interrelate. By doing so, the information produced by the model can aid the decision maker in choosing between a number of alternative courses of action.

Linear Programming Model

As in other problem areas, management should be able to recognize those kinds of problems that are adaptable to linear programming analysis. Linear programming is an important development in management science methodology. The purpose of linear programming is to provide a method of optimizing the allocation of scarce resources to competing demands.

Generally speaking, methods for solving optimization problems, that is, problems which attempt to maximize or minimize a given function subject to a set of limitations or constraints, have been available for over a century. Following is a list of kinds of problems which have been solved by linear programming methods. [5] This list is not exhaustive, but indicates only a few examples.

- (1) Allocation of energy sources in electrical power generation.
- (2) Determining optimal mix of food products for beef cattle production.
- (3) Adapting production to variable and seasonal sales.
- (4) Allocation of limited raw materials and production facilities to the production of a multiple product line.
- (5) Optimum multiple plant and warehouse location.

Two major assumptions which are required in using linear programming techniques include linearity and certainty. Linearity means all the relationships involve variables of the first degree and can be illustrated graphically by straight lines. Certainty requires that the value of all variables must be known and that all variables must be non-negative.

Linear programming problems can be solved graphically or algebraically. A simplex method was developed to solve linear programming problems more efficiently by using a procedure for moving step by step from a given

corner extreme point to an optimal corner extreme point. The simplex method, coupled with the use of the computer, has given management a very useful tool for solving certain business problems.

Overall Systems

Information systems range from small bookkeeping systems to elaborate and complex corporate computer systems using sophisticated and experimental techniques and models. Most information systems used by small businesses take advantage of accounting type models introduced at the beginning of this chapter. [3] The simplest and most efficient system that meets the needs of the user, small or large, will be the one best suited for its use.

By Industry

Examples of overall information systems for specialized industries are available from a number of sources. [24, 38] These example systems usually provide the accounting models adjusted for the particular needs of that industry. These systems can provide companies in the same industry guides to methods used to report standard information needed by that industry. The industry systems cover a wide range as exhibited by a list of a few of those industry systems: automobile repair system, children's dresses (manufacturing), bakeries, dentists, motels, etc.

By Function

Also available for guidance are general information systems or models, usually patterned after the traditional accounting type models, by function. [5, 19, 29] Functions represented include planning and

control systems, personnel administration systems, fixed property and investment systems, payroll systems, sales and receivable systems, and several others. These standard systems, by function, provide assistance in designing and implementing functional systems, which can be modified if needed for the particular companies needs.

Summary

This chapter has presented basic features of some accounting models, additional models not frequently used by small businesses, and some overall systems, by industry and function. A basic understanding of these models and systems should provide a basis for determining techniques and statements which may be useful in the designing of financial information systems that fulfill the needs of small businesses. The use of financial information systems could reduce the high percentage of small business failures due to the lack of useful financial information by these companies.

CHAPTER IV
THE CONCEPTUAL DESIGN OF A COMPUTERIZED
FINANCIAL INFORMATION SYSTEM
FOR SMALL BUSINESSES

Introduction

An information system for small businesses can be a valuable method of providing management with useful information for decision making. The purpose of this chapter is to illustrate an organized and structured information system development methodology and to present the conceptual design of a computerized financial information system for small businesses.

First, this chapter presents a development methodology from analysis, through design, justification, to implementation, and management considerations. Then the financial information system is illustrated. The output considerations and format are explained, followed by the input considerations, and a look at how the input data is transformed into output information. Finally, the overview of the system is presented, with the aid of flowcharts.

Systems Work and the Information

Systems Development Methodology

In designing and implementing information systems for large or small organizations, either as a member of management or as an outside consul-

tant, it is important to take an organized and structured approach. If a complete and proven development methodology is followed, the resulting system will more than likely meet the stated needs of the organization. Before presenting a conceptual design of a computerized financial information system for small businesses, an information systems development methodology is given to provide a standard approach to this type of activity.

Systems Analysis

"Systems analysis is the separation of anything into its constituent parts, and the study and evaluation of these parts to see if there are better ways of meeting the needs of management." [4] The first step in any systems analysis is for the analyst to acquire an understanding of the reason or purpose for which the analysis is being undertaken. A basic understanding can usually be attained through preliminary interviews with the persons requesting, or authorizing, the systems analysis. Some basic reasons for initiating systems analysis are: [4]

- (1) Problem-solving--It might be that the present system is not functioning as required and the analyst is called upon to correct this malfunction.
- (2) New Requirement--There could be a new requirement or regulation imposed upon the organization, or the need of a new system.
- (3) Implementing New Idea/Technology--another reason for conducting systems analysis might arise from a desire to implement a new idea, piece of technology, or technique.
- (4) Broad Systems Improvement--Finally, systems analysis might be initiated simply because of a desire to find a better way to do what is currently being done.

Initially, in some instances, these reasons are vague and poorly defined. However, the analyst must be careful to identify any specific objectives stated by the user or requester of systems analysis.

It is essential that the scope of the systems analysis be completely understood and documented in order to insure the system analysis performed is within set boundaries in terms of duration, complexity, and expense. Once the systems analyst has conducted the initial interviews, and determines what systems analysis should be conducted, an understanding of what must be accomplished and the general approach toward this goal must be communicated formally to those having the authority for approval.

Once the approval has been obtained on a proposal to conduct systems analysis, various sources of study facts are available for investigation. [37] The sources of study facts can be categorized into the existing system, internal sources, and external sources. The several advantages of analyzing the old system, if one exists, are to determine the effectiveness of the existing system, provide design ideas for the new system, identify the resources available for the new system, provide conversion knowledge for implementation, and provide a starting point for initiating a change to the new system. Internal sources include the employees of the organization, the existing paperwork and documentation of the company, and the relationship and structure of the units making up the business unit. The external study facts can encompass a wide variety of information and literature outside the organization.

Once the analyst investigates the sources of study facts, he is prepared to communicate his findings in some type of systems analysis completion report. It is important that progress is periodically communicated through reports to provide management the opportunity to stop work, modify, enter a wait state, or issue a conditional or unconditional proceed. Upon approval of the systems analysis work, the general design phase may begin.

General Systems Design

"Systems design is concerned with the development of specifications for a proposed new system or subsystem which achieves the requirements detailed during the systems analysis phase." [10] Eventually the systems design becomes a detailed elaboration of the systems analysis completion report. It is helpful in the design of a system that the analyst possess sufficient knowledge related to the organizational resources, user information requirements, other system requirements, methods of data processing, data operations, and design tools. Much of this information is obtained in the systems analysis phase, but some depends on the training and experiences of the analyst.

In practice, the application of the design process is an iterative endeavor. As each of the design process elements is addressed by the analyst, he is usually forced to reexamine whatever structure or relationship had been developed to date, and modify it to satisfy the new requirement. Some basic steps in the design process include the following:

(1) defining the systems goal, (2) developing a conceptual model, (3) applying organizational constraints, (4) defining data processing activities, and (5) preparing some type of systems design proposal. [28]

It is sometimes assumed that the identified systems requirements, and users information needs, must be met by the design of a new system. The analyst should be aware of other available alternatives. The analyst has several alternatives each time he or she evaluates a set of systems and user requirements:

- (1) The No Action Alternative--Reasons for choosing the alternative may include: a poor identification and definition of requirements or needs, a determination that it is unfeasible to develop a meaningful system or solution to the user's needs, other sys-

tems requests have higher priorities, or the user's needs as stated are not real needs.

- (2) Modify an Existing System Alternative--The majority of all systems investigations conducted in organizations include some consideration of existing systems and subsystems. To effectively satisfy new or revised user requirements, the analyst often recommends modifying existing systems and subsystems.
- (3) Design a New System Alternative--This alternative is obviously the most complex and difficult solution to implement. When an analyst recommends that a new system be implemented, a decision must be made whether this system is to be developed from scratch, or whether an acceptable system can be purchased from other sources, to satisfy the user requirements.

A general systems design proposal can be prepared to communicate to management and users in the organization how, at a broad level, the designed system will satisfy their information and data processing requirements. Assuming management authorizes continuation of the project, it can be the forerunner of a final systems design report.

Systems Evaluation and Justification

System evaluation and justification is a process gone through to prepare a final systems design report. [20] This type report can be the basic document which management uses to make its decision as to whether or not the proposed systems design should be implemented.

The major considerations as to whether or not an organization undertakes any project should always be stated in cost/effectiveness terms. If the effectiveness of a proposed system sufficiently outweighs costs of that system, then it is likely that the proposed system will be implemented. To receive a go/no go decision from management, the analyst can prepare a final systems design report which should contain, among other things, the results of the cost/effectiveness analysis.

