A MODEL OF THE DATA PROCESSING MANAGER IN THE 1980'S

309

by

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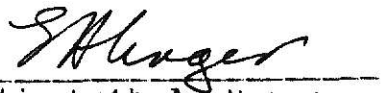
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CHAPTER 1

INTRODUCTION

1-1 General Overview.

This report is an attempt to establish a role model for data processing managers in the 1980-1990 timeframe. It uses a manager survey, literature search and projection methodology, to establish a current standard of data processing manager job requirements. It also attempts to project the changes these managers will face in the post 1980 time period. Much of the input for this report came from data processing managers themselves. A questionaire was sent to 93 managers throughout the United States and 65 responded. By no means does the author claim that this is a valid sample of all data processing managers in the U.S. It does however, provide a means for gauging the perceptions of data processing managers. It also provides a means to discover what they feel is important and what they think will happen in the future.

A copy of the questionaire with the cover letter is attached at Annex A. Summary statistics from the responses are attached at Annex B.

1-2 Importance of the Study.

The Data Processing/Computer industry is perhaps the fastest growing segment of the U.S. economy. The explosive growth and importance of this industry and the "information revolution" have caused major changes in U.S. society and industry.

The management of data processing assets has become increasingly important as a segment of the industry. In the past few years, top level managers of most organizations, have come to the realization that Data processing management is not just the management of computers, it is the managment of an organizations most important asset, its information. [GET78]

There is generally a lack of research literature on the role, functions and models for data processing mannagers. Some serious research has been done by sociologists and educators. ([WOO77], [TAY79], [PRI74]) Very little has been done in this field by computer professionals, and most of what has been reasearched, concludes that data processing professionals have different personality and motivational needs. [COU79] The author feels that basic investigation in this area by "people working in the discipline" is required.

The technology of data processing is making rapid advances. Memory costs are becoming smaller, while conversely, personnel costs are becoming higher. Because of these and other factors to be explored, the role of the data processing manager will "have" to change. This report has attempted to project how that role will change, and what must be done to prepare present and future data processing managers for their new role.

The author has attempted to balance computer manager perceptions obtained by the questionaire, with the recognized job requirements in most organizations. In many cases it was found that manager perceptions and reality were contradictory. The author views this as perhaps normal. However, it may provide a key to what must be done to better prepare future data processing managers.

The author has also attempted to project how changes in the data processing management function will change. The latest industry statistics and projections were utilized for this function. ([LEC77], [DOL76])

Also addressed are some of the social and legal issues which may have major impacts on data processing managers and the computer industry.

In summary it could be stated that this report is based on four premises:

1. Computers are vitally important as a major component of the United States economy.

2. Efficient management of this information asset is a key that can enhance or hamper the development of the economy.

3. Technological changes will modify the data processing managers role and function.

4. A critical need exists to better train data processing managers to employ these assets, and cope with future changes.

1-3 Assumptions

1. Definition of data processing management-- The definiton chosen was that of Norton and Rau [NOR78] who define an data processing manager as:

> "the individual in the organizational structure that has as his main task the improvement of the effectiveness and efficiency of the parent organization through the development, operation and maintenance of data processing systems and resources."

2. Notional model--The model developed is notional. Different organization structures, management philosophies and procedures will modify and basic model. However, the model as developed is broad enough to transfer between organizations and has a general application to all data processing managers.

3. Terminology--This report is written at a terminological level such that it can be used by non-computer professionals. Where detailed technical terms or concepts are used, they are explained in non-technical language.

4. Survey constraints--The survey of data processing managers doesn't have a sample size large enough to be wholly predictive of the perceptions of all data processing managers. The author feels however, that the statistical findings and correlations are reasonably accurate indicators of the data processing management community, and generally express that communitys feelings on job task importance and skill requirements, as well as perceptions of future trends.

1-4 Organization

This report is organized in the following manner:

Chapter 1--This chapter provides a broad overview of the goals and objectives of the report and outlines some of the report methodology.

Chapter 2--This chapter examines the importance of Data Processing/Computer industry to the United States' economy. It explains the critical need of the orderly, efficient utilization of the data processing resource. It also examines positive and negative trends that will have direct impacts on data processing management.

Chapter 3--This chapter investigates the present role of the data processing manager. It addresses some of the background, perceived tasks, and skill requirements of data processing managers in the present environment. Most of the input is from the survey results and current data processing industry sources.

The chapter discusses job requirements and establishes a basic data processing management role model. The model established portrays the present data processing manager. It also highlights some of the differences in perception between different groups of managers, in accordance with their age and experience.

Chapter 4--This chapter examines many of the trends in data processing technology and organization and discusses the profound effect they will have on the role of the data processing manager in the 1980's. It addresses the direct impact on the current model and compares industry predictions about the future with data processing manager perceptions of future changes obtained from the data processing manager survey.

Chapter 5--This chapter establishes the computer service management model for the 1980's and discusses in detail how this model differs from model established in Chapter 3. The rationale for staging the model in 3 phases is justified in accordance with data processing manager professional advancement. Also illustrated are the actual transition of job requirements in the three stages and suggestions for career development are offered.

Chapter 6--This chapter concerns the development and training of data processing managers to fit the projected model, with particular emphasis on evaluation of curricullum in Computer Science and Information Management. Comments and recommendations are included on continuing education, career progression, and data processing manager certification.

Chapter 7--This chapter provides a summary of the report, conclusions, and an evaluation of suggested approaches to data processing manager development and outlines areas for further research.

Annex A--This Annex contains a copy of the original questionaire mailed to data processing managers nationwide.

Annex B--This Annex contains the summary statistics of the survey in a numerical and graphic format. The summary statistics were obtained by using revision 4 of the Statistical Package for the Social Sciences.

CHAPTER 2

THE IMPORTANCE OF DATA PROCESSING TO THE U.S. ECONOMY

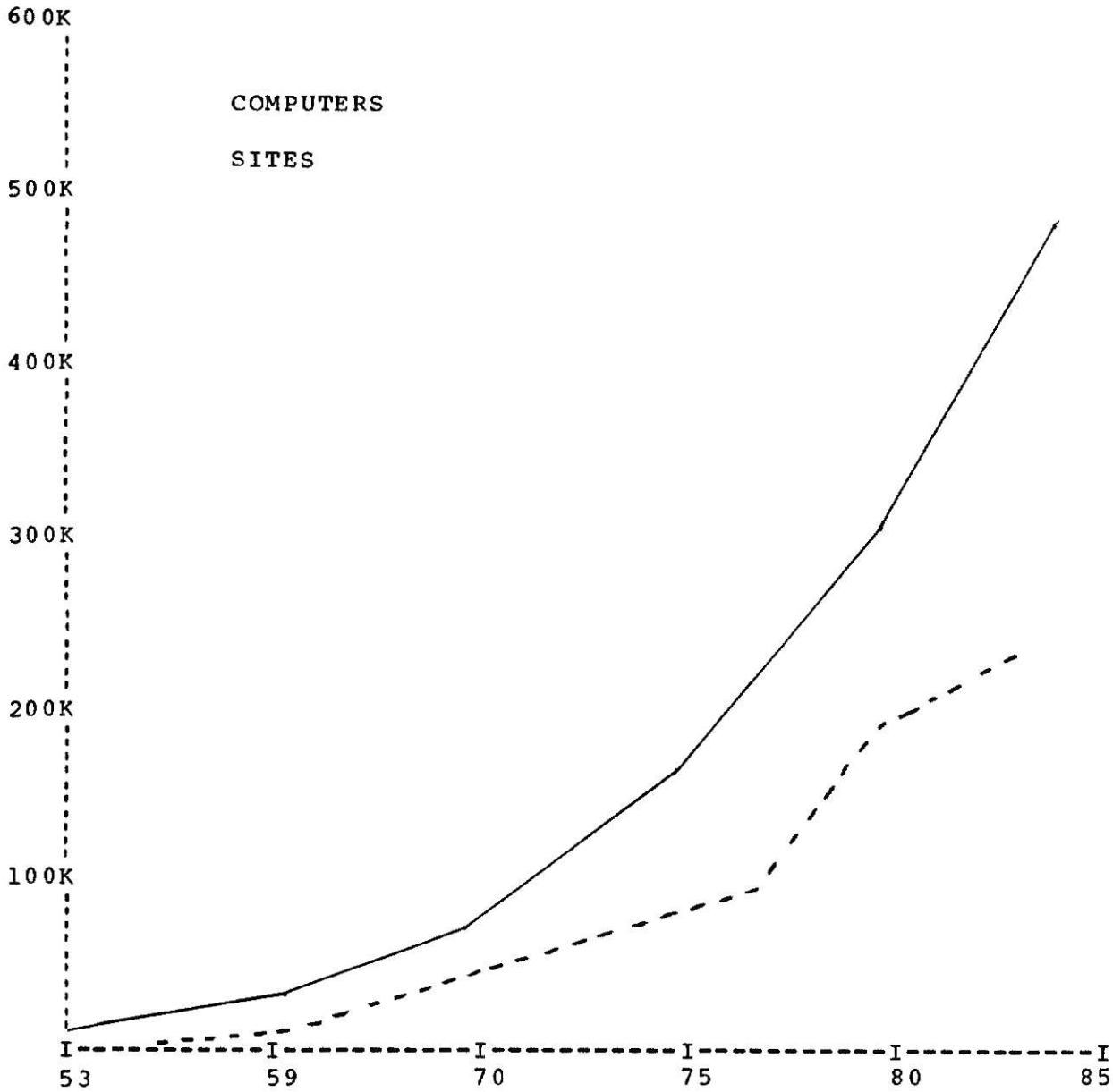
2-1 Background.

The first general purpose computer was installed by the United States government at the Bureau of the Census in 1953. Since that time both computer professionals and non-professionals will admit that computers and data processing have made a major impact on the economy and lifestyle of the United States and the rest of the world. As major as this impact is, the author feels that the importance of the computer/data processing industry as a segement of the United States economy is underestimated.

One example of this growth can be illustrated by the value of computer assets. Figure 2-1 shows the total number of general and special purpose computers installed by site from 1953 and projected through 1985. The growth has been exponential and ranges from approximately 50 sites in 1953 to more than 175,000 projected sites by 1985.

These figures are predicated on our present concept of what a computer is and as Lecht points out, the concept of a computer is will change in the next 5 years, in comparison with the presently accepted definition. [LEC77]

FIGURE 2-1
COMPUTERS INSTALLED & COMPUTER SITES
1953-1985

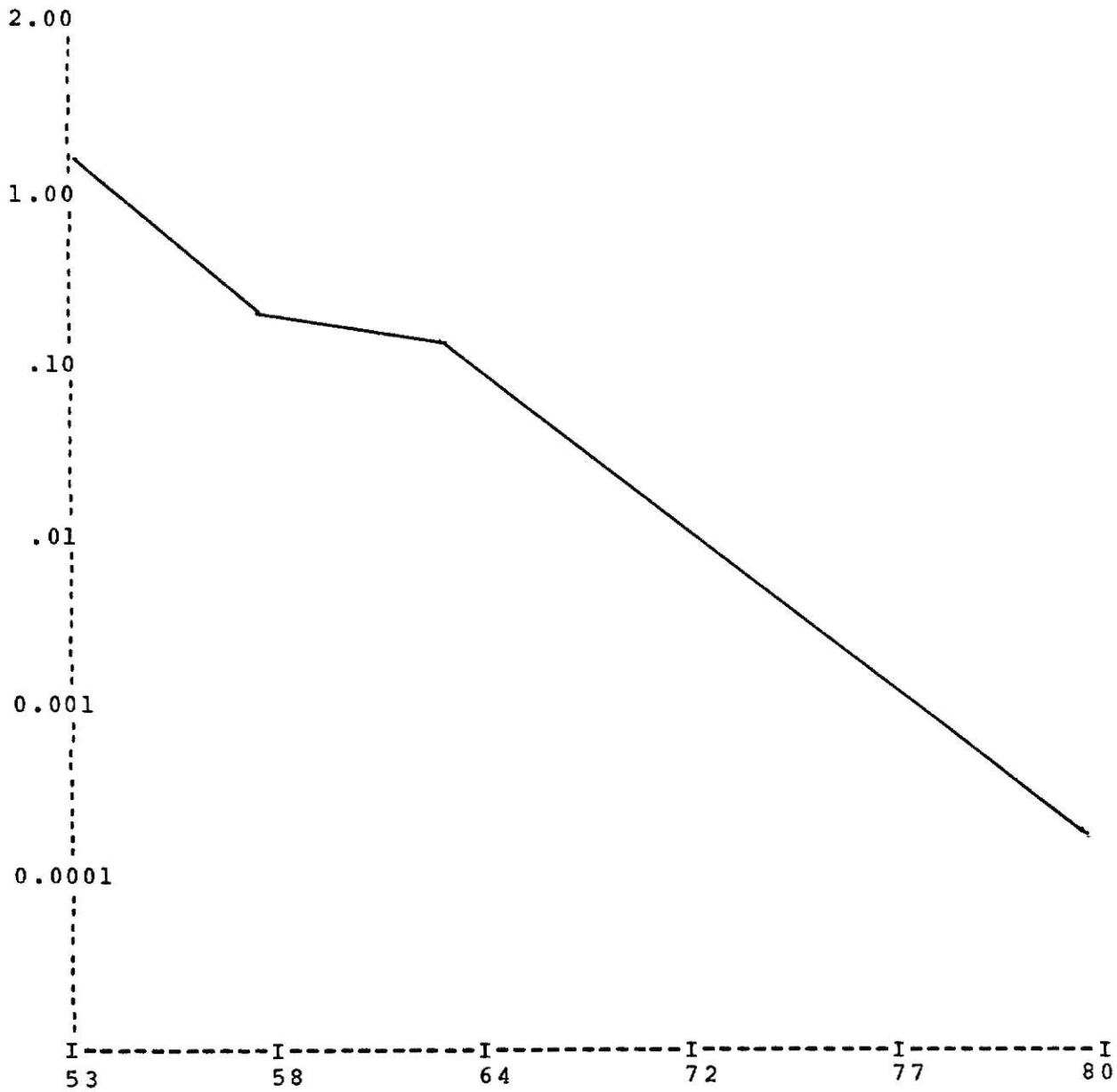


Source--[LEC77].

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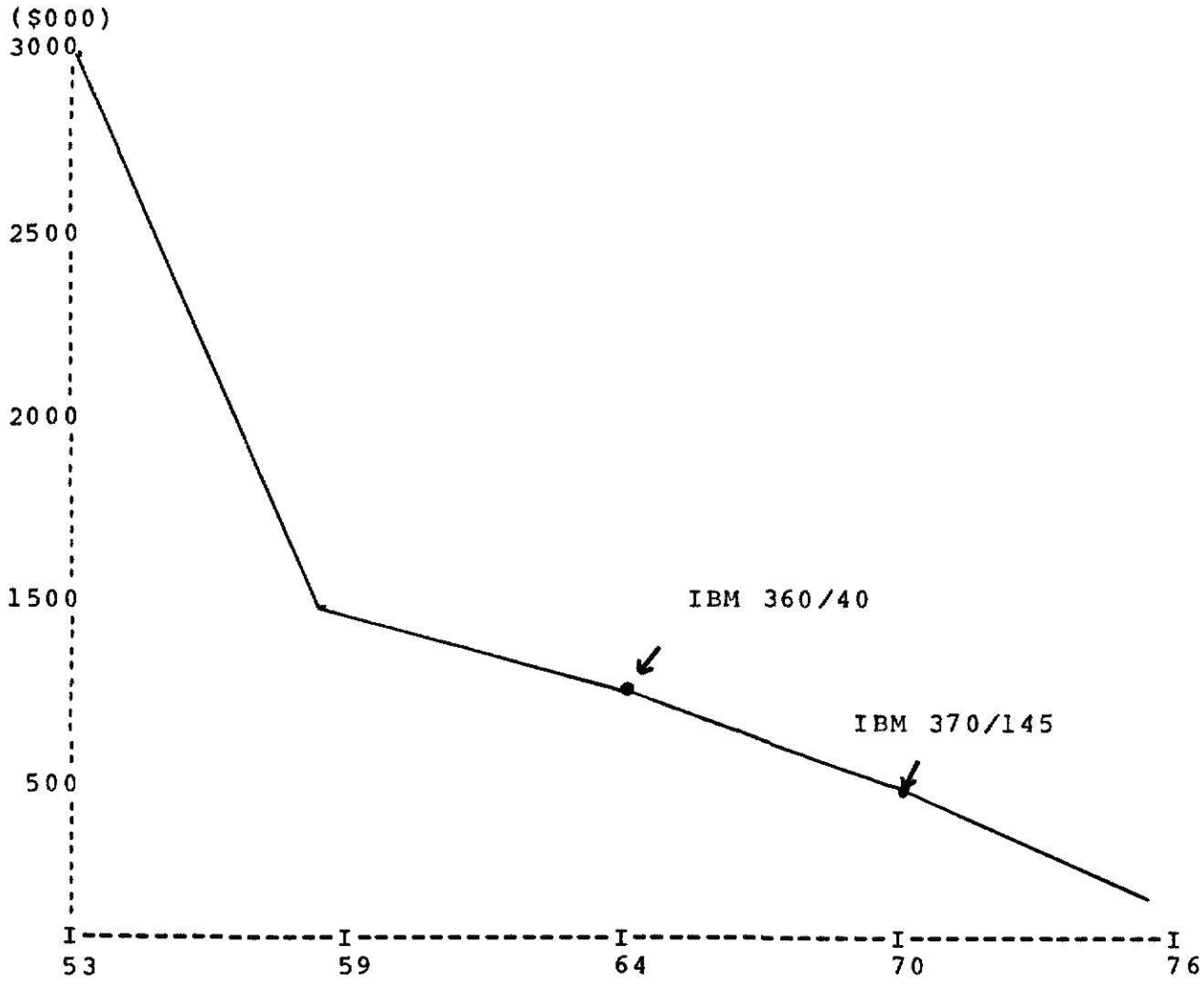
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FIGURE 2-2
AVERAGE COST PER 100,000 CALCULATIONS
1953-1985



Source--[LEC77].