In conducting a cost/effectiveness study the costs should be defined: by type, by behavior, by function, and by time. Secondly, effectiveness should be analyzed, followed by preparation of cost and effectiveness summaries.

In order to fully understand the implications of the costs of the proposed system, they should be analyzed according to the following categories: [11]

(1) Definition of Costs by Type.

- a. Direct Costs--These costs represent expenditures which can be identified as resulting from the proposed system
- b. Indirect Costs--These are overhead costs which cannot be easily identified with the proposed system and are, thus portioned out to each area in the organization.

(2) Definition of Costs by Behavior.

- a. Variable Costs--These costs fluctuate with volume changes in a direct manner.
- b. Nonvariable Costs--These costs might vary from period to period, but this fluctuation is not in response to volume changes in a particular period.

(3) Definition of Costs by Function.

- a. Development Costs--These are costs incurred to bring something into being and making it better, more useful, etc.
- b. Operational Costs--These are costs which must be expended to make something work or perform.
- c. Maintenance Costs--These costs are expended toward the support, upkeep, and repair of the system.

(4) Definition of Costs by Time.

- a. Recurring Costs--These costs are repeated at regular intervals, such as, payroll costs, or computer rental payments.
- b. Nonrecurring Costs--These costs will end at some specific point in time. The cost of computer program development is an example of a nonrecurring costs.

Once the costs of the proposed system have been investigated, attention must be turned to the effectiveness of the system. The effec-

tiveness of the system. The effectiveness of any proposed system is measured in terms of direct benefits, sometimes called tangible benefits, and indirect benefits, sometimes called intangible benefits. These benefits occur over the useful life of the system which runs, from the point of start-up, to the point of operational obsolescence. The direct benefits are cost savings resulting from the elimination of an operation, or from the increased efficiency of some process. Indirect benefits cannot be easily traced to the system itself, but in some way increase the effectiveness of the system. The effectiveness of a system is often difficult to state, however, an attempt should be made to express, in quantitative terms, those which can be identified.

The final step in the cost/effectiveness analysis is the preparation of summaries of the results to be included in the report to management before approval for detailed systems design is given.

Detailed Systems Design

In order to transform a general or conceptual design into a unified system of people and machines who collect and process data, and produce information, the systems analyst must perform some detail systems design activities.

The information system is a large and valuable resource to the organization. Ensuring that this resource is performing as required, and protecting its operation from both internal and external misuse, begins in the design phase. For effective administration and control of an information system, an overall framework of organizational and procedural controls must be designed and implemented. Such a framework helps to ensure the stewardship of assets, reliability of operations, and general integrity of the system.

Most of the major control points can be grouped into these general categories and defined as follows:

- (1) External Control--These control functions emanate from, and are performed by, such groups as independent auditors and consultants, user departments, top management, special staff control groups, and various constituents of the organization. They establish an independent check on the overall activities of the system through observation and feedback.
- (2) Administrative Control--These controls emanate directly from management of the information system and are traditional management functions, such as selection and assignment of personnel, delineation of responsibilities, preparation of job descriptions, establishment of performance standards, etc.
- (3) Documentation Control--Documentation control refers to all of the communications prepared by the analyst and his coworkers during the developmental phase of the system, and to the formal procedures which describe each activity required in the information system's operations.
- (4) Processing Control--Processing controls ensure that data are accurately and reliably transformed into information. These controls include input controls, programming controls, hardware controls, data base controls, and output controls.
- (5) Security Control--Security controls include all of the physical and logical preparations taken to ensure that the system is not intentionally or unintentionally disrupted during operations.

The detail system design activities required to satisfy these controls result in a designed information system with its programs completed, the forms designed, the system fully documented with a complete operations manual and ready for implementation.

Systems Implementation

In order to implement the new system successfully, there are a few activities which must be performed by the systems analyst which are generally not classified as design work. [35] These activities involve the training and educating of personnel, and the testing of the system. Also, because a new system must be implemented into the dynamic environment of an

organization, there is a special consideration, termed systems conversion, required to achieve this implementation. Finally, the efforts of the systems analyst do not end with the implementation of the system. An implementation follow-up is often vital to the eventual acceptance of the system.

People are a key ingredient in any system. Providing adequate education and training both initially, and on a continual basis, is essential if a system is to achieve its objective.

Testing the system is the final activity before implementation. In reality, testing occurs at many levels within a system, with the highest level being systems testing. There are several different approaches available for testing. These approaches reflect a trade-off between the cost of preparing a test and the reliability obtained from the testing activity. Testing is an important activity in the implementation of a new system.

The implementation of many new systems involves a conversion process from an existing system. The conversion process can include one or more considerations: an equipment conversion, a data processing method conversion, or a procedural conversion. Planning is an important aspect of conversion. Generally, a broad conversion plan is prepared before specific design and development activities begin. A specific conversion plan is prepared shortly before the actual implementation of the new system.

Once the system has been implemented, the systems analyst serves in a consultants role in systems follow-up. Immediately after implementation, the analyst is available to assist operations and user personnel in understanding the new system, and in solving of any identified problems. After implementation, follow-up management will generally be responsible for the new information system and requires several unique considerations.

Management Considerations of the Information System

Once the information system has been designed and implemented, the activities of management may determine the success or failure of the system. Some of the general activities that management may be responsible for include the following: the establishment of, and adherence to, a master plan for the information system; selection, training, and assignment of personnel; definition and description of each employee's responsibilities and duties; establishment of procedures and performance standards; establishment of internal control; and the preparation and establishment of budgets, user request procedures, and pricing techniques. [1] The variety of these activities stresses the importance of good systems management.

Data center activities are generally routine in nature, and performance can usually be easily measured and controlled by management. On the other hand, since systems and programming work are more creative in nature, they are difficult to manage. However, with the use of appropriate time estimates and control techniques, management's effectiveness in planning, scheduling and controlling these activities can be enhanced considerably.

One significant area of management responsibility is systems maintenance. Some common causes of systems maintenance include emergency maintenance, routine maintenance, special reporting requests, and systems improvements. One of the major goals of management should be to develop a highly maintainable system. This objective can usually be accomplished by designing for change, the establishment of standard configuration policies, the enforcement of maintenance policies through audit and control procedures, the organization of programmers and systems analysts for maintenance work, and by converting to more maintainable systems.

Auditing procedures are often used to ensure that management objectives are being met and that the integrity of the system is maximized. Several types of audits include: post implementation audit, routine operational audit, financial audit, and systems audit. Many auditors, especially independent CPA auditors, are extending their traditional financial audits to include many aspects of the systems audit.

In performing effective systems work and ensuring that changes in the system are accepted by the personnel of the organization, both the systems analyst and the management of the information system must be aware of human needs, especially the resistance to change, and see to it that all systems designs are compatible with these needs. If the technical potential of information systems are to be realized, the various factors arising from people problems must be satisfied first. The above considerations provide an organized and structured development methodology for designing and implementing a small business information system.

The Financial Information System

The remainder of this chapter deals with the presentation and discussion of the conceptual design of a computerized financial information system for small businesses. The system uses the historical data of a small business as input. Based upon that data, it makes calculations, pro forma extensions, and rearrangements. Then the system outputs useful information in standard formats and statements to assist the small business user in decision making.

The system is designed to use the conversational programming system (CPS). CPS PL/I is the language used in writing programs by users in this system. [12] The CPS system allows a single large computer to serve

many users simultaneously while each has the illusion that the system is responding to him only. Terminals, which are similar to regular typewriters are used to interact with the computer. The nearly instantaneous processing under CPS is a benefit that small users and those accustomed to waiting long periods of time for results can appreciate. The output considerations and formats are presented first. This makes it easier to understand the input considerations which are shown next. Then the computer techniques and considerations necessary to transform the input data into the desired output information are discussed to aid those who may wish to go from this conceptual design to a fully programmed system. Finally, an overview of the system, with an accompanying flowchart, and the conclusion are illustrated.

Output Considerations and Format

The small business financial information system (SBFIS) design takes the input data, which is discussed later, manipulates that data, and outputs the following statements for the shown periods:

- (1) Historical Balance Sheets (for up to twelve periods),
- (2) Historical Income Statements (for up to twelve periods),
- (3) Sources and Uses of Funds Statement (for up to twelve periods),
- (4) Ratio Analysis Report (for up to twelve periods),
- (5) Pro forma Balance Sheets (for up to twelve periods),
- (6) Pro forma Income Statements (for a user determined number of periods),
- (7) Cash Budget (for twelve months).

Exhibit 2 presents a flowchart of these output statement. The flowchart shows the logical order of the statements and how they relate to

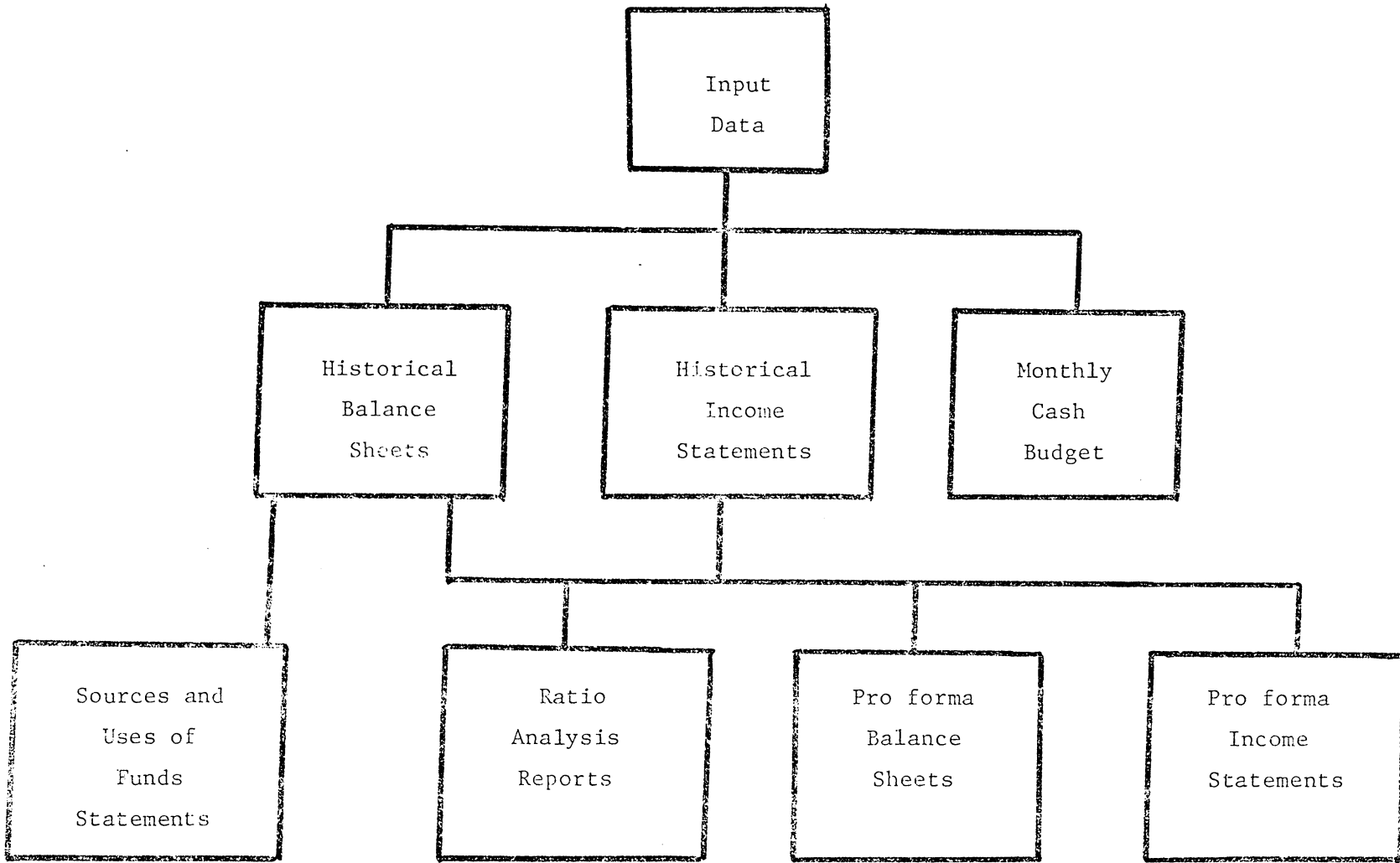


Exhibit 2

one another. Next, each of these statements and their proposed format will be examined individually.

Historical Balance Sheets. The balance sheet attempts to present the value associated with the business assets, liabilities, and owner's equity at a given point in time. The system is designed to allow the user to output up to twelve periods of historical balance sheets. This gives the user the option of analyzing yearly information or monthly information for a full year.

In order to design a flexible system, for use by any small business, a standard set of accounts is used in the statements. This may require the user to rearrange some of his data to correspond to the standard accounts. Also, to save program space, account titles are abbreviated while still keeping them clearly identifiable.

The balance sheet line items and format are presented below:

	<u>PERIOD X</u>	
CASH	<u>XXX</u>	.XX
ACCTS REC	<u>XXX</u>	.XX
INVENTORY	<u>XXX</u>	.XX
OTHER CUR ASSETS	<u>XXX</u>	.XX
TOTAL CUR ASSETS	<u>XXX</u>	.XX
NET FIXED ASSETS	<u>XXX</u>	.XX
TOTAL ASSETS	<u>XXX</u>	1.0
ACCTS PAY	<u>XXX</u>	.XX
OTHER CUR LIABS	<u>XXX</u>	.XX
TOTAL CUR LIABS	<u>XXX</u>	.XX
LG TM LIABS	<u>XXX</u>	.XX
COM STK	<u>XXX</u>	.XX
PFD STK	<u>XXX</u>	.XX
RET EARNINGS	<u>XXX</u>	.XX
TOTAL LIABS & EQUITY	<u>XXX</u>	1.0

Two columns are presented for each period. The first gives the absolute amount of the corresponding line items and the second gives the percentage amount each asset is of the total assets or each liability or equity is of the total liabilities and equity.

Up to twelve periods of statements may be presented. If the user chooses to output the maximum number of periods it is presented in a four-by-three matrix; with periods one through four across the first horizontal level, five through eight across the second, and nine through twelve across the last horizontal level.

Historical Income Statements. The income statement attempts to match the expenses associated with the revenues earned during a specific period of time. Again, the system will output up to twelve historical income statements, depending upon the determination of the user.

The standard income statement line items and format are as follows:

	PERIOD X	
SALES	XXX	1.0
COGS	<u>XXX</u>	XX
MARGIN	XXX	XX
TOTAL OPER EXPS	<u>XXX</u>	XX
EBIT	XXX	XX
INT EXP	<u>XXX</u>	XX
EBT	XXX	XX
TAXES	<u>XXX</u>	XX
NET INC	<u>XXX</u>	XX
DEP	XXX	XX
DEC IN NON CASH CUR ASSETS	XXX	XX
INC IN CUR LIABS	<u>XXX</u>	XX
CASH FLOW FROM OPERS	<u>XXX</u>	XX

An additional determination of cash flow from operations is presented with the traditional income statement to provide more useful information to the user. Cash flow from operations is defined as net income plus depreciation, decreases in non cash current assets and increases in current liabilities. [25]

Two columns are presented for each as with the balance sheets. In the second column each line item is expressed as a percentage of sales for that period. Again a four-by-three matrix presentation of the periods is followed if the user selects to output the maximum of twelve periods.

Sources and Uses of Funds Statement. A "rough and ready" sources and uses of funds statement illustrates the increases and decreases in the balance sheet accounts during a specific period of time and provides information about the short or long term nature of the sources and uses of funds. Sources of funds include decreases in assets, increases in liabilities, and increases in equities. Conversely, uses of funds include increases in assets, decreases in liabilities, and decreases in equities.

Thus, the above definitions are used in the following presentation of the format for the sources and uses of funds statement:

	<u>PERIOD X</u>	
	<u>SOURCES</u>	<u>USES</u>
CASH	XXX	
ACCTS REC	XXX	
INVENTORY		XXX
OTHER CUR ASSETS	XXX	
NET FIXED ASSETS	XXX	
ACCTS PAY		XXX
OTHER CUR LIABS		XXX
LG TM LIABS	XXX	
COM STK	XXX	
PRD STK	XXX	
RET EARNINGS	XXX	

As illustrated, a line item can represent only a source or use of funds, not both. Also, the sources will always equal the uses during any given period. Since only a maximum of twelve periods of historical balance sheet accounts can be used as input and the sources and uses of funds statements represent changes between periods, a maximum of eleven statements are given. Thus, they are presented with periods one through four on the first horizontal level, five through eight on the second, and nine through eleven on the third. The sources and uses of funds statement assists the small business user in analyzing changes in balance

sheet items and checking if short or long term uses are being financed by short or long term sources.