FIGURE 2-3
AVERAGE COMPUTER PURCHASE PRICE
1953-1976 (IN THOUSANDS OF DOLLARS)



Source--[LEC77].

During the period from 1953 to 1976 the number of organizations that utilized data processing assets increased to 95,000. By 1985 this number is projected to increase to 240,000. This means that there will most likely be one computing installation for every United States company or organization with more than 50 employees by 1985. [LEC77]

Figures 2-2 and 2-3 show some of the reasons for this rapid growth. The first reason is the rapidly declining cost of calculations due to advances in technology. The cost per 100,000 calculations was $1.26 in 1952 on IBM 701 hardware. By 1985, using the IBM "System 80" the projected cost per 100,000 calculations is $.0025. This is a reduction of cost per 100,000 calculations of factor of 504 since 1952.

Another indicator is the cost per installation purchase price. In 1953 the average computer purchase price (Figure 2-3) was 3 million dollars. In 1976 a medium scale system which compares very favorably with the 1953 machine costs only about $380,000.

These factors alone demonstrate the growth of the computing industry, but when related to the Gross National Product they also illustrate the real importance of data processing to the economy. Figure 2-4 illustrates a comparison of total spending by users for data processing

and computer services from 1970, projected through 1985, in 1970 constant dollars.

The figure portrays the almost explosive growth of user spending. It also shows, perhaps more importantly, the rapid increase in per capita expenditures in relation to the United States population. An interesting sidelight noted by Biglow, [BIG78] is that computer capability per dollar spent will be far greater in the future. This is supported by the data in Figures 2-2 and 2-3. A projection of this trend to 1990 whould mean that computers and user spending for computer products would account for 13% of the Gross National Product. A 13% share of the GNP would place data processing as one of the most important sectors of the national economy. Even at its present size, government statistics indicate that data processing is a larger portion of the GNP than either construction, transportation, communications, or agriculture. [CEN78]

By 1990, If present trends continue, only manufacturing, wholesale and retail trade, and financial services will be a larger sector of the economy. These trends and forecasts may be conservative, and they have major impacts on the future of the country.

FIGURE 2-4

TOTAL DATA PROCESSING INDUSTRY EXPENDITURES
(In Billions of 1970 U.S. Dollars)

YEAR	USA	% of GNP	WORLD	% of GWP
1970	21	2.1	28	.9
1975	41	3.2	56	1.4
1980	82	5.2	111	2.2
1985	164	8.3	223	3.5

Source--[DOL76]

Another measurement of the importance of data processing is in its contribution to the U.S. balance of trade. In 1977, United States exports of computer equipment exceeded imports by a factor of 15 to 1. This added a trade surplus to the U.S. balance of payments deficit of 2.8 million dollars in hardware alone. [CEN78] This figure may be underestimated, because none of the software costs are included. If a very conservative figure of software export sales, i.e., 50% of hardware sales, is used, then this increases the trade surplus in data processing related products to 4.2 billion dollars. That figure would account for a 14% reduction of the 28.8 billion dollar trade imbalance for 1977. This is further highlighted by the fact that computer products make up only 3.1% of total exports. [CEN78]

Because of current advances in technology and favorable overseas exchange rates, this figure will most likely increase at an even more rapid rate and add even more importance to the data processing industry as a major component of the national economy.

2-2 Problem Areas.

The factors outlined above give a brief outline of the critical role of data processing and computer use and highlight some of the advances. However, all the news is

not good. There are some trends on the horizon that are casting clouds over this critical component. They include:

1. High personnel turbulance.

2. Lack of confidence in Data Processing on the Part of line managers.

3. A noticable lack of increase in computer programmer productivity.

An apparent lack of significant funding of research to help solve current problems.

2-3 Personnel Turbulence.

The first problem to be addresssed is personnel turbulance. Guarino [GUA79] found that turnover is higher among data processing professionals than in almost any other profession. His research concluded that turnover at junior programmer and systems analyst levels is greater than 90% over a 2 year period. Even among senior level data processing staff elements, the turnover rate is still very high, and ranges between 30 and 50 percent. This contrasts with figures for other professions such as engineers, who have junior turnover rates of 40% and senior level turnover rates of about 20%.

This rapid personnel turnover is perhaps a major cause for inefficient use of data processing assets and tends to hamper constructive software engineering and project management practices.

2-4 Management Confidence.

The lack of confidence by line management at almost all levels is also a problem. Cross [CRO78], and Garino [GAR77] note, that for the most part, line managers at all levels tend to distrust data processing professionals and much of their output. Some of this feeling may be due to salary differentials, as found by Priestly, [PRI74] or because many data processing managers tend to hide behind technical jargon and concentrate on centralized empire building rather than meeting the needs of other departments. Some authors , i.e., Dolotta [DOL76] and Lecht [LEC77], note that in many cases the gap in understanding is increasing and fault the data processing community for the problem. Further acceleration of this trend will surely hamper data processsing growth.

2-5 The Software Bottleneck.

The previous problems cited are almost minor when considered against the issues of software costs and

programmer productivity. Figure 2-5 shows a comparison of life cycle costs between hardware and software. The projection is that software costs will continue to increase as a percentage of total cost.

Figure 2-6 shows that software productivity seems to be increasing at a rate of only 3% per year. This is a serious shortcoming in view of the fact that all other costs are being reduced while software and people costs continue to increase.

Current Americian Federation of Information Processing Societies (AFIPS) projections as shown in Figure 2-6 indicate that this "software bottleneck" may hamper growth of the industry. Even if programmer productivty were to increase at a rate of 10% per year between 1980 and 1985 there would still be a cost tradeoff problem. This is because of the high cost of software development and maintenance in relation to the value received from computing.

2-6 Research and Development.

This "software bottleneck is a major problem. Many data processing professionals in the academic and industrial community state that the software problem will be handled by hardware or firmware modules. On the surface this seems to

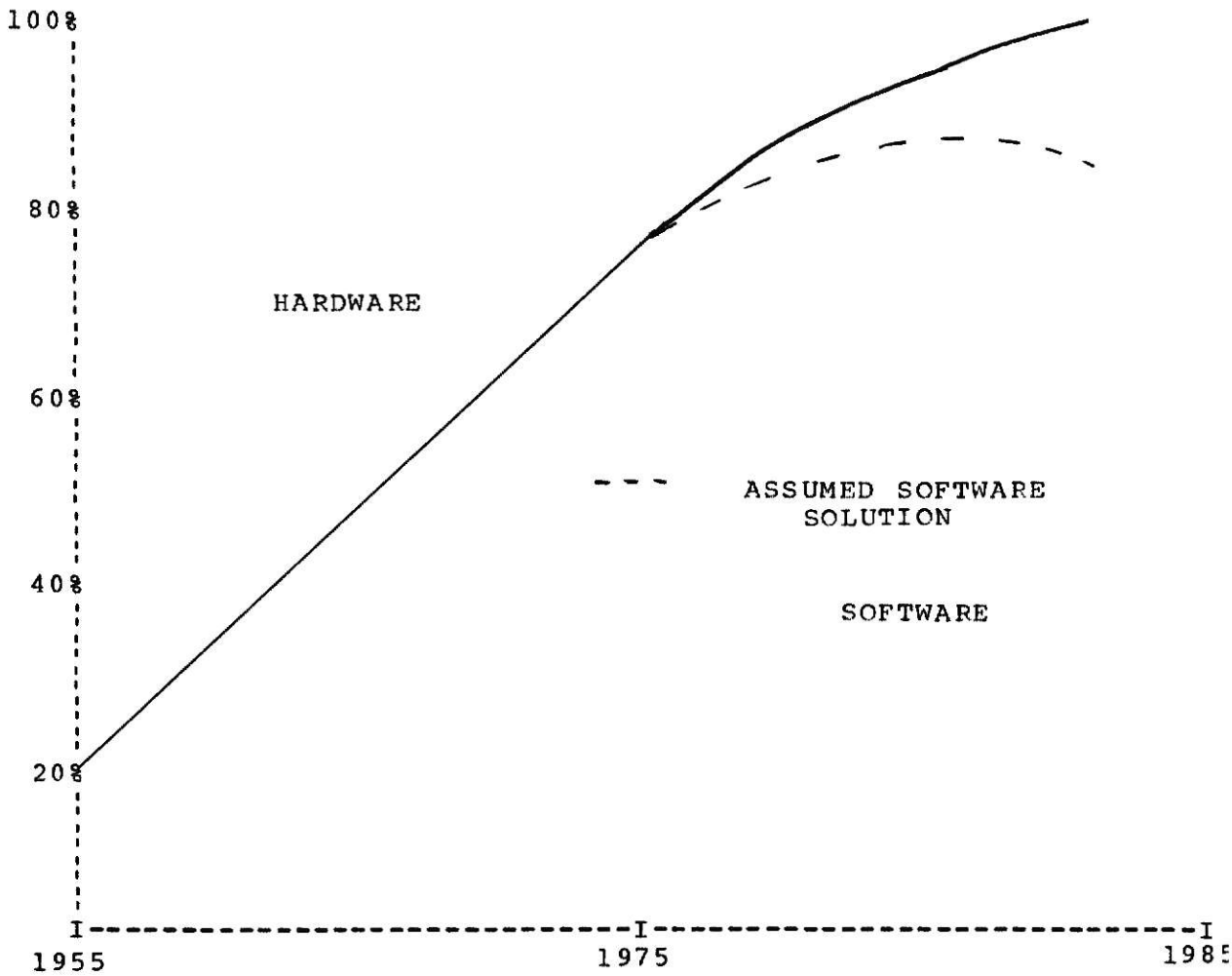
be a convincing argument, but closer investigation reveals that funding for data processing/computer science research and development is not increasing as fast as the growth of computer applications.

Using the latest figures available as extraplolated by Dolotta [DOL76], it appears that only 0.1% of the GNP is devoted to data processing and computer research and development. Dollota states that this amount would be barely adequate if the efforts are properly channeled. However, current research and development trends do not seem to be directly aimed at solving the "software bottleneck" problem.

2-7 Summary.

The reason the author has highlighted the importance of data processing to the United States economy and discussed some of the potential problems in the future, was to bring attention to the fact, that in the 1980's all this growth, technological change, and still unsolved problems will fall on the shoulders of one individual, the data processing manager. He is the one who is responsible to meld the technology and the people of an organization, into workable systems that that can take full advantage of the state of the art. He has to be capable of innovative problem solving to overcome both current and future personnel and organizational shortcomings.

FIGURE 2-5
HARDWARE/SOFTWARE COST TRENDS
1955-1985 (AS A PERCENT OF TOTAL COSTS)



Source--Data Processing in the United States.

FIGURE 2-6

PROGRAMMER PRODUCTIVITY & TOTAL

U.S. YEARLY CODE PRODUCTION

(Normalized to 1955)

YEAR	PRODUCTIVITY	PRODUCTION
1955	1	1
1960	1.6	5
1965	2.0	16
1970	2.3	38
1975	2.7	59
1980	3.1 (4.3)	85 (118)
1985	3.6 (7.0)	119 (231)

Numbers in parenthesis indicate a 10% annual growth rate of programmer productivity.

Source--[DOL76]

Failure of the data processing manager to be properly prepared for the transition is not only vital for the individual, but could possibly have a major impact on the growth of the economy.

CHAPTER 3

PROFILE AND MODEL OF CURRENT DATA PROCESSING MANAGERS

3-1 Evolution of the Data Processing Management Function.

Management of the data processing function in organizations is as new as data processing and computer technology. For the most part, the position of Data Processing Manager is a result of the development of unit record departments in the 1940's and 50's.

The process started with the use of unit record equipment in the late 1940's. Unit records are punched cards that represent alphabetic and numeric characters. Unit record machines were the forerunners of modern computing equipment and were "the" status symbols for many companies in this time period. During this formative period the Unit Record Department usually reported to the accounting manager or comptroller, since the applications were primarily accounting systems.

From the first, this new department did not relate well with other managers in the organization. The department manager was not an executive, but a technician who was an electrical engineer, timekeeper, or accountant.

The new department spoke its own language, dealt with its own problems, and didn't effect the marketing or manufacturing departments. More importantly, if there was a problem, the unit record manager didn't turn to his boss the comptroller, he turned to the manufacturer. Thus the isolation and mystique of data processing was born.

In the mid 50's the first general purpose computers were installed. Many organizations bought the new equipment because, "everyone else had one". The data processing department expanded in scope. Large, batch processing, centralized data processing organizations were established. The data processing department manager was still not considered and executive. He still reported to the accountant or the comptroller. [BRE78]

Because of the technical basis of the computing operation the data processing manager had to maintain a split loyalty. He worked for the organization, but most of his problems, information and hints on how to succeed, were provided by the vendor. In addition, the need to expand applications caused the "programmer-analyst" to appear on the scene. This individual worked for the data processing manager, but his main task was to venture forth from the data processing department to write applications for users. Because of hardware and software restrictions most users felt they didn't get what they asked for and most computer

professionals felt that "users didn't know what they wanted anyway." [TEL73]

In the mid 60's transistor technology computers were introduced. They had more capacity and capability. This new generation of machines had uses in marketing, forecasting and manufacturing. They had the capability to enhance the effectiveness of the entire organization.

The data processing department changed slowly. It remained centralized. Most departments preferred to be identified as different, and not subject to the controls and constraints of other departments. The data processing managers were still considered primarly as technicians and seemed to prefer the role of protecting their department and justifying their assets. This was done, not by optimizing current applications, but by finding new ones. [BRE78]

3-2 Current Image of Data Processing Managers.

In the minds of many organizational managers, the image of the mysterious technician who controls the centralized "data processing empire" is the one that exists today. The data processing managers interface with the rest of the organization is most likely clouded with technical jargon. In most cases the data processing department is not truely held accountable for true costs and few measures are used to

measure the productivity of the data processing assets.

This image is generally suported by research. Axelrod [AXE76] found that a majority of managers support the view that computer resources are wasted in most organizations. Gilbert [GIL78] states that most data processing managers are "empire oriented" and don't fulfill the needs of the entire organization. He faults data processing managers attitudes as the cause of the problem. Even more disconcerting are the feelings of some researchers, notably Smith [SMI77] and Nolan [NOL79]. They have the opinion that many data processing managers are not technically qualified, even though they make free use of technical jargon and acronyms when dealing with others.

This perceived low level of technical competence seems to be justified in view of the latest results of the Certificate of Data Processing examination which was administered in July 1979. The examination is designed to certify data processing managers and is sponsered by the Institute for the Certification of Computer Professionals and backed by all the computer professional organizations to include the Data Processing Management Association and the Association for Computing Machinery. Of the 2948 individuals who sat for the exam, only 973 made a passing score. [FOX79]

3-3 Image of Current Data Processing Managers.

The Data Processing Mangager Survey as outlined in Appendix A, and current industry sources, have provided enough data to establish a composite image of data processing managers. This is important, because it provides an insight to the role model and task orientations of data processing managers and also provides a means to get a feel for who is controlling the data processing assets.

Age--The average data processing manager is in his mid to late 30's. This is approximately 10 to 15 years younger than his counterpart in other professions. The Data Processing Manager Survey determined the mean age to be 37 years. This correlates well with Bureau of the Census Statistics [CEN78] which show that 52.3% of computer professionals are less than 40 years of age and that only 2.1% are greater than 50 years of age. Contrast this with engineers, who have 16.1% of the profession over 50 years old.

Education--Census statistics show that the data processing professional is most likely college educated and has at least a baccalaureate degree. Meaningful statistics on the type of degree are not reliable, but some researchers have suggested that mathematical degrees tend to be predominant in the data processing field. ([WOO77],

[KIN77],[GUA79])

Class Background--Studies done by Lansbury [LAN78] show that data processing professionals come from different class background than other professionals in the same organizaion. His research found that approximately 58% of systems analysts, in 2 airline data processing organizations, came from upper class or upper middle class families. This contrasted with only 22% of production staff employees in comparable skills having the same class background. It is reasonable to expect that data processing managers display these same background traits.

Sex--The data processing manager is most likely a male. Census figures [CEN78] indicate that data processing is still a male field. Over 78% of the professionals in the field are male and those females in the field tend to be in the lower level positions.

Experience--The survey results found that most data processing managers had a good level of experience in the field. This correlated with age (Figure 3-1) as would be expected. In the sample group the mean level of experience in data processing was 12 years.