Ratio Analysis Reports. Ratio analysis reports assist the user in financial analysis by making comparisons of key values to gain additional information about the organizations liquidity, leverage, activity, and profitability. Suggested ratios for the above four areas are used in the report and are defined using the previously displayed standard balance sheet and income statement line items, as follows: [7]

(1) Liquidity ratios:

- a. Current = Total current assets ÷ Total current liabilities
- b. Quick = (Total current assets - inventory) ÷ Total current liabilities

(2) Leverage ratios:

- a. Debt to total assets = (Total current liabilities + long term liabilities) ÷ Total assets
- b. Times interest earned = (Earnings before taxes + interest expense) ÷ Interest expense

(3) Activity ratios:

- a. Inventory turnover = Sales ÷ Inventory
- b. Fixed asset turnover = Sales ÷ Net Fixed Assets
- c. Total asset turnover = Sales ÷ Total assets

(4) Profitability ratios:

- a. Profit margin on sales = Net income ÷ Sales
- b. Return on total assets = Net income ÷ Total assets
- c. Return on net worth = Net income ÷ (Common stock + preferred stock + retained earnings)

The following format is used to illustrate the ratio analysis report in the small business financial information system:

<u>Ratios</u>	<u>Period X</u>
CURRENT	XXX
QUICK	XXX
DEBT TO TOTAL ASSETS	XXX
TIMES INTEREST EARNED	XXX

(cont'd)

INVENTORY TURNOVER	XXX
FIXED ASSET TURNOVER	XXX
TOTAL ASSET TURNOVER	XXX
PROFIT MARGIN ON SALES	XXX
RETURN ON TOTAL ASSETS	XXX
RETURN ON NET WORTH	XXX

This ratio analysis report should provide the small business user with valuable information. The liquidity ratios provide information on the firm's ability to meet its short term obligations, the leverage ratios on the firm's risk of financial leverage, the activity ratios on the efficient employment of assets, and the profitability ratios on the success of the firm in meeting return objectives. This report is presented in a four-by-three matrix when all twelve periods are desired.

Pro forma Balance Sheets and Income Statements. Pro forma financial statements are ones that show how the actual statements will look if certain specific assumptions are realized. The same standard accounts are used for these statements, as were used for the historical balance sheets and income statements, therefore, the format will not be repeated. The value of each line item account is shown in a column for each of the user determined periods projected.

Regression analysis is used on the past sales from the historical income statements presented to form a trend for projecting sales for the pro forma statements. Then the historical relationship between the past sales and past balance sheet and income statement accounts are also projected to determine the pro forma balance sheet and income statement accounts to be associated with the projected pro forma sales.

The pro forma balance sheets and income statements assist the small business user in planning for the future and obtaining longer term goals.

Monthly Cash Budget. The cash budget attempts to show projected cash flows, including receipts, disbursements, and net cash, for a firm over a specific period. The following monthly cash budget format is used in the financial information system for small businesses:

	<u>Month X</u>
SALES	XXX
COLLECTIONS - 1ST MO	XXX
COLLECTIONS - 2ND MO	XXX
COLLECTIONS 3RD MO	XXX
OTHER RECIEPTS	<u>XXX</u>
TOTAL RECEIPTS	<u>XXX</u>
PURCHASES	XXX
OPERATING EXPENSES	XXX
OTHER PAYMENTS	<u>XXX</u>
TOTAL PAYMENTS	<u>XXX</u>
NET CASH	<u>XXX</u>
BEGINNING CASH	XXX
CUMMULATIVE CASH	<u>XXX</u>

The system user stipulates the projected percentage of sales collected in each of the three months following the sales period. The monthly cash budget is presented for a twelve-month period, with all periods shown in one horizontal level across the output page. The monthly cash budget assists the user in determining his future cash flows and arranging for credit to meet deficits and investment opportunities for any surplus.

Input Considerations

The input program of the small business financial information system is presented in the Appendix A, along with an example execution of the program in Appendix B. This shows how the user actually gets on the computing system via remote terminals and inputs the required data of the financial information system. The program is written in CPS PL/1, as mentioned previously.

Basically, the input program does the following tasks:

- (1) declares the input arrays and their dimensions,
- (2) gives basic instructions and definitions to the user,
- (3) shows the association between account titles and array dimensions,
- (4) asks the user to specify the number of periods desired, and,
- (5) asks the user to supply input data as requested.

The program shows the association between account titles and array dimensions, but a brief explanation here may be helpful. The historical balance sheet accounts are symbolized by a two-dimensional array called $BS(I,J)$, where I represents the number of balance sheet line item accounts and J represents the number of periods of statements to be read in, which can be specified by the user from one to N periods. The historical balance sheet account symbols, where N is less than or equal to twelve, is listed below:

CASH	$BS(1,1)$, $BS(1,2)$, . . . $BS(1,N)$
ACCTS REC	$BS(2,1)$, $BS(2,2)$, . . . $BS(2,N)$
INVENTORY	$BS(3,1)$, $BS(3,2)$, . . . $BS(3,N)$
OTHER CUR ASSETS	$BS(4,1)$, $BS(4,2)$, . . . $BS(4,N)$
NET FIXED ASSETS	$BS(5,1)$, $BS(5,2)$, . . . $BS(5,N)$
ACCTS PAY	$BS(6,1)$, $BS(6,2)$, . . . $BS(6,N)$
OTHER CUR LIABS	$BS(7,1)$, $BS(7,2)$, . . . $BS(7,N)$
LG TM LIABS	$BS(8,1)$, $BS(8,2)$, . . . $BS(8,N)$
COM STK	$BS(9,1)$, $BS(9,2)$, . . . $BS(9,N)$
PFD STK	$BS(10,1)$, $BS(10,2)$, . . . $BS(10,N)$
RET EARNINGS	$BS(11,1)$, $BS(11,2)$, . . . $BS(11,N)$

Within the program DO LOOPS are used to request the balance sheet accounts for the first period, then the second, through N periods. (i.e., $BS(1,1)$, $BS(2,1)$, . . . , $BS(11,1)$, $BS(1,2)$, $BS(2,2)$, . . . , $BS(11,2)$, . . . , $BS(11,N)$).

Within the program, similar arrays are used to represent the historical income statements input data ($IS(I,J)$), the monthly cash budget input data ($CB(I,J)$), and so forth. These array symbols and associated accounts are

explained to the user in the program so they will not be listed again here.

The example execution of the program is provided to show how to get onto the computing system via remote terminals and how the input data is entered. The only difference is that each individual is required to have his own user identification number and password.

From Input to Output

The output considerations, format, and input considerations, including the input program and sample execution, of the conceptually designed financial information system for small businesses has been presented. To progress from input to designed output requires a more detailed knowledge of CPS PL/1 than the author possesses. Therefore, the techniques mentioned in this section can be further developed by using the current Conversational Programming System (CPS) Terminal Users Manual. [12] It is hoped an interested reader with a higher level of CPS PL/1 expertise will take this conceptual design and carry it through to a fully programmed and operational financial information system for small businesses.

The input program, presented in Appendix A, should provide all of the necessary data to be used to output the previously illustrated output statements. Next will be several comments on techniques to use to get from the given input to the designed output.

One limitation of CPS PL/1 is that a maximum amount of twelve pages (one page equals 4,096 bytes of storage) of primary storage can be utilized by the system at one time. Because of the large amount of storage required in this system, the use of external procedures is required. In addition, each external procedure is limited to four pages. A master pro-

gram is set up with the sole task of calling into storage one or two external procedures at a time. The external procedures are simply modules or small segments of the total system. For example, the total system may require a total of twenty pages of primary storage; eight pages above the twelve page maximum. Assume the system consists of one master call program of four pages and four external procedures of four pages each, totally the required twenty pages. The master call program could call in two external procedures, execute them, and release them, then call in the final two external procedures, execute them, and release them. Through this technique, the system requiring twenty pages of primary storage could be executed with no more than the twelve page maximum of storage used at one time.

In the designed financial information system, a separate external procedure should be used for the input program, and each of the seven output statements or reports. Including the master call program, this would require nine separate programs or external procedures.

An example in regard to the financial information system is shown here to further explain the use of the master program and external procedure.

Statements in master call program:

```
10. DCL INPUT ENTRY EXT KEY(Z);
15. DCL BAL SHT ENTRY EXT KEY(Z);
20. CALL INPUT (BS);
25. CALL BAL SHT;
30. RELEASE;
```

Statements in external procedure (INPUT):

```
10. INPUT: PROC (BS);
90. END INPUT;
```

Statements in external procedure (BALSHT)

10. BALSHT: PROC;

90. END BALSHT;

The statements in the master call program first declare the INPUT and BALSHT external procedures along with their keys. Then it calls into primary storage the INPUT external procedure with its input array BS. Next, the BALSHT external procedure is called into storage. It takes the BS array and uses it in combination with its program statements to make calculations and output the historical balance sheets. Then the master call program releases these external procedures from storage to continue called others to perform calculations and output other statements and reports. The statements in the external procedures first declare the procedure, then has various statements to perform the calculations and output the statements, and terminates with an end statement. The use of external procedures is a major technique to get from the given to the designed output in the financial information system because of the large amount of storage required.