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CROSS TABULATION OF MANAGER PERCEPTIONS 11/19/79

FILE STUDY (CREATION DATE = 11/19/79) STUDY OF DP MANAGER PERCEPTIONS

* CROSSTABULATION OF * * * * * * * * * * * * * *
AGE MANAGERS AGE BY ADPEXP ADP EXPERIENCE
* *

AGE	ADPEXP	1. LESS THAN 3 YEARS	2. 3-6 YEARS	3. 6-10 YEARS	4. 10-15 YEARS	5. MORE THAN 15 YEARS	ROW TOTAL
1. UNDER 30	COUNT	1	0	1	0	0	2
	ROW PCT	50.0	0.0	50.0	0.0	0.0	3.0
	COL PCT	20.0	0.0	10.0	0.0	0.0	
	TOT PCT	1.5	0.0	1.5	0.0	0.0	
2. 30-40	COUNT	4	8	6	15	2	35
	ROW PCT	11.4	22.9	17.1	42.9	5.7	52.2
	COL PCT	80.0	100.0	60.0	83.3	7.7	
	TOT PCT	6.0	11.9	9.0	22.4	3.0	
3. 40-50	COUNT	0	0	3	2	13	18
	ROW PCT	0.0	0.0	16.7	11.1	72.2	26.9
	COL PCT	0.0	0.0	30.0	11.1	50.0	
	TOT PCT	0.0	0.0	4.5	3.0	19.4	
4. OVER 50	COUNT	0	0	0	1	11	12
	ROW PCT	0.0	0.0	0.0	8.3	91.7	17.9
	COL PCT	0.0	0.0	0.0	5.6	42.3	
	TOT PCT	0.0	0.0	0.0	1.5	16.4	
COLUMN TOTAL		5	8	10	18	26	67
		7.5	11.9	14.9	26.9	38.8	100.0

CHI SQUARE = 50.27017 WITH 12 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000
CONTINGENCY COEFFICIENT = 0.65473

FIGURE 3-1
Crosstabulation of Age & Experience

Type of Facility Managed--Most of the systems and facilites managed by respondents to the survey could be classed as medium size. This was difficult to determine, because many of the managers answers provided only general responses to this question. However, figures obtained from the InfoSystems 1979 salary report [DPS79] seem to back up this statistic. If a medium size system is defined as one whose total equipment lease would cost between $6000 and $12000 per month, then the majority of systems are in this range.

Number of Personnel Supervised--In the survey respondents indicated that the average number of employees supervised was slightly below 30. This statistic was unreliable, because some answers included only those individuals under the "direct" supervision of the respondent. Other answers included the managers entire span of responsibility. The InfoSystems survey does provide a general indication that provide a feel for the size of the average department. It indicates that smaller companies with workforces of approximately 500 have data processing departments of about 12 people. Larger companies with about 12000 employees have data processing departments of about 200. The average size department was listed as being part of a 1500 employee organization and having 24.1 employees. Interesting to note, is the fact that the average number of employees per department has declined since 1970. In 1970

the average number of employees per department was 37.7. [DPS70]

Entry Level--The majority of data processing managers entered the computing field as programmers or systems analysts. (Figure 3-2) This was perhaps to be expected, but when age and experience are correlated with with entry level it shows that the younger and less experienced managers entered the field by other paths. This might have been through direct appointment to a management position after technical schooling (This is done frequently in the Department of Defense), or thru lateral transfer from outside the data processing department. The sample size is probably too small to make an accurate evaluation, but the trend is very interesting.

Responsibility--Over 70% of data processing managers don't report directly to the chief operating officer. The InfoSystem survey showed that only 27.7% of data processing departments were responsible to the major decision maker. This trend is up from 11.3% in 1968 [DPS68], but it shows that the data processing department may still be thought of as on organizational step child. Figure 3-3 shows the trends in reporting for 1968,1970,and 1979.

```
SUMMARY STATISTICS

FILE   STUDY     (CREATION DATE = 11/16/79)   STUDY OF DP MANAGER PERCEPTIONS

ENTLVL    ENTRY LEVEL

      CODE
         I
        1. ************************************ (     37)
         I  PROGRAMMER
         I
         I
        2. ********** (      9)
         I  SYSTEMS ANALYST
         I
         I
        3. ********** (     10)
         I  OPERATOR
         I
         I
        4. ******* (      6)
         I  ADP/CLERICAL
         I
         I
        5. ****** (      5)
         I  OTHER
         I
         I.........I.........I.........I.........I.........I
         0         10        20        30        40        50
         FREQUENCY

MEAN          2.000      STD ERR       0.162      MEDIAN        1.405
MODE          1.000      STD DEV       1.325      VARIANCE      1.758

VALID CASES      67      MISSING CASES      1
```

FIGURE 3-2
Entry Level in ADP

FIGURE 3-3
REPORTING CHAINS FOR DATA PROCESSING MANAGERS
(PERCENT REPORTING BY YEAR)

POSITION	1968	1970	1979
PRESIDENT OR GEN. MGR.	11.3	14.4	27.7
VICE PRES. OR STAFF CHIEF	25.8	29.3	24.9
COMPTROLLER OR TREASURER	33.3	28.7	31.1
DIR. MGT. INFO. SYS.	4.9	5.5	5.5
OTHER	24.7	22.1	10.8

SOURCE-INFOSYSTEMS MANAGER SALARY SURVEY (1968,1970,1979)

Motivational Character Traits--Several studies, but most recently Couger's, [COU78] have noted that data processing professionals have markedly different personality traits than other workers. Cougers research is supported by Woodruff's. [WOO77] Both studies found that data processing people are significantly different from other professionals in the following ways:

1. They have very low social needs compared to other workers. This is significant, because it is directly opposite from other workers, and more importantly, other managers. Sociologists usually identify people with low social needs as "loners" who lack communications skills.

2. Data processing professionals display a high need for individual growth. This can be taken to mean that mundane tasks such as documentation, routine report generation and other hum-drum funtions that help an organization function smoothly, are counter-productive to motivation in the data processsing environment. This might possibly explain the deep seated problems encounterd in program documentation and software maintenance. A cross correlation study by Fitz-enz, [FIT78] shows that data processing managers display these same traits.

3. Most programmers and analysts have a very low opinion of their supervisors. Of all employees, it seems that programmers and analysts think their managers are the worst. This is particularly revealing, since the Data Processing Manager Survey indicates that the majority of the data processing managers come from the programmer/system analysts ranks.

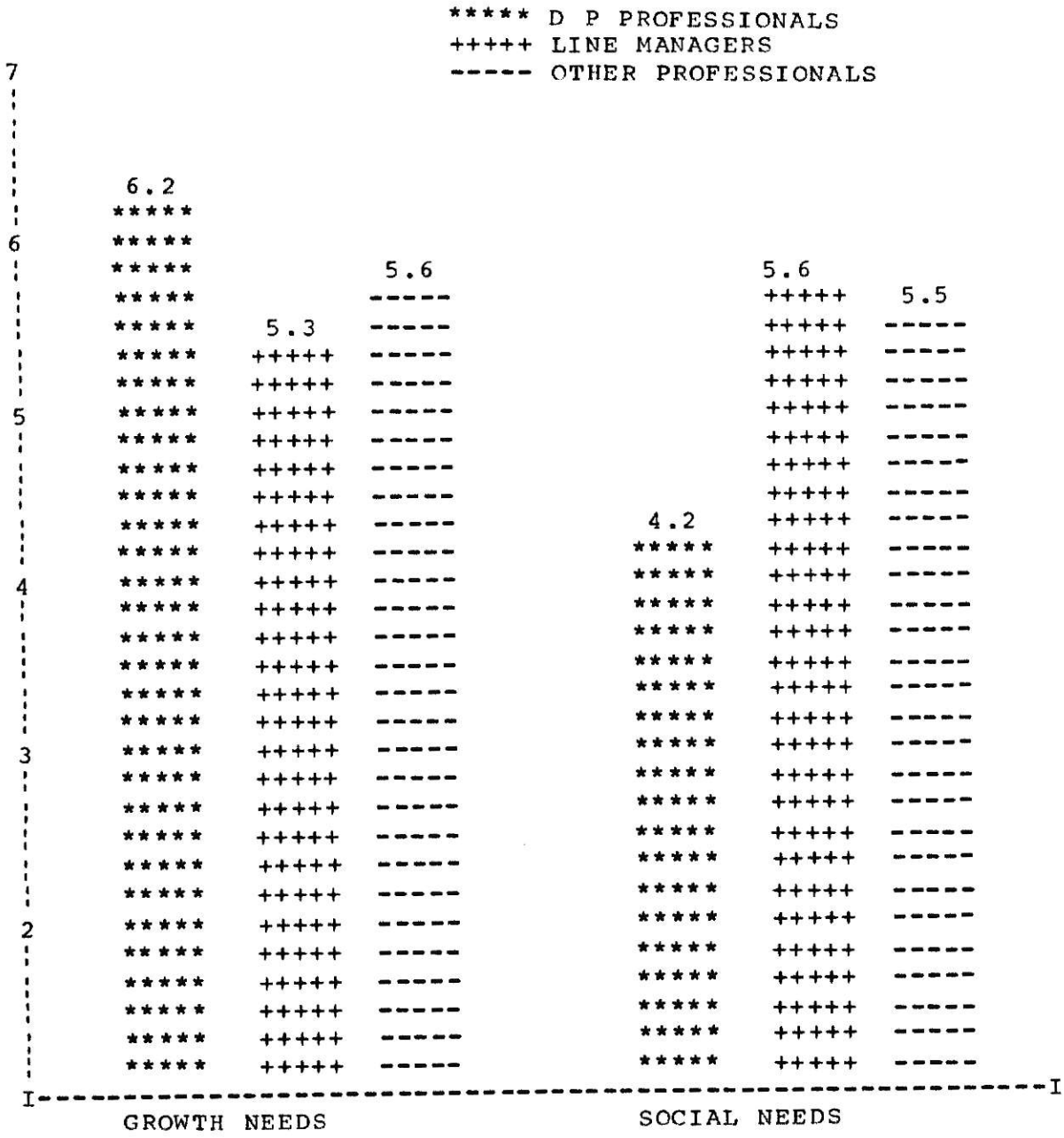
A graphical outline of these personality traits is shown at figure 3-4.

3-4 Job/Task Importance.

The Data Processing Manager Survey asked managers to rate their perceptions on just what tasks they thought were important. The design of the questionaire allowed free format answers. These answers were then grouped into major areas.

Summary data for ratings of task importance is shown at figures 3-5, 3-6 & 3-7. One interesting fact was that over 30 % of the respondents gave answers that could not be categorized. These answers ranged from such things as "political manuvering within the organization" to "participating in management." The next most frequent responses were planning (17.5%), Managing (15.9%) and Supervision (11.1%).

FIGURE 3-4
DATA PROCESSING PROFESSIONAL
PERSONALITY PROFILE



Source--[COU78].

SUMMARY STATISTICS

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

TASK1 MOST IMPORTANT TASK

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
PROBLEM SOLVING	1.	1	1.5	1.5	1.5
PLANNING	2.	11	16.4	16.4	17.9
SYSTEM DEVELOPMENT	5.	3	4.5	4.5	22.4
SYSTEM DESIGN	6.	2	3.0	3.0	25.4
MANAGE	7.	12	17.9	17.9	43.3
SUPERVISION	9.	7	10.4	10.4	53.7
CONSULTING ON EDP IS	13.	5	7.5	7.5	61.2
BUDGETING	14.	4	6.0	6.0	67.2
DOCUMENTATION	15.	1	1.5	1.5	68.7
OTHER TASKS	16.	21	31.3	31.3	100.0
	TOTAL	67	100.0	100.0	

FIGURE 3-5
Most Important Task

SUMMARY STATISTICS

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

TASK2 2ND MOST IMPORTANT TASK

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
PROBLEM SOLVING	1.	1	1.5	1.5	1.5
PLANNING	2.	6	9.0	9.0	10.4
ORGANIZING	3.	2	3.0	3.0	13.4
IMPROVE	4.	2	3.0	3.0	16.4
SYSTEM DEVELOPMENT	5.	2	3.0	3.0	19.4
SYSTEM DESIGN	6.	2	3.0	3.0	22.4
MANAGE	7.	7	10.4	10.4	32.8
SOFTWARE DEVELOPMENT	9.	3	4.5	4.5	37.3
SUPERVISION	9.	5	7.5	7.5	44.8
PERFORMANCE EVALUATI	10.	3	4.5	4.5	49.3
STAFF COORDINATION	12.	5	7.5	7.5	56.7
CONSULTING ON EDP IS	13.	9	13.4	13.4	70.1
BUDGETING	14.	3	4.5	4.5	74.6
OTHER TASKS	16.	17	25.4	25.4	100.0
	TOTAL	67	100.0	100.0	

FIGURE 3-6
2nd Most Important Task

SUMMARY STATISTICS

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

TASK3 3RD MOST IMPORTANT TASK

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
PROBLEM SOLVING	1.	2	3.0	3.0	3.0
PLANNING	2.	7	10.4	10.4	13.4
IMPROVE	4.	3	4.5	4.5	17.9
SYSTEM DEVELOPMENT	5.	4	6.0	6.0	23.9
MANAGE	7.	5	7.5	7.5	31.3
SOFTWARE DEVELOPMENT	8.	2	3.0	3.0	34.3
SUPERVISION	9.	3	4.5	4.5	38.8
PERFORMANCE EVALUATI	10.	6	9.0	9.0	47.8
COST EFFECTIVENESS	11.	1	1.5	1.5	49.3
STAFF COORDINATION	12.	1	1.5	1.5	50.7
CONSULTING ON EDP IS	13.	17	25.4	25.4	76.1
BUDGETING	14.	3	4.5	4.5	80.6
DOCUMENTATION	15.	1	1.5	1.5	82.1
OTHER TASKS	16.	12	17.9	17.9	100.0
	TOTAL	67	100.0	100.0	

FIGURE 3-7
3rd Most Important Task

Responses to the second most important task question were, Other tasks (25.4%), Consulting on EDP Issues (13.4%) and Managment (10.4%). Responses for the third most important task were, Consulting on EDP Issues (25.4%), Other tasks (17.9%) and Planning (10.4%)

These responses provide an interesting insight on just what data processing managers think they are supposed to do. However, there seems to be no "real" consensus on just what are their most important tasks. Cross correlation by age, experience, and type of equipment managed, showed no differences among manager groups. This lack of unity on task importance is perhaps an indicator that the data processing management function differs from the formal task structure usually imposed in other functional management areas such as manufacturing and marketing.

3-5 Data Processing Manager Job Skills.

The Data Processing Manager Survey asked managers to rate what skills they considered important on a rating scale from 1 (not important) to 5 (critical). Figure 3-8 shows the responses ranked in accordance with the mean and median task importance.

FIGURE 3-8
DATA PROCESSING MANAGER RANKING OF JOB SKILLS
Ratings 1 (Not Important) to 5 (Critical)

RANK	TASK	MEAN	MEDIAN	VARIENCE
1	SUPERVISION	4.910	4.951	.083
2	EXPRESSION OF IDEAS	4.761	4.856	.215
3	VENDOR RELATIONS	4.032	4.174	.999
4	PROCUREMENT SKILLS	3.761	3.950	.185
5	MORAL ISSUES	3.806	3.880	.947
6	SYSTEMS ANALYSIS	3.552	3.609	.554
7	ACCOUNTING	3.478	3.481	.920
8	LEGAL ISSUES	3.134	3.138	1.057
9	DATA BASE SYSTEMS	2.821	2.857	.543
10	OPERATING SYSTEMS	2.597	2.655	.911
11	SOFTWARE ENGINEERING	2.433	2.212	1.370
12	JOB CONTROL LANGUAGE	2.149	1.960	1.280
13	COBOL	2.104	2.083	.913
14	ASSEMBLY LANGUAGE	1.672	1.457	.678

The responses give an indication on what skills current managers believe are important. They indicate that ability to communicate ideas and ability to supervise are critical. Ranked next in importance are "Vendor relations" and "Hardware and Software Procurement" skills. These ratings would seem to conflict with the very low ratings given to the technical skill components such as compiler design, operating systems, and data base systems. The logical question posed here is, "How can intelligent vendor decisions be made without a good, "current" technical base to draw from?" The low ranking of the technical skills may indicate a lack of confidence in the technical areas and may help explain some of the real problems that presently exist in the data processing community that were referred to in Chapter 1.

More importantly, these skill rankings may be an indicator of reasons for the high levels of programmer dissatisfaction found by the Couger, Fitz-enz and Woodruff studies. ([COU78], [FIT78], [WOO77]) There may be a strong link that suggest that the lack of "current" technical skills rather than a lack of managment skills has a strong bearing on programmer productivity.

To date the only overt indicator that data processing managers may not be technically qualified is the dismal success rate on the CDP certification examination as cited

earlier. This may not be a fully valid indicator. It is especially disconcerting when viewed in the light that certification is not presently a requirement, and that each applicant was motivated enough to pay $75 to take the examination.

The contradictions posed above caused the author to more closely examine perceptions in the technical areas between managers of differing age and experience levels. This cross correlation shows that younger data processing managers tend to place the technical factors at a much higher level.

Figure 3-9 thru 3-15 show these cross tabulations. One possible explanation for this trend may be that younger managers are closer to the daily technical operations of the data processing facility. Another explantion is that younger data processing managers realize that both technical and managerial qualifications are important.

3-6 Composite Profile of Current Data Processing Managers.

The composite profile of todays' data processing manager was developed from the previous input and is shown at figure 3-16. The author feels that this profile is moderately accurate and is useful as a basis for establishing the generalized model of data processing managers.

CROSS TABULATION OF MANAGER PERCEPTIONS 11/16/79

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

* CROSSTABULATION OF * * * * * * * * * *
ADPEXP ADP EXPERIENCE BY COBOL KNOWLEDGE OF COBOL
* *

	COBOL				
	COUNT / ROW PCT / COL PCT / TOT PCT	1. LOW IMPORTANCE	2.	3. USEFUL	4. IMPORTANT	ROW TOTAL
ADPEXP						
1. LESS THAN 3 YEAR		1	2	2	0	5
		20.0	40.0	40.0	0.0	7.5
		4.3	11.1	9.1	0.0	
		1.5	3.0	3.0	0.0	
2. 3-6 YEARS		0	1	3	4	8
		0.0	12.5	37.5	50.0	11.9
		0.0	5.6	13.6	100.0	
		0.0	1.5	4.5	6.0	
3. 6-10 YEARS		3	2	5	0	10
		30.0	20.0	50.0	0.0	14.9
		13.0	11.1	22.7	0.0	
		4.5	3.0	7.5	0.0	
4. 10-15 YEARS		9	4	5	0	18
		50.0	22.2	27.8	0.0	26.9
		39.1	22.2	22.7	0.0	
		13.4	6.0	7.5	0.0	
5. MORE THAN 15 YEA		10	9	7	0	26
		38.5	34.6	26.9	0.0	38.8
		43.5	50.0	31.8	0.0	
		14.9	13.4	10.4	0.0	
COLUMN TOTAL		23	18	22	4	67
		34.3	26.9	32.8	6.0	100.0

CHI SQUARE = 37.20912 WITH 12 DEGREES OF FREEDOM SIGNIFICANCE = 0.0002
CONTINGENCY COEFFICIENT = 0.59801

FIGURE 3-9
Crosstabulation ADP Experience vs COBOL

CROSS TABULATION OF MANAGER PERCEPTIONS 11/16/79

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

* CROSSTABULATION OF * * * * * * * * * * * * *
ADPEXP ADP EXPERIENCE BY OPSYS KNOWLEDGE OF OPS SYSTEMS
* *

ADPEXP	OPSYS	1. NOT IMPORTANT	2. LOW IMPORTANCE	3. USEFUL	4. IMPORTAN	5. CRITICAL	ROW TOTAL
1. LESS THAN 3 YEAR	COUNT	1	0	3	1	0	5
	ROW PCT	20.0	0.0	60.0	20.0	0.0	7.5
	COL PCT	11.1	0.0	10.3	14.3	0.0	
	TOT PCT	1.5	0.0	4.5	1.5	0.0	
2. 3-6 YEARS	COUNT	1	0	3	2	2	8
	ROW PCT	12.5	0.0	37.5	25.0	25.0	11.9
	COL PCT	11.1	0.0	10.3	28.6	100.0	
	TOT PCT	1.5	0.0	4.5	3.0	3.0	
3. 6-10 YEARS	COUNT	1	1	7	1	0	10
	ROW PCT	10.0	10.0	70.0	10.0	0.0	14.9
	COL PCT	11.1	5.0	24.1	14.3	0.0	
	TOT PCT	1.5	1.5	10.4	1.5	0.0	
4. 11-15 YEARS	COUNT	2	10	5	1	0	18
	ROW PCT	11.1	55.6	27.8	5.6	0.0	26.9
	COL PCT	22.2	50.0	17.2	14.3	0.0	
	TOT PCT	3.0	14.9	7.5	1.5	0.0	
5. MORE THAN 15 YEA	COUNT	4	9	11	2	0	26
	ROW PCT	15.4	34.6	42.3	7.7	0.0	38.8
	COL PCT	44.4	45.0	37.9	28.6	0.0	
	TOT PCT	6.0	13.4	16.4	3.0	0.0	
COLUMN TOTAL		9	20	29	7	2	67
		13.4	29.9	43.3	10.4	3.0	100.0

CHI SQUARE = 39.23257 WITH 16 DEGREES OF FREEDOM SIGNIFICANCE = 0.0168
CONTINGENCY COEFFICIENT = 0.55761

FIGURE 3-10
Crosstabulation
ADP Experience vs Knowledge of Operating Systems

CROSS TABULATION OF MANAGER PERCEPTIONS 11/16/79

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

* C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * *
ADPEXP ADP EXPERIENCE BY SYSANL KNOWLEDGE OF SYSTEMS ANALYSIS
* PAGE

ADPEXP	SYSANL 1. LOW IMPORTANCE	2.	3. USEFUL	4. IMPORTANT	5. CRITICAL	ROW TOTAL
1. LESS THAN 3 YEAR	COUNT	1	2	1	1	5
	ROW PCT	20.0	40.0	20.0	20.0	7.5
	COL PCT	20.0	8.0	3.1	20.0	
	TOT PCT	1.5	3.0	1.5	1.5	
2. 3-6 YEARS	COUNT	1	1	3	3	8
	ROW PCT	12.5	12.5	37.5	37.5	11.9
	COL PCT	20.0	4.0	9.4	60.0	
	TOT PCT	1.5	1.5	4.5	4.5	
3. 6-10 YEARS	COUNT	0	4	6	0	10
	ROW PCT	0.0	40.0	60.0	0.0	14.9
	COL PCT	0.0	16.0	18.8	0.0	
	TOT PCT	0.0	6.0	9.0	0.0	
4. 10-15 YEARS	COUNT	1	9	7	1	18
	ROW PCT	5.6	50.0	38.9	5.6	26.9
	COL PCT	20.0	36.0	21.9	20.0	
	TOT PCT	1.5	13.4	10.4	1.5	
5. MORE THAN 15 YEA	COUNT	2	9	15	0	26
	ROW PCT	7.7	34.6	57.7	0.0	38.8
	COL PCT	40.0	36.0	46.9	0.0	
	TOT PCT	3.0	13.4	22.4	0.0	
COLUMN TOTAL		5	25	32	5	67
		7.5	37.3	47.8	7.5	100.0

CHI SQUARE = 19.96696 WITH 12 DEGREES OF FREEDOM SIGNIFICANCE = 0.0677
CONTINGENCY COEFFICIENT = 0.47916

FIGURE 3-11
Crosstabulation
ADP Experience vs Knowledge of Systems Analysis

CROSS TABULATION OF MANAGER PERCEPTIONS 11/16/79

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

* CROSSTABULATION OF * * * * * * * * * *
ADPEXP ADP EXPERIENCE BY DBMS KNOWLEDGE OF DBMS
* * * * * * * * * * * * * * * * * * * \

CROSS TABULATION OF MANAGER PERCEPTIONS 11/16/79 PAGE

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

* C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * *
ADPEXP ADP EXPERIENCE BY CS70C KNOWLEDGE OF COMPILER DESIGN
* * * * * * * * * * * * * * * * * * * \

CROSS TABULATION OF MANAGER PERCEPTIONS 11/16/79 PAGE

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

* C R O S S T A B U L A T I O N O F * * * * * * * * * * * * * * * * * * *
ADPEXP ADP EXPERIENCE BY SOFTE KNOWLEDGE OF SOFTWARE ENGINEERING
* * * * * * * * * * * * * * * * * * * \

CROSS TABULATION OF MANAGER PERCEPTIONS 11/16/79

FILE STUDY (CREATION DATE = 11/16/79) STUDY OF DP MANAGER PERCEPTIONS

* * * * * * * * * * * * * * * * * * * CROSSTABULATION OF * * * * * * * * *
ADPEXP ADP EXPERIENCE BY JCL KNOWLEDGE OF JCL
* *

ADPEXP	JCL	1.	2.	3.	4.	5.	ROW TOTAL
1. LESS THAN 3 YEAR	COUNT	0	2	1	2	0	5
	ROW PCT	0.0	40.0	20.0	40.0	0.0	7.5
	COL PCT	0.0	8.0	8.3	50.0	0.0	
	TOT PCT	0.0	3.0	1.5	3.0	0.0	
2. 3-6 YEARS	COUNT	0	3	0	1	4	8
	ROW PCT	0.0	37.5	0.0	12.5	50.0	11.9
	COL PCT	0.0	12.0	0.0	25.0	100.0	
	TOT PCT	0.0	4.5	0.0	1.5	6.0	
3. 6-10 YEARS	COUNT	3	2	4	1	0	10
	ROW PCT	30.0	20.0	40.0	10.0	0.0	14.9
	COL PCT	13.6	8.0	33.3	25.0	0.0	
	TOT PCT	4.5	3.0	6.0	1.5	0.0	
4. 10-15 YEARS	COUNT	9	8	1	0	0	18
	ROW PCT	50.0	44.4	5.6	0.0	0.0	26.9
	COL PCT	40.9	32.0	8.3	0.0	0.0	
	TOT PCT	13.4	11.9	1.5	0.0	0.0	
5. MORE THAN 15 YEA	COUNT	10	10	6	0	0	26
	ROW PCT	38.5	38.5	23.1	0.0	0.0	38.8
	COL PCT	45.5	40.0	50.0	0.0	0.0	
	TOT PCT	14.9	14.9	9.0	0.0	0.0	
COLUMN TOTAL		22	25	12	4	4	67
		32.8	37.3	17.9	6.0	6.0	100.0

CHI SQUARE = 55.98587 WITH 16 DEGREES OF FREEDOM SIGNIFICANCE = 0.0000
CONTINGENCY COEFFICIENT = 0.67470

FIGURE 3-15
Crosstabulation
ADP Experience vs Knowledge of JCL

FIGURE 3-16

Composite Profile of Current Data Processing Managers

AGE:	37
ADP Experience:	12 years in the ADP Field.
Education:	College Graduate.
Class Background:	Upper Middle Class.
Sex:	Male.
Organization Managed:	Medieum Size--24 Employees.
Entry Level:	Programmer/Systems Analyst.
Reports To:	Comptroller or Vice President.
Main Concern:	Planning, Managing, Consulting on Data Processing Issues.
Skill Focus:	General Management Tasks & Vendor Interface.
Minor Focus:	Technical Tasks.
Problem Areas:	Employee Motivation. Management Interface. Peer Communication.

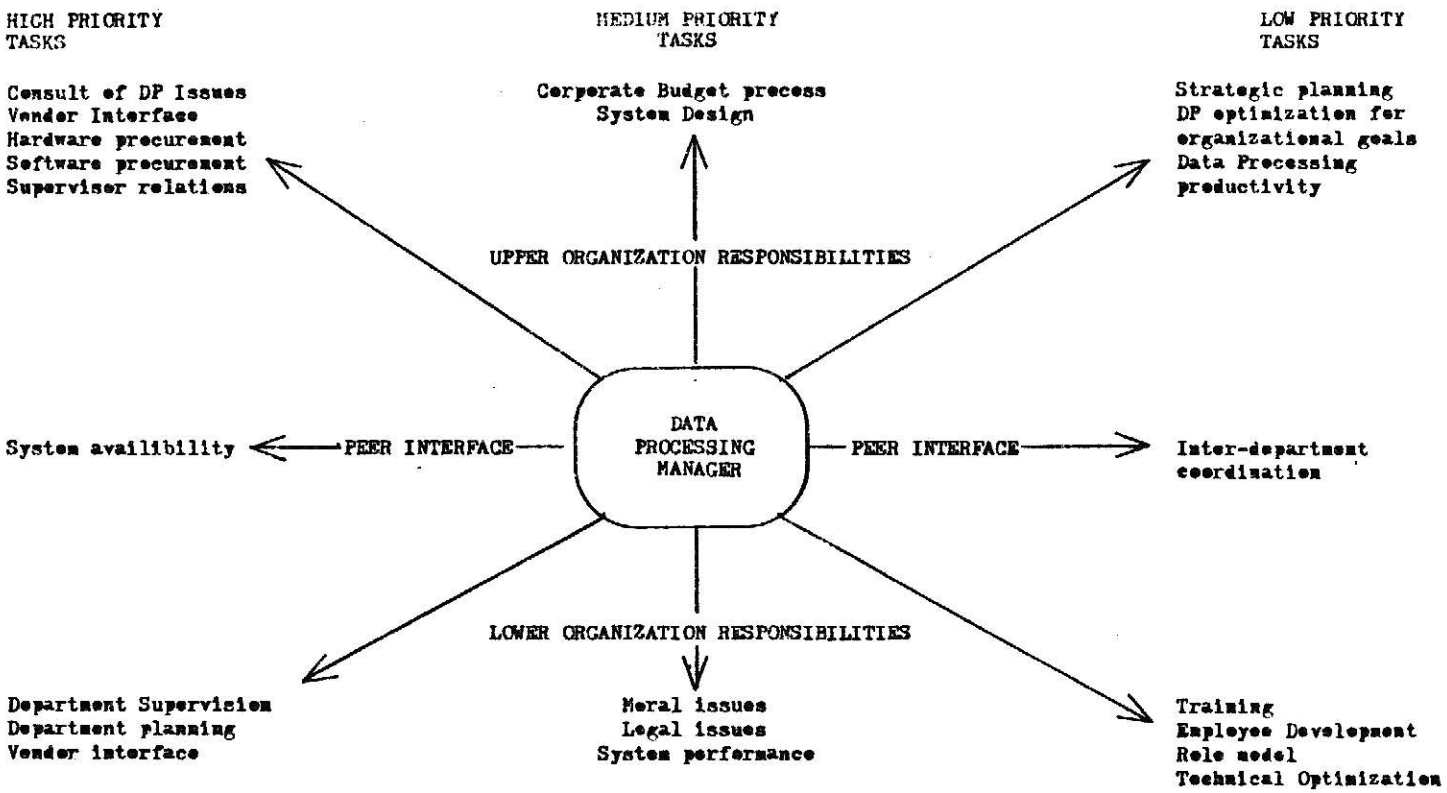
3-7 Model of the Current Data Processing Manager.

Once the composite profile has been established it is relatively easy project this profile into a current model of todays data processing manager. This model is shown at Figure 3-17. This model is based on the concept of a centralized data processing installation within a higher organization. the model portrays the data processing managers functional tasks as he perceives them. This model does not model the ideal manager. It does try and show the authors opinion of just what the data processing manager considers important. The model portrayed is not a very flattering one. However, it may help explain the generalized low rating that data processing managers receive from their subordinates and from other managers.

As discouraging as this model seems to be, apparently most current manager's performance is adequate. It is the author's opinion that the efficiency of data processing hardware and declining cost versus performance ratios have most likely hidden much of the glaring inefficiency in most data processing departments. Tools with which to measure the true cost benefits to the enterprise are only slowly being developed and applied by line managers.

FIGURE 3-17

Model of Current Data Processing Managers



In addition, many current line managers still fear the mistique of the computer and will accept almost any explaination for failure if it is couched in the proper technical jargon and has not caused a major immediate financial impact on operations.

3-8 Summary.

This type of performance may be acceptable in the present centralized environment, but advances in technology, growth in the sophistication about data processing in line managers, and better measurement tools, will force this type of model to change. This must be done in order for the data processing asset to be used efficiently and for growth to continue. Failure to do so might have dire consequences.

CHAPTER 4

TECHNOLOGY TRENDS AND THE DATA PROCESSING MANAGER OF THE 80'S

4-1 Overview.

The 1980's will see a continuation of the rapid growth of the data processing/computer industry. Technological advances will continue to decrease unit cost/performance ratios of computer hardware. However, software impacts, increasing dependence of organizations on data processing, and growing sophistication about computer technology by line managers, will cause major changes in the roles, job tasks and organizational powers of data processing managers. The technological changes will be evolutionary, but the impact on the organization and the data processing manager will be revolutionary.

The major changes can be categorized as Hardware changes, Software Improvements, and Organizational and Social Developments. A general discussion of the areas follows.

1. Changes in hardware technology to include:

a. Continued improvements in the cost/performance effectiveness of semi-conductor memory and logic.

b. Incresing use of optical fiber and laser technology and a slow decrease in data communications costs.

c. Development and use of large mass storage devices with up to 940 billion character capacity. These devices will use bubble memory or charge coupled device technology.

d. Increasing use of Computer Output Microfilm.

e. Movement away from Von-Neuman (sequential processing) hardware designs to special purpose parallel Processing machines.

2. Improvement of software utilities and an evolution to non-procedural languages. This includes:

a. Better software design and testing tools.

b. Adoption of non-procedural languages. (Languages that describe "what" to do not "how to do.")

c. Universal acceptance of the data base concept.

3. Organizational and social developments. These include:

a. Movement to distributed processing environments, with centralized data processing planning and control, and decentralized execution.

b. Legal ramifications of data security and personal privacy.

c. Increasing awareness that an organizations data is one of its most valuable assets.

d. Adoption of office automation.

None of these changes will take place in isolation. All changes will have a great impact on just how the data processing manger does his job, and on his role in the organization. These changes are discussed in detail and evaluated for their specific impact on the data processing manager of the 80's.

4-2 Changes in Hardware.

Hardware technology has had the most direct impact on data processing in the past and will continue to do so in the future. The rapid advances in integrated circuit and fiber optics technology has continued to decrease hardware costs. At the present time there are no indicators that the point of diminishing returns has been reached. [LEC77]

4-3 Semi-conductor Technology Improvements.

Past hardware improvements caused by the advances in semi-conductor technology are shown at Figures 4-1 and 4-2. Examination of these figures show that semi-conductor technology is responsible for the rapidly decreasing cost/performance ratios in the past 10 years. These technological advances are the main reason for the current hardware software cost factors discussed in the previous chapters. Although some industry experts predict that the state of the art in semi-conductor technology has reached

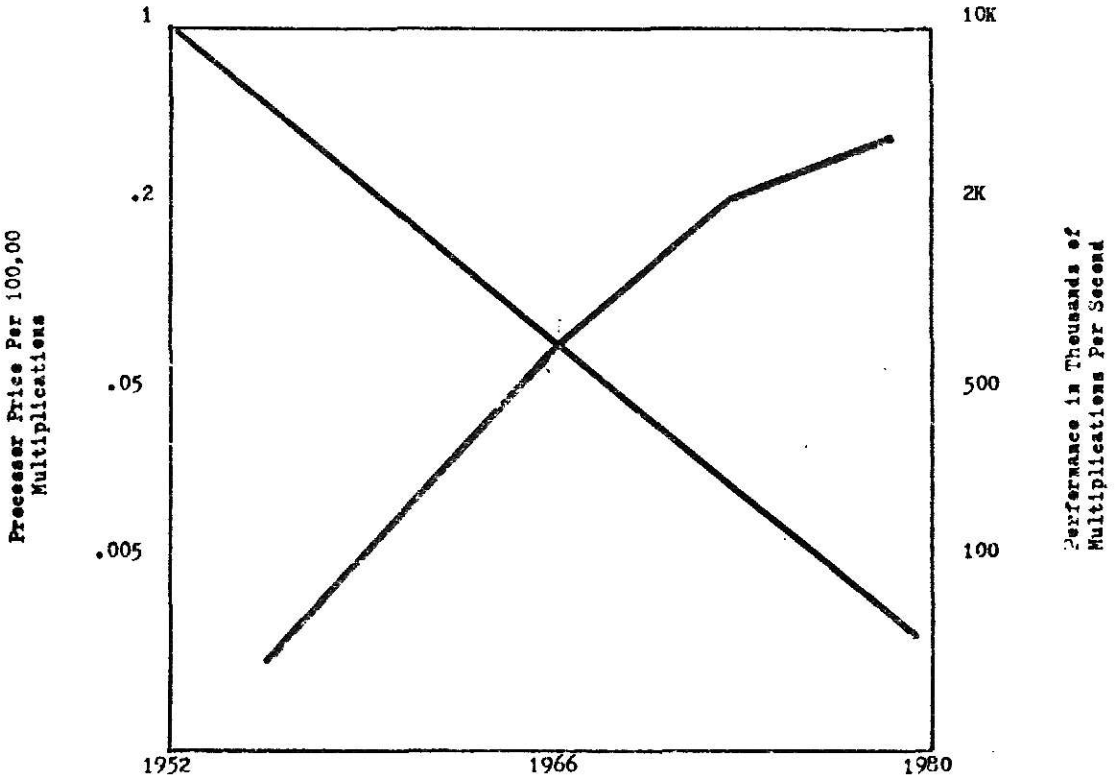
the point of diminishing returns, a detailed examination of technical journals and vendor literature indicates that optimum performance has not been acheived.