With the provided input program and designed output statements and formats, and knowledge of the external procedure techniques, the conceptually designed financial information system for small businesses is complete. As mentioned previously, it is hoped that further work can be done in the detailed programming area to make this system into a fully programmed and operational system.

Overview of the system

Exhibit 3 presents in flowchart form the overview of the financial information system for small businesses. The flowchart shows the ordering

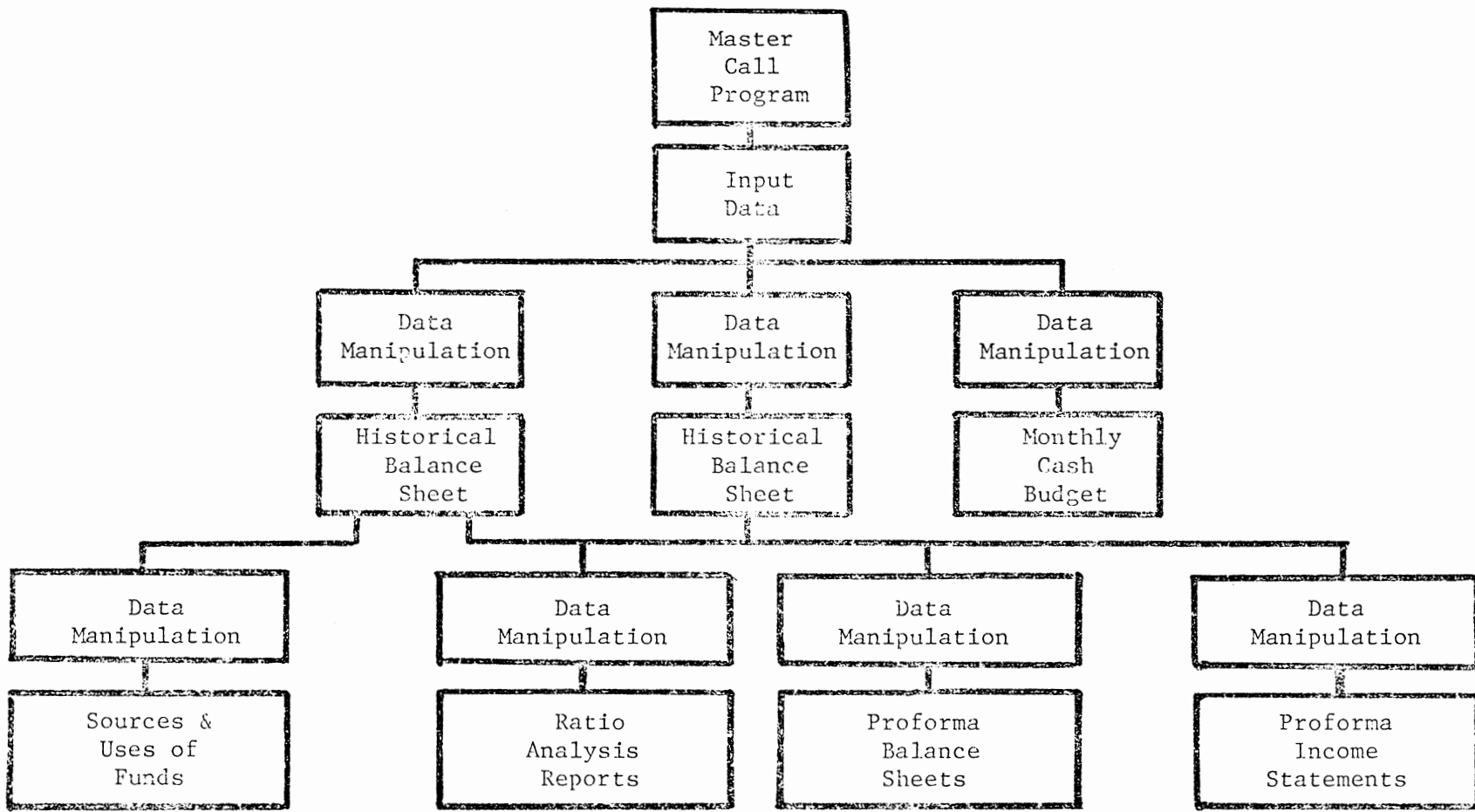


Exhibit 3

and interrelationships between the programs, processes, and statements.

Summary

This chapter first presented a structured information systems development methodology. This methodology is offered for both organization insiders or outsiders in development of systems. This section progressed from systems analysis, general systems design, systems evaluation and justification, detail systems design, systems implementation, to management considerations of the information system. Secondly, the chapter presented the conceptual design of the financial information system for small businesses. The explanation included discussion of output considerations and format, input considerations, concerns for moving from input to output, and a flowchart presentation of an overview of the system. The intent of the chapter was to provide the small business organization with a structured systems development methodology and a financial information system that will be of assistance in gathering and presenting useful information for decision analysis.

SUMMARY AND CONCLUSION

A lack of use of financial information by small businesses has contributed to their high percentage of failures. [13] One reason for this is that many businesses do not have any kind of models or systems to gather their raw data, condense and summarize that data, and then report it in a useful format to assist in decision making. It is felt that the conceptually designed financial information system for small business should contribute to the solution of the above problem.

System Values

The financial information system for small businesses uses the CPS PL/1 programming language. The conversational programming system allows the user to enter his input data, in a relatively short time, through remote terminals. The system is designed to make calculations and manipulate the historical input data and to output useful information in an organized format. The output reports and statements include historical balance sheets, historical income statements, sources and uses of funds statements, and ratio analysis reports, all for up to twelve periods; pro forma balance sheets and income statements for a user determined number of periods; and a twelve month cash budget. It is felt that the value added by these reports and statements will assist the small business user in his decision making.

Implications For Further Design

The output considerations, format, and input considerations, including the input program and sample execution, on the conceptually designed finan-

cial information system for small businesses has been presented. It is hoped an interested reader with a higher level of CPS PL/1 expertise will take this conceptual design and carry it through to a fully programmed and operational financial information system for small businesses.

BIBLIOGRAPHY

- [1] Alter, S. L. "How Effective Managers Use Information Systems," Harvard Business Review, November, 1976.
- [2] Archibald, Russell D. Network-Based Management Systems (PERT/CPM), John Wiley and Sons, Inc., New York, 1967.
- [3] Awad, Saber A. and Jones, Gardner M. "The Use of Accounting Techniques in Small Firms," Management Accounting, February, 1972.
- [4] Boehm, W. "Shaping Decisions With Systems Analysis," Harvard Business Review, September, 1976.
- [5] Bower, James B. Financial Information Systems; Theory and Practice, Allyn and Bacon, Boston, 1969.
- [6] Brandon, Dick H. Data Processing Management: Methods and Standards, Macmillan Co., Inc., New York, 1975.
- [7] Brigham, Eugene F. and Weston, J. Fred. Essentials of Management Finance, Holt, Rinehart and Winston, Inc., 1974.
- [8] Brown, J. "Designing an Accounting System for a Small Business," Management Accounting, June, 1975.
- [9] Bucci, Robert A. "Avoiding Hassles with Vendors," Datamation, July, 1974.
- [10] Cleland, D. I. and King, W. R. "Design of Management Information systems; An Information Analysis Approach," Management Science, November, 1975.
- [11] Clower, Robert W. and Due, John F. Intermediate Economics Analysis, Richard D. Irwin, Inc., Homewood, 1961.
- [12] Conversational Programming System (CPS) Terminal Users Manual. International Business Machines Corporation, February, 1972.
- [13] CPA Journal, "Small Business Needs MAS Too," CPA Journal, November, 1976
- [14] Curry, Othel J. and Matz, Adolph. Cost Accounting, Planning and Control, South Western Publishing Co., Cincinnati, 1972.
- [15] Dale, John D. Managerial Accounting in the Small Company, Reinhold Publishing Corporation, New York, 1961.