One particular indicator of this fact is the IBM research concept of "Josephson Technology." This technology uses liquid helium cooled super-conductors which operate 100 to 200 times faster than todays fastest semi-conductors. IBM projections [ANA79] state that two 4 bit numbers can be multiplied in 12 nano-seconds using this technology. This type of speed and computing power will have a direct effect on data processing managers. Lecht feels that todays concern about "efficient and optimal code" will no longer be a major consideration. It will allow the hardware to try all possible solutions to a problem and choose the best. [LEC77]

Other possible impacts include the use of large cache memories and very high speed buffers that may allow for entire data bases to be brought into main store from off line storage. Industry sources [LEC77] state that this technology will most likely be marketed in the mid 1980's. Future data processing managers will have to cope with this quantum leap in computing power and will have to make complicated vendor decisions on how, where, and when to upgrade.

FIGURE 4-1

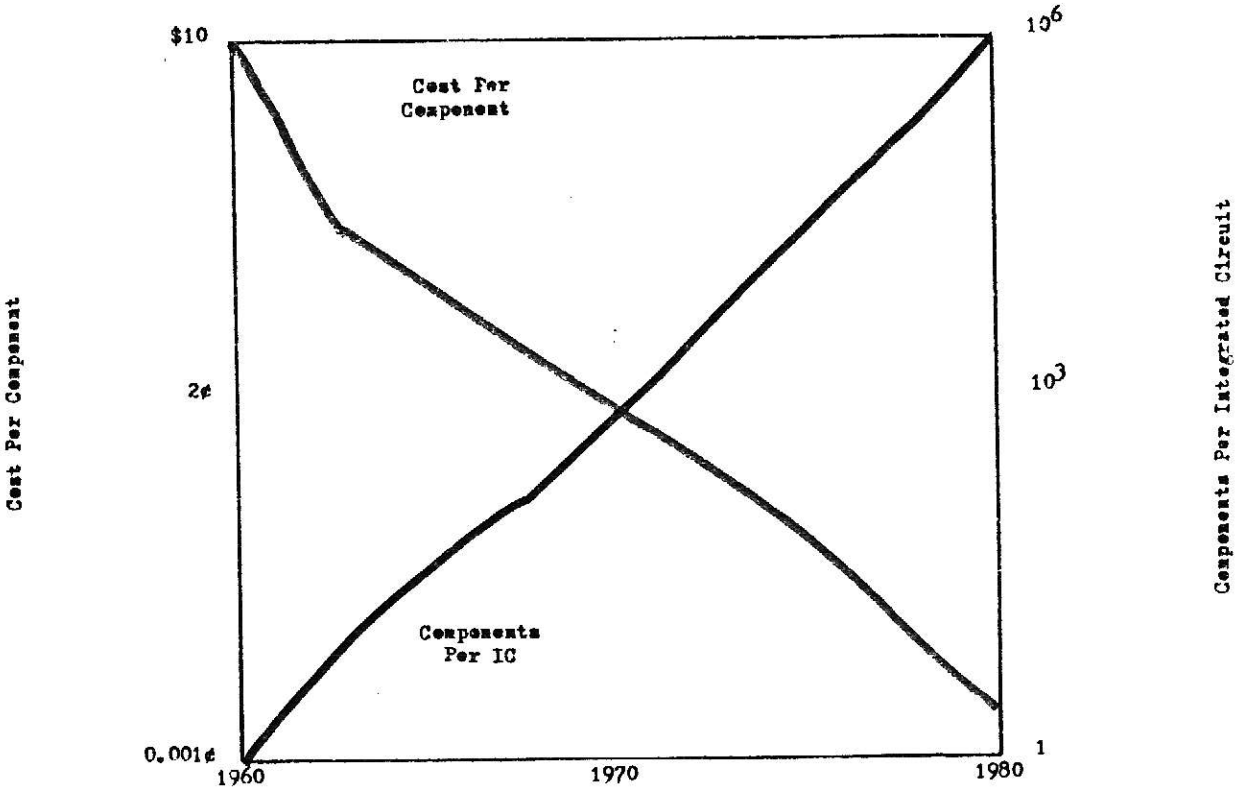
Processor Price/Performance Trends



Source- (LEC77)

FIGURE 4-2

Cost Evolution of MOS Circuits



Source- (LEC77)

Other impacts to be considered will be in the areas of applicaton design and hardware interface. For example is a computer that can outperform all the terminals on the system really worth the money? The data processing manager of the 80's will have to consider these very factors.

4-4 Optical Fiber Technology.

Increasing emphasis on data communications and the lack of real cost improvements compared to hardware technology has spurred development in the area of fiber optics. New applications in this area have been developed which offer advantages of increased bandwidth, lack of electrical interference and low frequency loss over long distances.

This technology will have major impacts on computer networking and interconnection. The largest impact will be at local levels. Optical fiber technology enhances the ability to bus data between remote terminals and a processor. This technology will accelerate the development of modular hardware that can be interconnected by very high quality fiber optic busses. This will effect data processing managers by offering almost limitless configuration possibilities and expandable local terminal networks.

Optical fiber interconnections will improve network interconnections and will enhance the quality and feasability of distributed processing networks. The technology is needed to help lower interconnection costs.

4-5 Improvements in Mass Storage Technology.

The cost of memory both on and off line will continue to decline in the 80's. Bubble memory devices are presently being marketed by some vendors (ITEL announced the production of a 64K bubble memory chip in May 1979.) Many manufactures are well on the way to developing mass storage devices using this technology and marketing will begin in the early 80's.

Bubble memories have the advantages of compactness, non-volatility, and simplicity. They are ideal replacments for fixed head disks and diskettes. Bubble memory and charged coupled devices will have major impacts in the intelligent terminal and word processing areas. Further expansion of this type of technology will most likely result in the capability to maintain high speed archival files. Such files are not presently cost effective.

Management of these large files and methods to maintain and update them will be a major concern for future data processing managers. In addition, this mass storage

capability will provide challenges in the security and privacy areas. In the past, the expense of storage forced the use of low cost, off-line storage media. This provided some constraints on the volume and type of data saved. The use of cheap, fast and efficient storage technology will remove most of these constraints and make archival data management a major concern.

4-6 Computer Output Microfilm.

The use of Computer Output Microfilm has expanded rapidly as paper processing costs continue to rise. It has many uses as an archival storage medium. Lecht [LEC77] states that the reduction of online storage costs may make the use of this medium limited. However, the current research in holographic storage, image storage and full color displays make maximum use of microfilm technology.

These types of applications will probably be accelerated by applications that allow microfilm records to be read stored and retrieved by processors at remote locations. Micofilm has the advantage of being acceptable as a transaction record in most legal proceedings. This makes it suitable for recording and storing image copies of checks, insurance policies, credit slips and other documents. Holographic applications have the advantage of being able to provide multi-dimensional views of certain images and

have applications in cartography, mathematics and engineering.

Many of these applications are in the test marketing stage today and the author predicts rapid adoption and many new applications in the 1980's. Future data processing managers will have to become more knowledgeable about microfilm technology and be prepared to accept the responsibility for the management and utilization of microfilm information assets.

4-7 Parallel Processing Hardware.

Current computers are based upon the classical Von-Neuman concept that processes data in a sequential manner. Even with advances in Von-Neuman type technology, applications such as text processing, string recognition, and list manipulation will still use an abnormal amount of processing time. Currently much work is being done on hardware that allows parallel processing. Several prototypes have been built and it is reasonable to expect that this type of hardware will be marketed in the mid to late 80's.

The use of this type of hardware in modular form makes the concept of a special purpose data base machine a real possibility. When combined with other hardware advances

such as inexpensive, high density storage and increased CPU processing power, data base processing technology will advance rapidly. This will have major impacts on computer usage because of the built in ability of parallel processors to accomplish simultaneous searches on large data bases in a very short time.

The adoption of large scale retrieval systems will make additional applications in the scientific, legal and engineering fields cost effective. This will effect the future data processing manager because of the increase in the number of applications and users. In addition, the increased ability to access and modify large amounts of data at very low cost will increase security and integrity problems.

Development of parallel processing capability may be the key that allows the massive networking of computer assets in schemes that allow hetrogeneous hardware, software and data bases. The concept may sound utopian, but the author belives that it will be adopted in the 1980-90 time frame.

4-8 Software Impact.

As discussed in the earlier chapters, software is currently the major bottleneck in data processing. If no major improvements are made in the next few years then

software costs will approach 95% of total systems costs. Current research however, shows that some improvements can be expected that will have a marked impact in the 1980's.

4-9 Software Design and Testing Tools.

Many software experts, notably Boehm [BOE73], long ago recognized the need to improve software design and testing tools. Much of the work being done in the field has started to come into everyday use and there are marginal indications that some software costs are being reduced. [LEH79] One glowing example is Systems Development Corporation's "Software Factory" concept [BRA75] which includes design, development and testing tools in one software package.

Other innovations, such as the use of team programming and advanced software engineering methods and the focus of line management on the true costs of software, will force future data processing managers to use and enforce valid software engineering techniques or suffer grave consequences in terms of cost overruns and high software maintenance costs.

Hardware advances may obviate the need for "efficient code" in the future environment. Past history has shown however, that improved hardware capability usually creates an even greater demand for more applications. Additional

applications result in more software to design, update and maintain. This is another problem area that the data processing manager of the 80's must face.

4-10 Non-Procedural Languages.

Software costs will continue to grow as long as programmers program in languages that tell the computer "how to do" instead of "what to do." Languages that use "what to do" instructions are classed as non-procedural. Presently the transition to these type of languages is based on large software packages such as BIOMED, MUMPS and SPSS. Software costs, difficulty factors and and a continued lack of programmer productivity provides a strong impetus for the adoption of computer languages that can be used by non-programmers.

McCracken [MCC78] claims that productivity using computer oriented procedural languages is just too slow to keep up with the demand for new applications. Since non-procedural languages depend upon large software packages, their adoption will depend on improvement in the capability of hardware. This improvement in hardware capability is almost certain.

With the hardware improvements in the 80's non-procedural language packages will be coming into increasing use. This will pose a challange for data processing managers who face the advantage of being able to decentralize the programming effort to the user level, but retaining responsibility for the software package maintenance. To further complicate the problem, it is doubtful that all the packages will be standardized and each may need to be fine tuned to run on different hardware. User applications programming will also create greater demands for system availability and responsiveness. Planning for, transitioning to, and administering this type of a computing environment is a major task for future data processing managers.

4-11 Adoption of the Data Base Concept.

Although data base management systems software packages are over 10 years old, universal movement to DBMS has not been as rapid as expected. For example the Joint Military Pay System (JUMPS) still uses a conventional program and sequential file processing to pay all members of the armed forces. While many organizations purchase and and have DBMS packages resident on their system, there is some indication that actual useful implementation is very low. For example, the U.S. Army installation at Fort Leavenworth, Kansas purchased MRI's System 2000 DBMS in 1975. As of June 1979

the only application that was using the package was a limited student data base application for the Army Command and General Staff College. The 200 remaining applications were still being run using conventional programs and sequential or indexed file methods.

By the mid 1980's however, the pool of knowledgeable applications programmers, software utilities, and line management awareness will have grown enough so that DBMS's will be commonly used. Adoption of DBMS causes the data processing mangager to face the reality of data base design and maintenance questions to include schema and subschema allocation and security and integrity problems. Although he may be assisted by a data base administrator, the data processing manager will most likely make the final decisions and provide direct input to line management on data base questions and priorities.

4-12 Distributed Processing.

The greatest advantage of new computer technology will be an ability to distribute data processing assets throughout the organization. Most corporate entities are in fact, decentralized. They have central corporate management with decentralized operating agencys. With the increased computer processing power it is desirable from an organizational point of view to place computing assets where

they are needed.

Distributed Processing is described by Miller [MIL78] as:

> "Computing capabilities at either local or remote sites which may or may not be connected by communications lines, but which have interleaved or interconnected memories."

Figure 4-3 shows some of the major characteristics of distributed data processing.

Most experts in the field, such as Enslow [ENS78] and Rothnie [ROT77], predict that future data processing organizations will most likely be distributed with processing power in nodal configurations. This is a revolutionary change from the present centralized environment.

Organizations that have adopted the distributed concept have found that it has a major impact on the organization and the data processing professional. The need for strong central control and guidance is balanced against the requirment for decentralized execution at node level.

FIGURE 4-3

TYPICAL CHARACTERISTICS OF DISTRIBUTED DATA PROCESSING

* LOCAL AUTONOMY OF DATA PROCESSING OPERATIONS.
* CHOICE OF INTERACTIVE AND/OR BATCH PROCESSING MODES.
* UTILIZATION OF VARIOUS INPUT/OUTPUT DEVICES.
* DISTRIBUTED DATA BASE AT THE LEVEL REQUIRED.
* INCREASED USE OF ON SITE FUNCTIONAL PERSONNEL FOR DATA ENTRY AND LOCAL PROCESSING.
* AVAILABILITY OF REPORTS THAT EMPHASIZE MANAGEMENT BY EXCEPTION.

Source- [THI78]

Line managers and other users must take on more responsibility for data entry. Perhaps the greatest change is the fragmentation of large centralized data processing departments, with total control over hardware, software and applications.

The author foresees multi-level organization of data processing nodes as shown in Figure 4-5. Each node will have a data processing facility and each facility will have a data processing manager who will have to serve 2 masters. The masters will be the executive in charge of the node (i.e plant or branch manager) and the data processing supervisor at the next higher level.

At the lowest nodal levels the data processing manger will be in charge of "all" data processing assets at that node and also be directly responsible to the functional manager. This is different from the centralized concept because of the immediate responsiveness to the user and because the scale of the operation will most likely not support the specialized technical experts in data base, operating systems and software design now found at most centralized data processing operations. Such a data processing manager will have to be technically competent and management oriented. He will be expected to be a technical consultant to the line manager at the local nodal level.

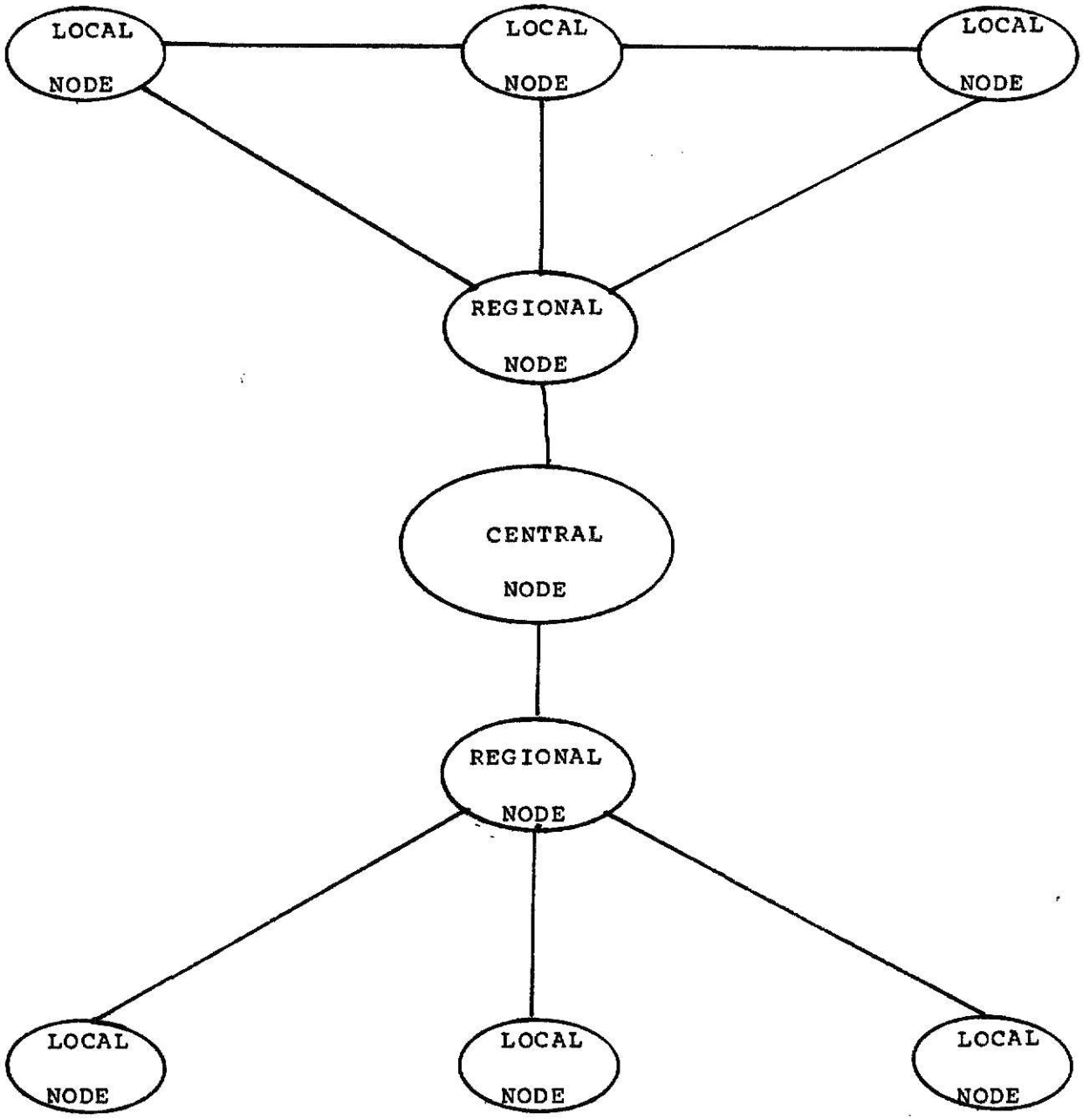
At the mid-level or regional node, the data processing manager will most likely be charged with overall technical supervision of subordinate nodes. He will be the major data processing advisor to the regional line manager. He will be involved in medium to long range planning at the regional management level. He will have to be technically competent enough to supervise and assist the lower level managers in problem situations.