- [16] Deardon, John. "Profit Planning Accounting for Small Firms," Harvard Business Review, January - February, 1969.
- [17] Electronic News, "Basic Timesharing Enters Small Business Market," Electronic News, March 15, 1976.
- [18] Foy, Nancy. Computer Management, Auerbach Publishers Inc., Philadelphia, 1972.
- [19] Gillespie, Cecil Merle. Accounting Systems: Procedures and Methods, Prentice-Hall, Inc. Englewood Cliffs, 1971.
- [20] Heany, Donald F. Development of Information Systems; What Management Needs to Know, Ronald Press Co., New York, 1968.
- [21] Hill, D. J. and Rutherford, G. L. "Computerized Financial Data Reporting System," Management Accounting, July, 1976.
- [22] Hobbs, L. C. and McLaughlin, Richard. "Minicomputer Survey," Data-mation, July, 1974.
- [23] Horngren, Charles T. Cost Accounting: A Managerial Emphasis, Prentice-Hall, Inc.- Englewood Cliffs, 1967.
- [24] James, Marjorie D. Portfolio of Accounting Systems for Small and Medium Sized Businesses, Prentice-Hall, Inc., Englewood Cliffs, 1968.
- [25] Johnson, Charles E. and Keller, Thomas F. Intermediate Accounting, McGraw-Hill Book Co., New York, 1974.
- [26] Kaufmann, Arnold. Methods and Models of Operations Research, Prentice-Hall, Inc., Englewood Cliffs, 1963.
- [27] Kuhn, Alfred. The Study of Society: A Unified Approach, Richard D. Irwin, Inc., Homewood, 1963.
- [28] Laden, Stanley M. System Design for Computer Applications, John Wiley and Sons, Inc., New York, 1967.
- [29] Lambourne, Simon. Computer Applications in Business, Longman, London, 1974.
- [30] Larsen, Gerald H. "Software: A Qualitative Assessment-or the Man in the Middle Speaks Back," Datamation, November, 1973.
- [31] Lowry, R. "Trends and Challenges in the Computer Industry," Computer Decisions, August, 1976.
- [32] Lucas, H. C. "Use of an Accounting Information System, Action, and Organizational Performance," Accounting Review, October, 1975.

- [33] Martin, Ronald. Computer Modeling and Simulation, John Wiley and sons, Inc., New York, 1968.
- [34] Mendenhall, William and Reinmuth, James E. Statistics for Management and Economics, Wadsworth Publishing Co., Belmont, 1974.
- [35] Murdock, Howard. Information Systems for Modern Management, Prentice-Hall, Inc., Englewood Cliffs, 1971.
- [36] New, C. W. "Small EDP Shop Risks," Journal of Systems Management, June, 1976.
- [37] Optner, Joel R. Systems Analysis for Business Management, Prentice-Hall, Inc., Englewood Cliffs, 1968.
- [38] Pescow, Jerone K. Encyclopedia of Accounting Systems, Prentice-Hall, Inc., Englewood Cliffs, 1976.
- [39] Reddington, D. A. "Control Methods for Small Business," Management Accounting, September, 1973.
- [40] Render, Barry and Stair, Ralph. "Data Processing: Computer Choices for Small Business," Journal of Small Business Management, January, 1975
- [41] Richmond, Samuel B. Statistical Analysis, Ronald Press Co., New York, 1964.
- [42] Robinson, Jack C. and Ward, D. Dewey. "Distributed Data Processing: A New Tool for Accountants," Journal of Accountancy, October, 1980.
- [43] Scarletta, Phillip J. and Walsh, Joseph L. "Syntax - Legal Analysis of Standard Commercial Computer Purchase and Lease Contracts," Data Management, October, 1972.
- [44] Schreiner, F. H. "Contracted EDP in a Small Business," Management Accounting, July, 1972.
- [45] Schwartz, Donald A. "minicomputers Take Aim on Small Business Clients," Journal of Accountancy, December, 1979.
- [46] Slaybaugh, C. Jay. "Pareto's Law and Modern Management," Management Services, March-April, 1967.
- [47] Still, Jack W. A Guide to Managerial Accounting in Small Companies, Prentice-Hall, Inc., Englewood Cliffs, 1969.
- [48] Todd, J. T. "Small Business Control Systems in a Dynamic Environment," Journal of Small Business Management, October, 1976.
- [49] Whiteside, Conon Doyle. Accounting Systems for Small and Medium-sized Business, Prentice-Hall, Inc., Englewood Cliffs, 1961.

- [50] Woodward, Herbert N. "Management Strategies for Small Companies," Harvard Business Review, January-February, 1976.
- [51] Zaffarano, J. "Data Systems: Generations I - IV," Administrative Management, January, 1976.

APPENDIX A

INPUT PROGRAM STATEMENT LISTING

LIST

```
6. DECLARE BS(11,12),IS(5,12),CB(5,12),DEP(12),PS(2),PC(3);
10. PUT LIST('THIS SYSTEM ASSISTS THE USER IN THE FINANCIAL ANALYSIS OF BUSINESSES.');
```

10.1 PUT LIST('GIVEN LIMITED DATA BY THE USER THE SYSTEM OUTPUTS THE FOLLOWING');

10.2 PUT LIST('STATEMENTS AND INFORMATION: HISTORICAL BALANCE SHEETS AND INCOME');

10.3 PUT LIST('STATEMENTS, SOURCES AND USES OF FUNDS STATEMENTS, AND RATIO ANALYSIS');

10.4 PUT LIST('REPORTS, ALL FOR UP TO TWELVE PERIODS; PROFORMA BALANCE SHEETS AND');

10.5 PUT LIST('INCOME STATEMENTS FOR A USER DETERMINED NUMBER OF PERIODS; AND A');

10.6 PUT LIST('TWELVE MONTH CASH BUDGET.');

19. PUT LIST('');

20. PUT LIST('THE USER WILL BE REQUESTED TO ENTER HIS FINANCIAL DATA FOR SELECTED');

20.1 PUT LIST('ACCOUNTS. IT MAY BE NECESSARY TO REARRANGE YOUR DATA TO FIT THESE ');

20.2 PUT LIST('ACCOUNTS. THE LISTING OF THE ACCOUNTS AND THEIR SYMBOLS ARE AS FOLLOWS:');

21. PUT LIST('');

22. PUT LIST('BALANCE SHEET ACCOUNTS WHERE N <= 12 PERIODS.');

23. PUT LIST('CASH.....BS(1,1) THRU BS(1,N)');

24. PUT LIST('ACCT REC.....BS(2,1) THRU BS(2,N)');

25. PUT LIST('INVENTORY.....BS(3,1) THRU BS(3,N)');

26. PUT LIST('OTHER CUR ASSETS.....BS(4,1) THRU BS(4,N)');

27. PUT LIST('NET FIXED ASSETS.....BS(5,1) THRU BS(5,N)');

28. PUT LIST('ACCTS PAY.....BS(6,1) THRU BS(6,N)');

29. PUT LIST('OTHER CUR LIABS.....BS(7,1) THRU BS(7,N)');

30. PUT LIST('LG TM LIABS.....BS(8,1) THRU BS(8,N)');

31. PUT LIST('COM STK.....BS(9,1) THRU BS(9,N)');

32. PUT LIST('PPD STK.....BS(10,1) THRU BS(10,N)');

33. PUT LIST('RET EARNINGS.....BS(11,1) THRU BS(11,N)');

34. PUT LIST('');

35. PUT LIST('INCOME STATEMENT ACCOUNTS WHERE N<= 12 PERIODS.');

36. PUT LIST('SALES.....IS(1,1) THRU IS(1,N)');

37. PUT LIST('COGS.....IS(2,1) THRU IS(2,N)');

38. PUT LIST('TOTAL OPER EXPS.....IS(3,1) THRU IS(3,N)');

39. PUT LIST('INT EXP.....IS(4,1) THRU IS(4,N)');

40. PUT LIST('TAXES.....IS(5,1) THRU IS(5,N)');

```

41. PUT LIST(' ');
42. PUT LIST('DEPRECIATION ACCOUNT WHERE N <= 12 PERIODS.');
```

43.	PUT LIST('DEP.....DEP(1)	THRU DEP(N)');
44.	PUT LIST(' ');	

```

45. PUT LIST('CASH BUDGET ACCOUNTS WITH VALUES PROJECTED FOR EACH OF THE 12 NEXT MONTHS.');
```

46.	PUT LIST('SALES.....CB(1,1)	THRU CB(1,N)');
47.	PUT LIST('OTHER RECEIPTS.....CB(2,1)	THRU CB(2,N)');
48.	PUT LIST('PURCHASES.....CB(3,1)	THRU CB(3,N)');
49.	PUT LIST('OPER EXPS.....CB(4,1)	THRU CB(4,N)');
50.	PUT LIST('OTHER PAYMTS.....CB(5,1)	THRU CB(5,N)');

```

51. PUT LIST('PERCENT SALES COLLECTED..PC(1) THRU PC(3) IN SALES MO AND FOLLOWING 2 MOS,
52. PUT LIST('PAST 2 MOS SALES.....PS(1) THRU PS(2) PRIOR TO BUDGET PERIOD.');
```

53.	PUT LIST('BEG CASH.....BC	PRIOR TO BUDGET PERIOD.');
-----	---------------------------	----------------------------

```

54. PUT LIST(' ');
55. PUT LIST('THE USER WILL NOW BE REQUESTED TO ENTER HIS DATA FOR THE BALANCE SHEET');
```

```

55.1 PUT LIST('ACCTS, INCOME STATEMENT ACCTS, CASH BUDGET ACCTS, AND DEPRECIATION');
```

```

55.2 PUT LIST('ACCTS, IN THAT ORDER, FOR THE NUMBER OF PERIODS UP TO 12 YOU SELECT.');
```

```

55.3 PUT LIST('FOR EXAMPLE, BS(3,1) REPRESENTS THE INVENTORY ACCT IN THE FIRST, MOST');
```

```

55.4 PUT LIST('HISTORICAL, PERIOD. BS(9,3) REPRESENTS THE COM STK ACCT FOR THE THIRD PERIOD.');
```

```

56. PUT LIST(' ');
60. PUT LIST('FOR HOW MANY PERIODS, N, UP TO 12 DO YOU WISH TO ENTER DATA FOR?');
```

```

61. GET LIST(N);
63. PUT LIST('ENTER YOUR DATA FOR THE BALANCE SHEET ACCTS FOR ',N,' PERIODS.');
```

```

64. DO J=1 TO N;
64.1 DO I=1 TO 11;
64.2 GET LIST(BS(I,J));
64.3 END ;
64.4 END ;
65. PUT LIST(' ');
66. PUT LIST('ENTER YOUR DATA FOR THE INCOME STATEMENT ACCTS FOR ',N,' PERIODS.');
```

```
67.      DO J=1 TO N;
67.1     DO I=1 TO 5;
67.2     GET LIST(IS(I,J));
67.3     END ;
67.4     END ;
68.     PUT LIST(' ');
69.     PUT LIST('ENTER YOUR DATA FOR THE CASH BUDGET ACCTS FOR 12 PERIODS. ');
70.     DO J=1 TO 12;
70.1     DO I=1 TO 5;
70.2     GET LIST(CB(I,J));
70.3     END ;
70.4     END ;
71.     PUT LIST(' ');
72.     PUT LIST('ENTER YOUR DATA FOR THE DEPRECIATION ACCTS FOR ',N,' PERIODS. ');
73.     DO I=1 TO N;
73.1     GET LIST(DEP(I));
73.2     END ;
74.     PUT LIST(' ');
75.     PUT LIST('ENTER YOUR DATA FOR THE PAST 2 MOS SALES, THE MOST HISTORICAL FIRST. ');
76.     GET LIST(PS);
77.     PUT LIST(' ');
78.     PUT LIST('ENTER YOUR DATA FOR THE PERCENT QF SALES COLLECTED AS DESCRIBED ABOVE. ');
79.     GET LIST(PC);
80.     PUT LIST(' ');
81.     PUT LIST('ENTER THE BEGINNING CASH BALANCE PRIOR TO THE CASH BUDGET PERIOD. ');
82.     GET LIST(BC);
83.     PUT LIST(' ');
84.     PUT LIST('FOR HOW MANY PERIODS, M, DO YOU WISH TO PRINT PROFORMA STATEMENTS. ');
85.     GET LIST(M);
86.     PUT LIST('YOUR DATA HAS BEEN INPUT INTO THE SYSTEM, THIS COMPLETES THE INPUT PROGRAM. ');
```

APPENDIX B

EXAMPLE EXECUTION OF INPUT PROGRAM

LOGON
IKJ56700A ENTER USERID -
BS2U016
ENTER PASSWORD FOR BS2U016-
FI4223

BS2U016 LOGON IN PROGRESS AT 20:52:32 ON MAY 1, 1977
NO BROADCAST MESSAGES

CPS LOGIN
CPS,T,LINESIZE(140)
?LOAD(INPUT)
?XEQ

THIS SYSTEM ASSISTS THE USER IN THE FINANCIAL ANALYSIS OF BUSINESSES.
GIVEN LIMITED DATA BY THE USER THE SYSTEM OUTPUTS THE FOLLOWING
STATEMENTS AND INFORMATION: HISTORICAL BALANCE SHEETS AND INCOME
STATEMENTS, SOURCES AND USES OF FUNDS STATEMENTS, AND RATIO ANALYSIS
REPORTS, ALL FOR UP TO TWELVE PERIODS; PROFORMA BALANCE SHEETS AND
INCOME STATEMENTS FOR A USER DETERMINED NUMBER OF PERIODS; AND A
TWELVE MONTH CASH BUDGET.

THE USER WILL BE REQUESTED TO ENTER HIS FINANCIAL DATA FOR SELECTED
ACCOUNTS. IT MAY BE NECESSARY TO REARRANGE YOUR DATA TO FIT THESE
ACCOUNTS. THE LISTING OF THE ACCOUNTS AND THEIR SYMBOLS ARE AS FOLLOWS:

- BALANCE SHEET ACCOUNTS WHERE N <= 12 PERIODS.
- CASH.....BS(1,1) THRU BS(1,N)
 - ACCT REC.....BS(2,1) THRU BS(2,N)
 - INVENTORY.....BS(3,1) THRU BS(3,N)
 - OTHER CUR ASSETS.....BS(4,1) THRU BS(4,N)
 - NET FIXED ASSETS.....BS(5,1) THRU BS(5,N)
 - ACCTS PAY.....BS(6,1) THRU BS(6,N)
 - OTHER CUR LIABS.....BS(7,1) THRU BS(7,N)
 - LG TM LIABS.....BS(8,1) THRU BS(8,N)
 - COM STK.....BS(9,1) THRU BS(9,N)
 - PFD STK.....BS(10,1) THRU BS(10,N)
 - RET EARNINGS.....BS(11,1) THRU BS(11,N)

INCOME STATEMENT ACCOUNTS WHERE N<= 12 PERIODS.

SALES.....IS(1,1) THRU IS(1,N)
COGS.....IS(2,1) THRU IS(2,N)
TOTAL OPER EXPS.....IS(3,1) THRU IS(3,N)
INT EXP.....IS(4,1) THRU IS(4,N)
TAXES.....IS(5,1) THRU IS(5,N)

DEPRECIATION ACCOUNT WHERE N <= 12 PERIODS.

DEP.....DEF(1) THRU DEP(N)

CASH BUDGET ACCOUNTS WITH VALUES PROJECTED FOR EACH OF THE 12 NEXT MONTHS.

SALES.....CB(1,1) THRU CB(1,N)
OTHER RECEIPTS.....CB(2,1) THRU CB(2,N)
PURCHASES.....CB(3,1) THRU CB(3,N)
OPER EXPS.....CB(4,1) THRU CB(4,N)
OTHER PAYMTS.....CB(5,1) THRU CB(5,N)
PERCENT SALES COLLECTED..PC(1) THRU PC(3) IN SALES MO AND FOLLOWING 2 MOS, EXPRESSED AS DECIMAL.
PAST 2 MOS SALES.....PS(1) THRU PS(2) PRIOR TO BUDGET PERIOD.
BEG CASH.....BC PRIOR TO BUDGET PERIOD.

THE USER WILL NOW BE REQUESTED TO ENTER HIS DATA FOR THE BALANCE SHEET ACCTS, INCOME STATEMENT ACCTS, CASH BUDGET ACCTS, AND DEPRECIATION ACCTS, IN THAT ORDER, FOR THE NUMBER OF PERIODS UP TO 12 YOU SELECT. FOR EXAMPLE, BS(3,1) REPRESENTS THE INVENTORY ACCT IN THE FIRST, MOST HISTORICAL, PERIOD. BS(9,3) REPRESENTS THE COM STK ACCT FOR THE THIRD PERIOD.

FOR HOW MANY PERIODS, N, UP TO 12 DO YOU WISH TO ENTER DATA FOR?

N

?12

ENTER YOUR DATA FOR THE BALANCE SHEET ACCTS FOR 12 PERIODS.