At the highest node level the data processing manager will have the responsibility for the maximization of data processing assets and will be a primary member of the corporate staff. The position will demand major professional contribution and require extensive technical and management skills. Particulary important at this level is a detailed understanding of both organizational and technical impacts of computer related decisions.

Many authors, but most notably Tushman [TUS79], Nolan, [NOL76] and Gilbert [GIL78] are very doubtful of the ability of data processing managers as we know them today can make the transition. It has already been shown that these type of managers are hard to find. One leading executive recruiter has described just how difficult and important this type of individual is:

FIGURE 4-4

Future Model of Distributed Processing



> "In recent years, companies have come to recognize the contribution that data processing can make to managing all the assets of a business. In order to attract a top quality executive salaries have risen and turnover has been high because competition for quality people is keen. A quality information system executive is in an attractive position in the marketplace" [MCL79]

This is an indication of the current scarcity of qualified individuals. In the future with the switch to nodal environments the need for this type of data processing manager will be even more critical. At the present time, many experts state that few data processing professionals are trained to fill these critical node manager positions. ([BOU78],[DEL78],[EMO79],[NOL76])

4-13 Legal Impacts.

The Passage of the privacy Act in 1974, current legal precedents on the liability of data processing organizations and cases of fraud caused by the manipulation of computer data, have had major impacts on data processing in the past 5 years. Public concern about the existence and potential for abuse of large data banks have made the industry security conscious. However, the security and integrity weaknesses of current data base management systems do little to help solve the problem. [COG77]

In the 1980's organizations will depend even more heavily upon computerized data banks. This will be made possible by the availability of low cost storage media. As the dependence increases, organizations become even more vunerable to computer criminals, disaster, and industrial espionage. Recent legal decisions have held that the data processing manager has a fudiciary responsibility as the organizations "data custodian." In the Department of Defense the data processing executive is considered legaly liable for the misappropriation or destruction of data. (DOD Directive 5200.8)

These restrictions and assignment of responsibility for the security and integrity of data will increase in the 1980's. Future data processing managers must develop a real awareness of these aspects. Even disregarding the legal ramifications, the actual damage that could be caused by the dileberate or inadvertant destruction of an organizational data base could be catastrophic. Imagine the nation wide impact of the destruction of 3 days worth of transaction records from the New York Stock Exchange.

Managagment in this type of environment requires a multi-disciplined approach which covers the full spectrum of the technical computer areas as well as organizational skills. These areas range from knowledge of operating systems and data base management, to design to employee

motivation and supervision. [NOL76]

The supervision and motivation area is particularly important in the light of a recent congressional study. The study discovered that over 85% of computer criminals are disgruntled employees. [COG77] Surveys of current literature and examination of curricula indicate that few of todays managers are properly prepared to deal with these types of problems.

4-14 Corporate Awareness of DP Potential.

As data processing matures, line managers are becoming increasingly aware of its potential and pitfalls. They have discovered that "information is power." More organizations treat information as an asset and view computer technology as a way to modify and enhance that asset.

Modern managers no longer view the computer with awe, and are becoming increasingly sophisticated in its use. Biriff [BIR78] has noted that the new breed of line manager is willing to experiment with the computer resource to enhance overall performance. Boulton [BOU78] on the other hand, states that many managers are concerned with how the asset is managed. These new line managers no longer accept the stylized jargon answers of the centralized data processing empire. They appear anxious to hold the data

processing departments feet to the fire as never before. It is these types of line mangagers who are leading the way to the decentralization of data processing assets.

The data processing manager of the 80's must be prepared to deal with these individuals and provide the proper counsel to them on major computer decisions. These new line managers have a better understanding about data processing than their predecessors, but they still lack the technical knowledge to manage computer technology without assistance. Future information managers will have to provide this technical assistance as an integral part of the management team.

4-15 Office Automation.

Whether he likes it or not, the data processing manager of the 80's will most likely be responsible for office automation. He is the logical individual in the oganization to manage these assets because of their computer based technology. The American Management Association has recommended that the information executive be placed in charge of office automation assets. [BRE77] This same course of action has been adopted by the Department of the Army.

Most of the reasoning centers not only around the technical base of the equipment, but upon the vendor relations aspect. Most of the high technology firms that sell office automation items are the same ones that manufacture computers.

For organizations that do control office automation through the information executive, the challange to the data processing manager is formidable. He will have to coordinate allocation of assets centrally and facilitate decentralized use. He will become even more visable in the total organization and be forced to accept increased responsibility for office productivity. [DOL76]

In organizations that have no clear transition plan, movement to automated office systems will be a slow, painful power struggle between the adminstrative services department and the data processing manager. The author believes that the data processing manager will inherit most of the assets as top level executives begin to realize that that office work is not process oriented, but data oriented. Future data processing managers at all levels must be prepared for the transition.

4-16 Summary.

This chapter has discussed some of the evolutionary and

revolutionary changes that will take place in the 1980's. Technology, as it has done in the past, will cause major changes in the job tasks and priorities of the DP manager. The author believes that the greatest impact will be caused by the movement to nodal distributed processing. In addition, security and integrity concerns and the increased knowledge of line managers about computers will directly effect how future data processing managers do their job.

Movement to the node configuration will cause the need for data processing managers to increase. These managers will be less experienced than contemporary managers. Additionaly, these local nodes will be the places where the majority of processing is done and where most of the problems will occurr. The present concept of the data processing mangager will not be adequate in the this type of environment. The next chapter discusses a type data processing management model that can be used to fit these requirements.

CHAPTER 5

MODEL FOR FUTURE DATA PROCESSING MANAGERS

5-1 Organizational Transition.

With the technological, organizational and control factors changing rapidly in the 1980's, the data processing managers current orientation must change in order to provide adequate support to the enterprise. Data processing in organizations passes through various evolutionary stages. Nolan [NOL79] has identified 6 stages. Figure 5-1 shows the stages and some indicators of change.

By 1985 the majority of organizations will be in the latter 2 stages. Even organizations that enter the field today will likely reach the final stages before the end of the decade. This is because the body of knowledge that has already been built up by other organizations as they transitioned from one stage to the other. Note that the latter stages lend themselves particularly well to the decentralization of data processing assets and the adoption of the distributed processing node concept.

FIGURE 5-1

Stages of Data Processing Growth

Growth Processes

Applications	Functional cost reduction applications	Proliferation	Upgrade of documentation and modify exhisting applications	Retrofit existing applications using data base technology	Integration of Applications	Application integration "mirroring" information flows
DP Organization	Specialization for technical learning	User-oriented programs	Middle management	Establish computer utility and user account teams	Data Administration	Data resource management
DP Planning and Control	Lax	More lax	Formalized planning and control	Tailored planning and control systems	Shared data and common systems	Data Resource Strategic planning
User Awareness	"Hands off"	Superficially supportive	Arbitrarily held accountable	Accountability learning	Effectively accountable	Acceptance of joint user and data processing accountability
	Stage I Initiation	Stage II Contagion	Stage III Control	Stage IV Integration	Stage V Administration	Stage VI Maturity

Source-(NOL79)

5-2 Changes in the Data Processing Organization.

As the organizational use of computers matures, the sophistication of assets and the types of applications change. In the 1980's the data processing organization will "have" to change in order to enhance effectiveness. Some of these organizational changes and indicators of user awareness are shown at Figure 5-2. A look at this figure compared to Figure 5-1 supports the prediction that adoption of the decentralized nodal concept is very likely.

Adoption of the node concept will eliminate the "Centralized Data Processing Empire" and fragment actual processing assets to functional areas. This means that the data processing organization will be spread out over the entire structure with local and regional nodes and a central node as shown in figure 4-4. The managers at each node will require different skills from the data processing managers of today. The author generally predicts that 3 distict kinds of node manager types will emerge. They are the central, regional and local node manager types.

5-3 Local Node Manager Type.

FIGURE 5-2

Indicators of Data Processing Transition

STAGES	TECHNICAL INDICATORS	DP DEPARTMENT PERCEPTION	USER AWARENESS
I & II	Mostly Batch Processing Some Remote Jobs Entry Majority of applications are labor saving or scientific types	DP operates as a "closed shop" DP provides all internal controls & manages all projects centrally	Superficial involvement Some usefull reports Hands off attitude
III & IV	Mix of batch & data base processing Some applications move to user Some on-line capability to tap central data bank.	Data custodian role Data entry function shared with users Chargeback accounting used for control	Driving force Data entry responsibility Concerned about availability and responsiveness
V & VI	Applications are mostly data base & communications Shared remote data bases Many remote applications	Data resource manager role Layers of responsibility used at different organizational levels Participates in organizational planning and control	Full participant Accountable for data entry purity and for effective use of DP assets

Source-(DOL79)

The local node manager will respond directly to the local functional or general manager. His primary task will be to support that local manager with computing assets and applications. He will serve a second master, because as part of the overall data processing organization he is responsible to insure that system objectives are met and rules followed.

He will be a "doer". He will probably manage a small to medium size computer that has an integral data base processor. His main concern will be to fine tune the operation for "local" needs. He will supervise a small staff and his activities will be concerned mainly with software and hardware maintenance and system availability.

The local node data processing managers point of view will be mostly short term and tend to concentrate highly in the technical areas that effect system availability and software maintenance. He will differ from present data processing managers in that he will be expected to help enhance the local node's total productivity. He will probably not have the high level of experience of todays centralized data processing manager. He must possess both technical and management skills to be effective. He will be a fully participating member of the local management team.

5-4 The Regional Node Manager Type.

Because of span of control problems caused by numerous local nodes and also because most organizations are organized in this fashion, there is a need for a regional or intermediate node manager. This data processing manager will also serve 2 masters. He will report to the regional node line manager and the central node data processing manager. He will have the same basic responsibility for the support of his regional node as the local node data processing manager does for his. However, his point of view will be more in the field of intermediate planning and problem solving. He will manage some computing assets, but his main technical function will be the supervision of a larger technical staff that will provide support to the local nodes.

Because of his position and the support requirement, this manager will be more involved in software development. Many application design packages or software product improvements will be implemented at this level. The regional node data processing manager will also be responsible for evaluating the efficiency of the local node computer assets and improving their performance in accordance with regional objectives.

This regional node manager will also have the primary responsibility for monitoring and maintaining the regional communications network. A large part of this task is dealing with communications service vendors at the regional level to insure that optimum service is obtained.

As a fully participating member of the regional management team he will also be involved in internode coordination and provide input to the regional planning process. The position will be a high visability one because his primary task will be to insure the optimal allocation and utilization of data processing assets from a region point of view.

5-5 Central Node Manager Type.

The information executive at the central node is the top data processing professional in the organization. He should be viewed as the keystone of data processing effectiveness. His most important qualification is that he have a complete mastery of both technical and organizational skills. He must be viewed as an integral part of the senior management team although he is different from the other members of senior management. The central node data processing manager provides the technical expertise to assist in top level decisions.

This manager will supervise a large technical staff and will focus on the strategic view of things. Such things as "system" modification and development will most likely take place at ths level. The central node will also conduct the basic adminstration of the system to include establishing rules, guidelines, and data base adminstration. The central node will also most likely control the procurement of major hardware items and large scale software.

The central node data processing manager will also have the primary organizational task of translating "the bottom line" of computing's value for the corporate staff, while serving as a key member of the corporate decision making body.

Some organizations have already taken tentative steps in this direction by establishing the position of "Director of Management Information Systems" or equivalent positions. Boulton [BOU78] notes that this had to take place. Because of the increasing complexity of computer sytems in many organizations, a top computer manager position had to be established. Many leading international companys such as Exxon, DuPont, Santa Fe Industries and the Vickers Corporation have had these type of senior data processing executives for at least 5 years.

The value of such a manager at the corporate level has been verified in studies by Sorenson [SOR78]. He found that the large majority of line executives in organizations that had effective information managers, considered that such an individual had greatly assisted the development, utilization and efficiency of computer assets in the company. They also felt that he could provide very valuable input to corporate decisions.

5-6 The New Breed of Data Processing Manager.

What all the node managers have in common is that they are what Nolan [NOL76] calls the "new breed" of data processing mangager. The current type of manager as portrayed in Figure 3-16 will no longer be adequate. The type of manager who is only marginally technically qualified and who controls a central empire that only occasionally interfaces with the rest of the organization will be obsolete.

Several authors such as Couger, [COU78] Nolan, [NOL76] & [NOL79] Tushman, [TUS79] and Emory [EMO79] feel that in order to effectively utilize computing assets in the future a new type of data processing manager with the following characteristics will have to emerge.

1. He must have a strong "current" technical grasp of data processing.

2. He must be cognizant that the management of technology is not as important to the organization as the mangement of change. This includes change in the decision making process as well as change in the way the element he supports is run.

3. He must eagerly participate in management decisions from the outset. His job will be to identify the computing assets required, the costs for implimentation, and a technical evaluation of the impact on the supported organization.

4. He will retain his "technical" bent. The lower the organizational level the more technically oriented he will likely be. However, at higher levels he must be able to insure that he is technicaly current from the general point of view. This is required because the penalties of poor technical decision or recommendation increase with the level of the decision.

5. He must adopt a general management viewpoint and be prepared to "sell data processing" and assist in the development and training of his subordinates and other executives. The focus of this training should be on how to

do business in a particular technological environment, whether that environment is office automation or distributed processing.

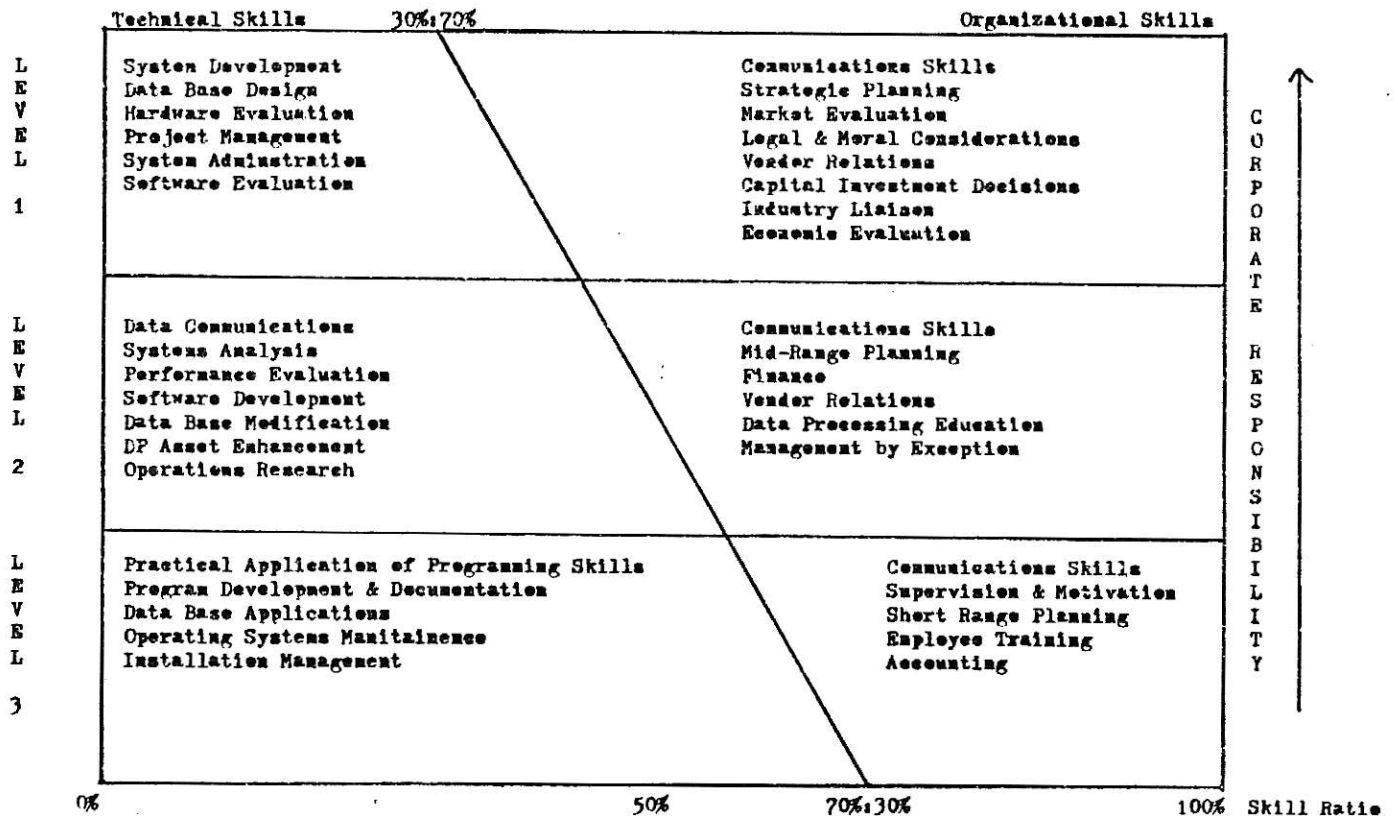
This "new breed" is radicaly different from todays data processing manager. This new type of data processing manager will have more exposure than ever before. Some of the exposure will be pleasant, but some of it will include direct participation in corporate politics, infighting and power struggles. For many data processing professionals this sounds like a horrible prospect. It does however, offer the real advantage of allowing the data processing manger an ideal opportunity for progress up the corporate ladder into top level management.