BS(1,1)

?6258

BS(2,1)

?56792

BS(3,1)

?176583

BS(4,1)

?42113

RS(5,1)
T1132311
RS(6,1)
T32910
RS(7,1)
T20011
RS(8,1)
T101938
RS(9,1)
T1000000
RS(10,1)
T0
RS(11,1)
T260098
RS(1,2)
T7853
RS(2,2)
T59211
RS(3,2)
T180432
RS(4,2)
T38761
RS(5,2)
T1132311
RS(6,2)
T35197
RS(7,2)
T21076
RS(8,2)
T115114
RS(9,2)
T1000000
RS(10,2)
T0
RS(11,2)
T246181

BS(1,3)
T7991
BS(2,3)
T5998
BS(3,3)
T182761
BS(4,3)
T41679
BS(5,3)
T1500198
BS(6,3)
T31821
BS(7,3)
T23193
BS(8,3)
T92187
BS(9,3)
T1000000
BS(10,3)
T0
BS(11,3)
T645616
BS(1,4)
T8432
BS(2,4)
T65538
BS(3,4)
T179873
BS(4,4)
T45632
BS(5,4)
T1500198
BS(6,4)
T41762

BS(7,4)
P21129
BS(8,4)
P95176
BS(9,4)
P1000000
BS(10,4)
TO
BS(11,4)
P641546
BS(1,5)
T8118
BS(2,5)
P65091
BS(3,5)
P193333
BS(4,5)
P46193
BS(5,5)
P1500198
BS(6,5)
P47877
BS(7,5)
P22076
BS(8,5)
P99123
BS(9,5)
P1000000
BS(10,5)
TO
BS(11,5)
P633857

RS(1,6)
T8773
RS(2,6)
T61876
RS(3,6)
T155921
RS(4,6)
T45778
RS(5,6)
T1500198
RS(6,6)
T48991
RS(7,6)
T24761
RS(8,6)
T11132
RS(9,6)
T1000000
RS(10,6)
T0
RS(11,6)
T617662
RS(1,7)
T8918
RS(2,7)
T77859
RS(3,7)
T190187
RS(4,7)
T49132
RS(5,7)
T1723819

BS(6,7)
PS1000
BS(7,7)
P25891
PS(8,7)
P105976
BS(9,7)
T1200000
BS(10,7)
P0
BS(11,7)
P667048
BS(1,8)
T9135
BS(2,8)
P78913
BS(3,8)
P192234
BS(4,8)
T51981
BS(5,8)
P1723819
BS(6,8)
P42876
BS(7,8)
P26178
BS(8,8)
P101765
BS(9,8)
T1200000
BS(10,8)
P
BS(11,8)
P695163

S(1,9)
0087
S(2,9)
81283
S(3,9)
193882
S(4,9)
51118
S(5,9)
1723819
S(6,9)
44891
S(7,9)
25190
S(8,9)
105931
S(9,9)
1200000
S(10,9)
10
S(11,9)
1633098
S(1,10)
19811
S(2,10)
183876
S(3,10)
1191776
S(4,10)
755187
S(5,10)
11723819

S(6,10)
45667
S(7,10)
26156
S(8,10)
110176
S(9,10)
1200000
S(10,10)
0
S(11,10)
682470
S(1,11)
9996
S(2,11)
371911
S(3,11)
193842
S(4,11)
F56891
S(5,11)
11928761
S(6,11)
747781
S(7,11)
728976
S(8,11)
9121118
S(9,11)
1200000
S(10,11)
1200000
S(11,11)
7673526

SS(1,12)
P10177
SS(2,12)
P80118
SS(3,12)
P178472
SS(4,12)
P57781
SS(5,12)
P1928761
SS(6,12)
P48123
SS(7,12)
P25179
SS(8,12)
P122193
SS(9,12)
P1200000
SS(10,12)
P200000
SS(11,12)
P6897794

ENTER YOUR DATA FOR THE INCOME STATEMENT ACCTS FOR 12 PERIODS.

IS(1,1)
P1500606
IS(2,1)
P750123
IS(3,1)
P150176
IS(4,1)
P15031

IS(5,1)
T51762
IS(1,2)
T1743981
IS(2,2)
T851198
IS(3,2)
T176721
IS(4,2)
T16321
IS(5,2)
T54932
IS(1,3)
T1653192
IS(2,3)
T791321
IS(3,3)
T171118
IS(4,3)
T14876
IS(5,3)
T48761
IS(1,4)
T718563
IS(2,4)
T844132
IS(3,4)
T165321
IS(4,4)
T15111
IS(5,4)
T41432
IS(1,5)
T1911871

IS(2,5)
T899122
IS(3,5)
T171832
IS(4,5)
T16123
IS(5,5)
T51773
IS(1,6)
T1976521
IS(2,6)
T899991
IS(3,6)
T173991
IS(4,6)
T17832
IS(5,6)
T52991
IS(1,7)
T1999811
IS(2,7)
T912371
IS(3,7)
T179876
IS(4,7)
T16521
IS(5,7)
T51176
IS(1,8)
T2054132

IS(2,8)
P999431
IS(3,8)
P181232
IS(4,8)
P15119
IS(5,8)
P5324
IS(1,9)
P1754621
IS(2,9)
P1021765
IS(3,9)
P182456
IS(4,9)
P16176
IS(5,9)
P51976
IS(1,10)
P2113412
IS(2,10)
P1011321
IS(3,10)
P179991
IS(4,10)
P177843
IS(5,10)
P52189
IS(1,11)
P2301112
IS(2,11)
P1113982
IS(3,11)
P184321
IS(4,11)
P18001

IS(5,11)
T55896
IS(1,12)
T2311218
IS(2,12)
T1103918
IS(3,12)
T186997
IS(4,12)
T18765
IS(5,12)
T554671

ENTER YOUR DATA FOR THE CASH BUDGET ACCTS FOR 12 PERIODS.

CE(1,1)
T191187
CB(2,1)
T21276
CB(3,1)
T93214
CB(4,1)
T9176
CB(5,1)
T6751
CB(1,2)
T192132
CB(2,2)
T22167
CB(3,2)
T94176
CB(4,2)
T8156

CR(5,2)
T7128
CR(1,3)
T199765
CR(2,3)
T19432
CR(3,3)
T25976
CR(4,3)
T8762
CR(5,3)
T6591
CR(1,4)
T201762
CR(2,4)
T19764
CR(3,4)
T96521
CR(4,4)
T8913
CR(5,4)
T3211
CR(1,5)
T203567
CR(2,5)
T20197
CR(3,5)
T101000
CR(4,5)
T9176
CR(5,5)
T6342
CR(1,6)
T199967

R(2,6)
21766
R(3,6)
98765
R(4,6)
10132
R(5,6)
7159
R(1,7)
201532
R(2,7)
22563
R(3,7)
99423
R(4,7)
10763
R(5,7)
7659
R(1,8)
202731
R(2,8)
22465
R(3,8)
99985
R(4,8)
12108
R(5,8)
7891
R(1,9)
209561
R(2,9)
23177

RE(3,9)
101273
RE(4,9)
11761
RE(5,9)
8132
RE(1,10)
210432
RE(2,10)
23775
RE(3,10)
103182
RE(4,10)
12304
RE(5,10)
9111
RE(1,11)
191765
RE(2,11)
25176
RE(3,11)
104765
RE(4,11)
12465
RE(5,11)
10987
RE(1,12)
210760
RE(2,12)
26178
RE(3,12)
108571
RE(4,12)
13121

B(5,12)
9932

ENTER YOUR DATA FOR THE DEPRECIATION ACCTS FOR 12 PERIODS.

DEF(1) T114321
DEF(2) T102761
DEF(3) T120132
DEF(4) T116467
DEF(5) T115232
DEF(6) T112736
DEF(7) T120123
DEF(8) T118765
DEF(9) T116521
DEF(10) T114761
DEF(11) T121176
DEF(12) T119187

ENTER YOUR DATA FOR THE PAST 2 MOS SALES, THE MOST HISTORICAL FIRST.

PS(1)
P188654
PS(2)
P190176

ENTER YOUR DATA FOR THE PERCENT OF SALES COLLECTED AS DESCRIBED ABOVE.

PC(1)
P.5
PC(2)
P.3
PC(3)
P.2

ENTER THE BEGINNING CASH BALANCE PRIOR TO THE CASH BUDGET PERIOD.

BC
P10177

FOR HOW MANY PERIODS, M, DO YOU WISH TO PRINT PROFORMA STATEMENTS.

M
P5

YOUR DATA HAS BEEN INPUT INTO THE SYSTEM, THIS COMPLETES THE INPUT PROGRAM.

P

VITA

Larry Dee Zimmerman

Candidate for the Degree of

Master of Business Administration

Report: THE CONCEPTUAL DESIGN OF A COMPUTERIZED FINANCIAL INFORMATION
SYSTEM FOR SMALL BUSINESSES

Major Field: Finance

Biographical:

Personal Data: Born in Bartlesville, Oklahoma, April 4, 1950, the
son of John and Mildred Zimmerman.

Education: Graduated from Bartlesville Sooner High School, Bartles-
ville, Oklahoma, May, 1968; received the Bachelor of Science
degree from Oklahoma State University with a major in Economics,
May, 1972; completed a second major in accounting, December,
1975; completed requirements for the Master of Business Admini-
stration degree at Oklahoma State University, December, 1980.

Professional Experience: Staff Accountant, Peat, Marvick, Mitchell &
Co., 1977-1979; Staff Assistant to Energy Resources Group Con-
troller, Cities Service Company, 1978-present; American
Institute of Certified Public Accountants, 1978.