5-7 A Multi-Staged Model for Future Data Processing Managers.

In accordance with the multi-level node concept of the future distributed processing environment and the requirement for a "new breed" of data processing manager a multi-staged model of future data processing mangers can be established. The model is shown at Figure 5-3.

FIGURE 5-3

Multi-Staged Data Processing Manager Model



The model is multi-staged and shows some of the progressive skills that are required as the level of responsibility is increased. The model tracks well with the distributed processing node concept.

5-8 Skill Perishability.

One very important consideration should be addressed at this point. This is the authors opinion that the technical skills portrayed are highly perishable when compared to the mangagement skills. This is because the technical skills are technology driven and the organizational skills tend to be driven by the level of responsibility. What this means is a constant need for upgrade of the technical skills no matter what the level of responsibility. The organizational skills also need upgrading, but they tend to be permanent once learned and can be added to and re-enforced as the manager moves up the organizational ladder.

This does not degrade the importance of organizational skills. It does point out that the technical skills are the most perishable and need constant re-enforcement and/or replacement. The prime value of the data processing manager is his technical ability. Just because he has become a manager is no reason to allow his technical base to erode.

The technical evolutionary cycle of data processing seems to be about 5 years. This means that every 5 years or so, computer technology advances have made the previous technology obsolete, or sub-optimal. An example is the transition from file processing to data base processing. The transition require an upgrade of technical skills on the part of all data processing professionals. Perhaps the slowness of the transition to full use of DBMS technology is because current data processing mangagers don't feel comfortable with the new technology. Conversely, during the same transition period organizational skills have not changed as rapidly.

5-9 Organizational Skill Importance.

Although organizational skills are not as perishable they are still very important. These skills tend to focus on the management of, and communication with, the most difficult asset to control--people. If data processing professionals follow the Couger model [COU78] these skills are perhaps the most difficult for future information managers to acquire and develop. However, in order to be effective the "new breed" manager must have these skills so he can participate in management decisions and manage his computer assets.

The ratio of skill emphasis as shown on the multi-staged model emphasizes that the lower level manager is a "doer" while the central node manager is a "thinker." It also illustrates the fact that while technical skill utilization at the highest level is only 30%. The quality of that skill must be very high in order to make the proper decisions and provide the proper advice and staff supervision.

5-10 Advantages of the Model.

The primary advantage of the model is that it tracks the way current organizations actually work. It recognizes levels of responsibility and the need for centralized planning and control and decentralized execution. It provides a generalized guide for progressive management development and training. The model also indicates that with the proper education and training in the technical or managerial area, multiple options exist for filling data processing positions with internal data processing or line manager assets. This option is especially critical at the local node level.

The model is adaptable to most organization structures. It can be modified slightly to reflect the management theory of the organization. An organization with a large central control management style can use a 2 stage model. A multi-national conglomerate may use a 5 stage model. The

concept remains the same. Most importantly the model recognizes the "new breed" requirement for data processing managers and will assist as a development tool for them.

5-11 Summary.

This chapter has developed and presented a model of future data processing managers. The model is multi-staged and reflects the authors perception of the future distributed processing configuration of computer assets. It recognizes the need for a manager-technician who will play a vital role in the organizational decision making process. It also recognizes the fact that technical skills are critical as the level of responsibility increases. The model serves as a basis for evaluation of current managers and can serve as a guide to help prepare future managers.

CHAPTER 6

TRAINING & DEVELOPMENT OF FUTURE DATA PROCESSING MANAGERS

6-1 Overview.

The last chapter developed a model of future data processing managers. This chapter discuss the training and development of those managers. It discusses current perceptions of the future environment and and the ability of current computer managers to successfully transiton into the future. It also will discuss current curriculum emphasis and evaluate this emphasis against the needs of industry. Finally, It offers specific recommendations on how to better prepare future managers, including suggestions for data processing manager certification.

6-2 Current Data Processing Manager Perceptions of the Future.

The data processing manager survey revealed that although current managers predominately fit the sterotyped model as discussed in Chapter 3. They have a very perceptive view of the future. The ratings of their perceptions are shown at Figure 6-1.

FIGURE 6-1
DATA PROCESSING MANAGER PERCEPTIONS OF THE FUTURE
Ratings 1 (Strongly Disagree) to 5 (Strongly Agree)

RANK	TASK	MEAN	DEVIATION
1	DP MGRS MORE PEOPLE ORIENTED	4.328	.994
2	DP MGRS ROLE MORE IMPORTANT	4.224	.885
3	DP MGRS ROLE MORE IMPORTANT	4.164	1.009
4	SECURITY A MAJOR CONCERN	4.134	1.043
5	USER ADP MGR COMMO BETTER	3.043	1.447
6	MANAGEMENT AWARE OF SOFTWARE COSTS BY 1985	2.896	1.459
7	DP MGR MORE TECHNICAL	2.836	1.214
8	OPS SYSTEMS SIMPLER	2.761	1.518
9	FEWER PROGRAMMERS IN 80'S	2.443	1.438

These ratings correlate well between all age groups and experience levels except for the disagreement between older and younger managers about the cost of software and the simplicity of operating systems. All the managers predict that the future data processing manager will play a more important role in the organazation. All data processing managers agree that they will need to be more people oriented. However, these same managers appeared to contradict themselves with the indication that they will have to be less technically competent while stating that the highly technical area of computer security will be a major issue.

The responses may have been influenced by the way the question was asked and by the concept of less personal technical involvement. It is recognized that the quantity of time devoted to technical tasks will be reduced but the quality of that time will have to be very high. Perhaps the most interesting indicator of manager perceptions were the free format responses that they provided.

One data processing manager stated:

> "One of the most serious problems that contributes to the bleak outlook is a concurrent decline in the skills of computer professionals....Their work capability does not meet the demand to create, use and maintain efficiently existing and future systems. We are bound to increase the gap between users and data processing

professionals and we become more and more exposed as not being able to deal with user needs and problems.

A West Coast data processing manager observed:

"Some attributes of a good manager are the abilities to comprehend the general concepts of new methodologies in software development. A good supervisor with competent people should not oversupervise, but stay informed so he can communicate with others."

A Vice President for Management Information Systems responded:

"I beleive that the keys to success in the 80's are the same as they have always been, 'good systems analysis and sound business sense.' However, the hardware/software/technology methods and procedures will change and the ADP manager who adapts by using good good analysis and business sense, will hopefully be able to manage the change."

A information executive with a railroad stated:

"More involvement in the decision making process. He will be involved with the marriage of 'word processing' and 'data processing' technologys."

A Midwestern DP manager answered:

1. How do we "manage" the DP resource?

2. How do we "define" user requests?

3. How do we measure DP productivity?

4. What do we do with software that was coded in the 50's & 60's.

5. What happens to programmers who no longer

"programs."

6. How do we get the universities to teach the leading edge techniques that are required to be a good systems analyst?

One of the younger managers replied:

"My ability to relate to non-data-processing managers will probably be more difficult, because they will know enough about DP to be dangerous."

These responses and opinions point out the current awareness of the need for a "new breed" of manager-technician that will be required to administer computer assets in the 1980's.

6-3 Are DP Managers Prepared to Make the Transition?

Using the current manager model developed in Chapter 3 and comparing this to the needs of the 80's, it appears there are serious questions on the ability of many current managers to change roles. One ironic fact is that data processing managers themselves admit it! Breslin [BRE78] noted that in a recent seminar on Distributed Processing conducted by the American Management Association, the audience overwhelmingly stated that the biggest obstacle towards decentralization was the impact on data processing managers, and the new roles they would be forced to assume. The seminar audience was made up primarily of data processing managers. The author believes that the major

reasons for these feelings stem from fear of the unknown and lack of educational preparation.

6-4 The Education/Industry Gap.

One prime reason that current managers will have trouble making the transition, is that they are not educationally prepared for it. In many recent articles, industry spokesmen have berated computer science educational institutions for their "ivory tower" approach to education of computer professionals. ([GAL78],[HOB77],[AND74])

Taylor [TAL78] found there is a wide split on what computer science educators think should be taught to students and what practicioners feel they really need. In a paper to the Americian Federation of Information Processing Societys in 1977 Hoberman [HOB77] pointed out that education patterns and lack of knowledge of organizations was one reason for the lack of understanding between line managers and data processing professionals. The Hoberman paper pointed out that most data processing managers realize that they lack these skills but seem to make only weak attempts to upgrade either their technical or organizational skills.

Most of the criticism from industry concentrates on the computer science educational communities proclivity for teaching exotic languages with to much attention to theory

and not enough to the world of work. Particulary berated is the general lack of good problem solving training by computer science graduates and an almost total lack of knowledge of file processing and data base programming. Taylor estimated that close to 70% of B.S. Computer Science graduates enter their first job experience with a very very weak knowledge of file processing.

Because of the focus of industry criticism, many universities have adopted programs that better prepare students for work in data processing. One approach is the modification of the Computer Science major at the undergraduate level to a major in Information Science. One such program as proposed by Maryanski & Unger [MAR79] contains emphasis on both technical and organizational skills. This looks like a step in the right direction. An extract of the program is shown at Figure 6-2.

One advantage of the Information Science major is that ideally prepares graduates with little experience to step into the lower node data processing management positions in a distributed processing environment. There is no reason to think that the present migration path to management via the programmer or analyst route will change. The Information Science graduate is probally better suited to make the transition from programming to management, than his pure Computer Science counterpart.

FIGURE 6-2

INFORMATION SCIENCE SAMPLE CURRICULUM

Sample Core Curriculum Subjects

Introduction to Computer Science
PL/1 Programming
COBOL Programming
Introduction to Computer Engineering
Algorithmetic Processes
Computer Organization and Programming I
Introduction to Programming Languages
Introduction to Operating Systems
Computer Organization and Programming II
Data Structures
Business Data Processing
Discrete Mathematical Structures
Data Base Management Systems
Systems Analysis

Suggested Technical Electives

Introduction to Software Engineering
Computer Installation Management
Computer Simulation
Accounting
Managerial Cost Controls
Business Law
Money and Banking
Elements of Statistics
Introduction to Probability
Business and Economics Statistics I & II
Calculus I & II

Source--[MAR79]

6-5 Cross-Migration Into Data Processing Management.

Another method of securing future data processing managers is the cross-migration into the data processing field by line managers. On the surface this looks like an attractive solution, but it does have the pitfall of perhaps attracting only marginally qualified line managers, who may have a mastery of the jargon, but lack real technical proficiency. Unfortunate experiences of this type occurred in the past, when unit record mamagers assumed control of computer facilities. In many cases, they mastered the jargon, but had no real technical expertise.

Some of the technical qualification problems can be overcome by providing prerequisite education before assignment to a data processing management position or by providing an intership program. Line manager migration is attractive because the line manager probably has already acquired good organizational skills that have a lower erosion rate than technical skills do. If the appropriate technical skills are overlayed by formal training then he will be well qualified to assume data processing management positions.

The program of study for these line managers should be very technically oriented, because the technical skills are the ones that are required. Currently, a program of this

type is used by the Department of the Army for lateral entry of some officers into data processing. The program emphasizes co-operative and fully funded degree programs in Computer Science.

6-6 Continuing Education.

Although the reduction of the industry/education gap can be reduced somewhat by changes in curriculum, and line manager migration, the author believes that the ideal solution is through continuing education. Technology is rapidly causing dramatic changes in the use of computer and in the structure of data processing organizations. To provide a solid technical and organizational skill foundation is commendable but it is not enough. What is needed is an organized program to insure that these skills are updated and reenforced.

Continuing education is perhaps the ideal way to accomplish this goal. A major effort in this area will benefit not only the data processing industry, but have a direct impact on educational institutions by providing additional students and sources of funds.

In the present expansion era of computer science education this last argument about providing additional students may sound spurious. However, the increase in

Computer Science Students in recent years has also spurred a concomitant increase in the number of Computer Science Departments. Pinkert [PIN78] has projected, that despite the increase in popularity of Computer Science as a major, the increase in the number of departments will cause an actual decrease in enrollment per program. Figures 6-3 and 6-4 show these trends. If Pinkert is correct then the average number of degrees per program will shrink to 13 in the near future.

Adoption of a vigorous continuing education philosophy will have great benefits in both the educational and industrial areas. Some educational institutions have already adopted this approach. Benson [BEN79] describes a very successful program conducted by Washington University in St. Louis, Missouri.

The program is a joint university/industry professional development program that provides continuing data processing/computer science education and training in the St. Louis metropolitan area. The program is housed in the university, but is directed by a joint steering committee made up of educators and data processing professionals from industry.

The program strives to combine "state-of-the-art" data processing techniques with conceptual developments. Its overall aim is to increase the effectiveness of data processing professionals. Benson states that the program has been beneficial to both parties and has influenced development of computer related curriculum. Some of the courses offered by the program are shown at Figure 6-5.

An important concept of the program is the interdisciplinary approach it takes. The courses and seminars draw instructors from all departments in the university. This allows for expert instruction in the organizational skills where current data processing managers are weak. The technical instruction focus on "state-of-the-art" topics and are generally oriented to data processing professionals. Some of the basic level instruction is used to provide possible transition routes for line managers into data processing.

Although not ideal this type of program meshes very well with the future data processing model. It emphasizes technical skills at the lower levels and organizational skills at the higher levels. Not shown in Figure 6-5 are the course offerings of the school of management in subjects such as economics, finance, accounting, and personnel supervision. This type of program is not a cure all. It does however, provide an excellent vehicle for the constant

upgrade of skills in both organizational and technical areas.

One advantage of this type program, is that it allows lower level data processing professionals to "prepare" themselves for management positions. Wide scale adoption of programs of this type would go a long way towards increasing the value of data processing as a national asset. Standardization in accordance with industry and educational institution guidlines could be established by such a body as the ACM, IEEE, or the DPMA.

An ideal approach to standardization would be to adopt a joint unified viewpoint on continuing education sponsored by AFIPS. Benefits of a unified approach include:

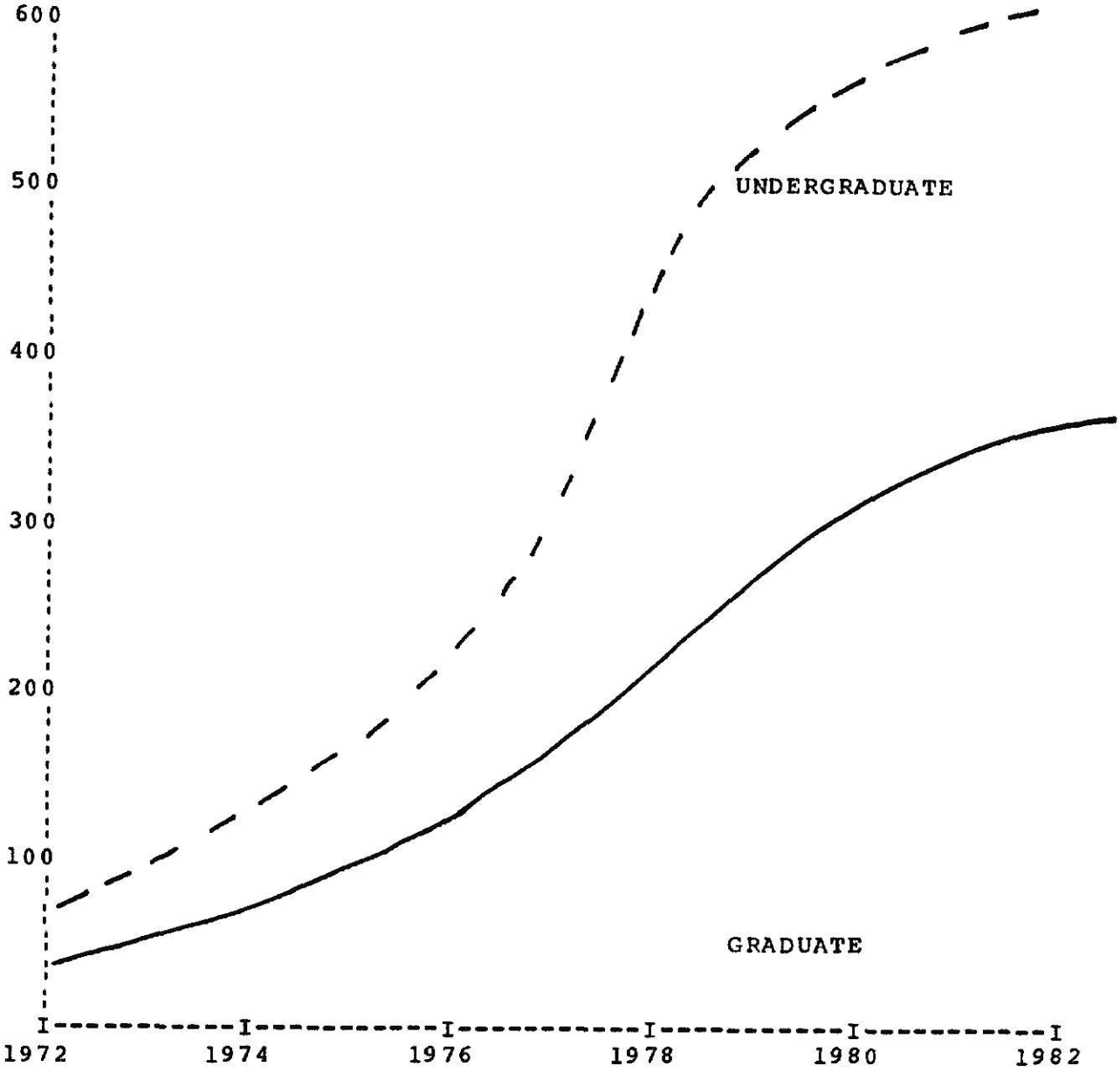
1. Adoption of a uniform approach for data processing personnel professional development and training.

2. Removal, or at least degradation of "vendor dependent" technical and organizational education that is now common.

3. A national means with which to espouse, teach and reenforce AFIPS and ANSII standards on structured programming, data base concepts and documentation.

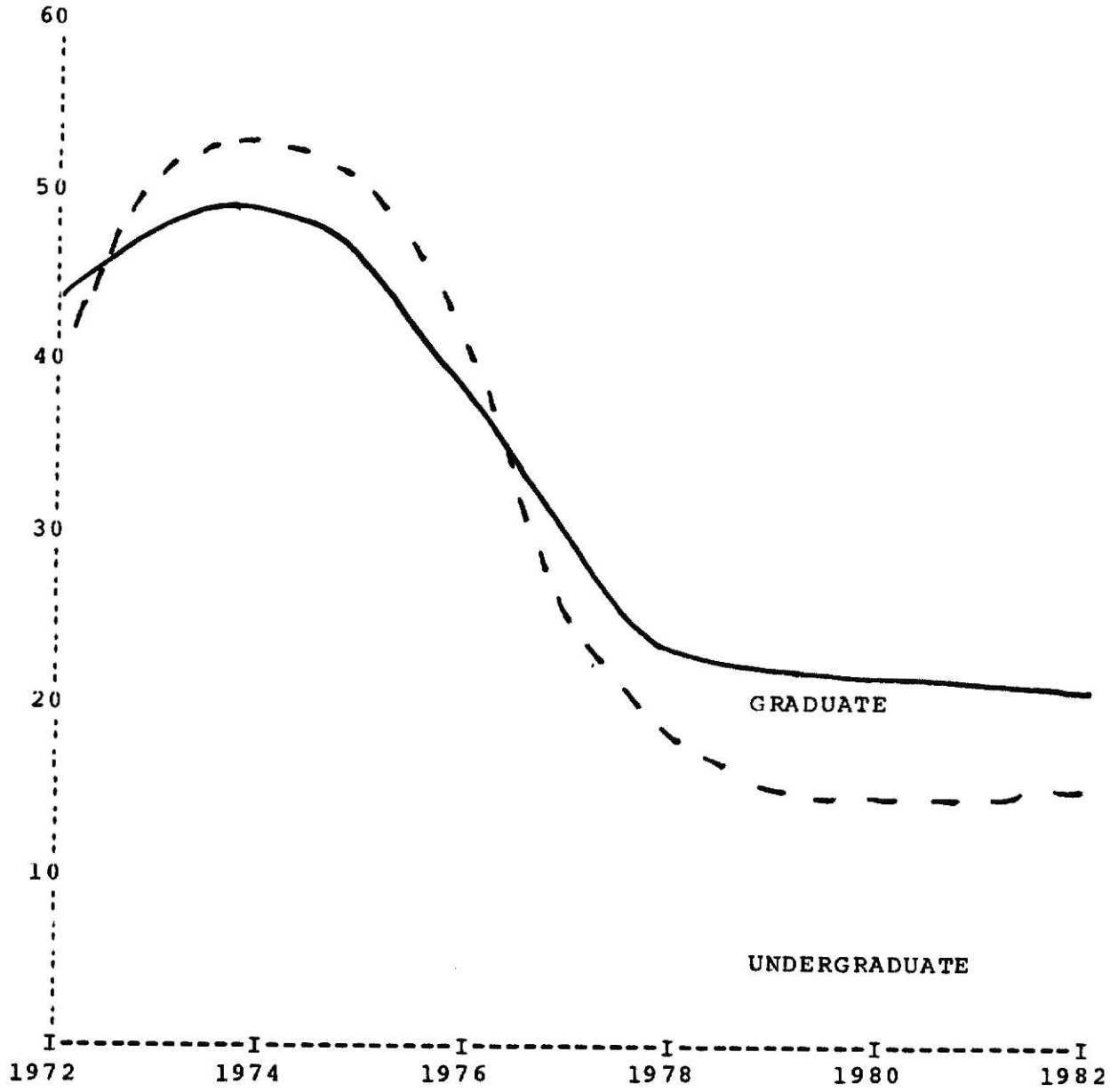
If such a national approach is adopted then the immediate benefits will be significant, but the long term benifits will be tremendous.

FIGURE 6-3
ESTIMATED AND PROJECTED
NUMBERS OF COMPUTER SCIENCE PROGRAMS



Source--[PIN78].

FIGURE 6-4
ESTIMATED AND PROJECTED
NUMBERS OF DEGREES PER PROGRAM



Source--[PIN78].

FIGURE 6-5

TYPICAL COURSE OFFERINGS

WASHINGTON UNIVERSITY D.P. PROFESSIONAL DEVELOPMENT PROGRAM

COURSE LEVEL	TITLE
Entry	Systems Analysis & Design. Data Base Concepts. Structured Programming. Effective D.P Communications. Intensive Cobol.
Advanced	Cost Benifit Analysis Data Base Design & Implimentation. Project Management. Distributed Systems. D.P. Control & Audit. DBMS Programming. D.P. Communications.
Management	Programmer Productivity. Operations Management. D.P. Management & Planning. Management Trainging for D.P.

Source--[BEN79]

6-7 The Certification Issue.

Many computer professionals are increasingly aware that a sizable number of data processing managers are not well qualified enough to be effective in their positions. This concern was a major reason for the formation of The Institute for the Certification of Computer Professionals. The institute is pushing for required certification of computer programmers and data processing managers. Currently, the institute awards the Certificate of Data Processing as recognition of the successful completion of a certification examination. The data processing examination covers areas of technical and organizational skills required by data processing managers. A similar but more technically oriented test is used to certify programmers.

The institute feels that certification will help eliminate the industry/education gap by eventually forcing ICCP certification standards as a prequesite to employment or as a passport to promotion in the data processing field. This type of approach is currently used by the accounting profession thru the CPA examination. Lawyers use it to a lesser extent through the state bar examination procedure.

On the surface, this looks like a very reasonable approach. However, Michael Portchuck chairman of the Federal Trade Commission takes a differing view. In an

address to the American Enterprise Institute, he stated:

> "Licensing does not solve quality problems since most professionals once licensed are certified for life. The average person needs periodic re-examination in most states to drive a car or pilot an airplane. No such formality is required to continue practicing as a doctor or lawyer. Between 1967 and 1973, only 400 doctors were disciplined by state medical boards for professional incompetence-an average of 1.6 per state per year." [POR79]

The key phrase "certified for life" is, in the authors opinion, the major drawback of certification as now proposed. If certification is required, then recertification should be accomplished periodicly. This is especially attractive for a high technology field such as data processing where the technical component is changing daily. Some critics might state, that such a course of action hampers growth. However, the author feels that it would encourage constant upgrading of technical and management skills.

Periodic certification would also insure, that the line managers or other personnel who migrated into data processing, would possess the technical skills required to perform the job. Although, there might be some initial disagreement in the data processing community on such draconian quality control measures, once the practice becomes accepted it will enhance the overall quality of the computer professional community.

6-8 Integrated Training.

Another method to prepare future data processing managers and help narrow the indusrty/education gap is to encourage computer science educators to integrate specific topics into their courses of instruction. Such subjects such as ethical responsibilities, file processing, security, documentation, and user interface can easily be integrated into most coursework. Other topics such as software engineering techniques and operating system considerations are more difficult to integrate, but can provide enormous advantages. One specific example is documentation standards. Is there any reason that specific documentation guidelines can not be established for all computer science projects? Many standards are published and available (ANSII & IEEE) they are just not enforced.

Another factor to consider is the industry criticism of the lack of realization by many educators that the majority of their students will eventually assume management roles. Taylors study [TAY78] projected that a large number of current Computer Science graduates could expect some type of managerial or supervisory role within 10 years of graduation.

The chairman of the Computer Science Department at the University of California, San Diego addressed the problem in a more somber light:

> "We have a sociological time bomb on our hands. There are students that get so wrapped up in DP that it is all they study. They enter the field, have no management skills and have careers that peak at age 30. What do they do next? Its a security nightmare." [DAT79]

We can better prepare our future computer professionals and future data processing managers if there is a clear recognition on the importance of the preparation of students for the real world of work.

6-9 Conclusions.

Using the past history of data processing developments and evaluating the rapid advances in computing technology, the author has come to the following conclusions:

1. Data processing will continue to expand rapidly and will be a major component of the U.S. economy by the mid 1980's.

2. The current concept of the centralized data processing organization will evolve into a distributed mode because of technological advances.

3. The current data processing manager role will evolve into the type roles projected by the model in Chapter 5.

4. Based on the manager survey, the literature, and industry evaluations, few of todays managers are really prepared to assume this new role. The primary reasons are:

a. Lack of organizational skills.

b. Weak or outdated technical skills.

5. In general there is only slow progress being made to reduce the education industry gap. This hampers the development of future data processing managers at the undergraduate level.

6. The lack of national guidance for continuing education programs for computer professionals hampers the professional development for data processing managers and others who want to move into the data processing management field.

7. "Once in a lifetime" certification standards will not be adequate to insure technical or organizational competence because of rapid advances in technology and the high degradation rate of technical skills.

The conclusions, although negative do identify the main problems. In the author's opinion, solutions are available, they are feasable and they can be adopted without major costs or dislocation.

6-10 Recommendations on Preparing Future Data Processing Managers.

The author makes the following specific recommendations to better prepare future managers.

1. Recognize a multi-stage data processing manager model as valid. Use the model as a tool for career counseling and development. This can have benefits at both the undergraduate and continuing education levels.

2. Intergrate interdisciplinary points of view in all computer science course work. This includes, but is not limited to:

   a. Ethics
   b. File processing
   c. Data base applications
   d. User interface
   e. Documentation
   f. Software engineering techniques

This recommendation can be most easily be implemented by department directives and minor course modifications. It can also be enhanced by the judicious choice of guest speakers for class presentations and/or lectures for student chapters of the ACM or DPMA.

3. Encourage students that are management oriented to pursue an Information Sciences type curriculum track for undergraduate studies. Other computer science students should be strongly encouraged to obtain basic organizational skills through enrollment in such courses as economics, accounting, and management.

4. Implement at the AFIPS level, a recommended continuing education program of the type now in progress in St. Louis. The AFIPS governing body could set up and monitor course guidelines and standards. This body might also consider the establishment of minimum educational participation standards for data processing professionals. Such education participation standards are now enforced by the nursing profession and have been adopted by several state medical boards.

5. Encourage certification of data processing managers, by the use of the Certificate of Data Processing or some other examination. However, the certification would only be valid for a limited period and then recertification would be

required. An alternative to recertification testing would be a minimum education participation requirement. (9 to 12 semester hours in specified areas every 5 years)

The author strongly beleives that limited certification is the only valid method to insure that both the technical and organizational skills of data processing managers are maintained. A further enhancement of this approach, would be to require different levels of certification that would focus on several different specialty areas.

If these recommendations are adopted, then the data processing community will be well on its way to solving many of the computer related problems of the 80's. It will have developed a realization that it is part of the management team, and it will have provided a method to acquire new skills and update old ones. One important factor is that the suggested steps can be taken now without major major costs for implementation. The potential benefit in increased organizational and technical capabilities is enormous.

6-11 Summary.

This chapter has discussed possible methods for developement and training of future data processing managers. The thesis is that contemporary managers are not

qualified to make the transition to the "new breed" concept of data processing manager without some form of educational enhancement. The chapter examined several shortcomings of the present situation that encourage the negative environment and then offered methods of training future managers.

CHAPTER 7

REPORT SUMMARY AND SUGGESTIONS FOR FURTHER RESEARCH.

7-1 Overview.

This report has taken a detailed look at the historical role of data processing and its importance to the the economy of the United States. It has also examined the present role of the data processing mangager and the technological advances that will effect his role in the 1980's. It has established a model for future data processing managers that reflects these changes in roles, and has offered suggestions on how to prepare data processing professionals to assume computer manager positions.

The report used published research sources, industry projections and a the results of a survey, to establish data processing management models.

7-2 Findings.

The report established some suprising findings. The author was amazed at some findings and initially discounted them i.e. perceived lack of "technical" competence. However, additional evidence supported the findings.

Finding 1-- Computers will play a more important role in the economy than most people beleive. The AFIPS projections becoming 13% of the GNP by the late 1980's is astounding. One particular area that is disconcerting is the fact that this growth is hardware based and the software bottleneck could hamper it badly.

Finding 2-- Current data processing mangers, although viewed primarily as technicans, appear not to be technically well qualified. This seems astounding and may require further research to validate completely. However, such indicators as the dismal success rate on the CDP examination, high turnover, the software crisis, and the slow movement to "actual" use of DBMS, is an ominous indicator.

Finding 3-- The most common data processing organization of the 80's will be a Distributed data processing organization based on the model shown in Chapter 4. The evolution to this topology will change data processing management roles and calls for a "new breed" of data processing manager, who is a manager-technician that is part of the "management team", not just a technical advisor.

Finding 4-- The multi-level management model portrayed in Chapter 5 is a valid method for representing the "new breed" of data processing manager. The model attempts to

emphasize that a "mix" of technical and organizational skills are required at each management level. The model also points out that the technical skill component is the one that is the most easily degradable. It also points out that as the time devoted to technical items decreases their importance increases.

Finding 5-- Current data processing managers will have a difficult time moving to the "new breed" management model. Their technical skills are probably weak, and their organizational skills underdeveloped or non-existant. This is caused by personality, educational background, and job evolution.

Finding 6-- Current data processing professional development methods are inadequate. Current continuing education efforts to help computer professionals upgrade their technical or organizational skills are not uniform, generally accepted, or adequate. No organized program at the national level has addressed this problem in a detailed manner.

Finding 7-- Computer Science educators have failed to use an interdisciplinary approach to Computer Science education. Although, the education/industry gap has narrowed somewhat, many institutions are not preparing their students for the real world of work. The authors contention

is, that although the direction of computer education should still be technical, many practical subjects can and should be integrated.

Finding 8-- Current certification initiaves will not be adequate to insure future competence of data processing managers. The Institute For the Certification of Computer Professionals certification efforts will be counterproductive if the present "Certified for Life" approach is used. Such an approch is unacceptable in a rapidly changing technolical field such as data processing.

Finding 9-- Adoption of a national continuing education program will greatly assist data processing manager professional development. The centralized guidance and control of such a program is essentail for insuring the organizational and technical skill competence of data processing managers. Such a program will also assist in the enhanced efficiency of data processing assets.

7-3 Suggested Solutions.

Some suggested solutions to the problems of preparing data processing managers for the environment of the 1980's are contained in Chapter 6. The author feels that these suggestions are the minimum essential steps required to insure a smooth transition into the era of distributed

processing. While the future is difficult to predict, the present status-quo data processing manager and his competency standard will probably not be adequate.

7-4 Suggestions for Further Research.

This report has attempted to identify and answer some of the problems that face the data processing manager of the 80's. However in uncovering some of the information the report raises the need for further research in the following areas:

1. Data Processing Manager Technical Competence. --The present report does not "conclusively" prove that the current technical and organizational skill levels of present data processing managers is inadequate. Indicators of inadequacy include; test scores, peer perceptions and lack of line manager confidence. Further work needs to be done to identify specific areas of weakness and gauge the depth of the weaknesses.

2. How do DP Managers Differ From Others? --Are the personality traits of data processing managers significantly different from other data processing professionals? It is the author's belief that many data processing mangers are selected for their positions because they most closely fit the line manager personality profile. Is this the best

method for selection? If specific personality differences do occur can potential data processing managers be screened at an early level, perhaps as undergraduates?

3. Job Enrichment and Professional Development. --Further research should be accomplshed in the area of job enrichment and professional development of those computer professionals that have neither the skills nor the inclination for management roles. At the present time the outlook for these individuals is grim. The 1978 DATAMATION Salary Survey [MCL78] revealed that the top salary for a Lead Systems Programmer was $26,740. Data processing manager salaries at Department and Corporate levels were $29,780 and 40,550 respectively. Failure to consider professional development tracks for non-manager data processing types may cause problems in the future.

Research in these areas will increase the existing knowledge of data processing manger profiles and help identify required skill components. Such information can be used to better prepare data processing mangers and help them to do their part to optimize the performance of a major sector of the United States Economy.

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ANNEX A

Overview

This annex contains a copy of the data processing manager survey which was mailed to 95 data processing managers nation wide. The questionaire contains questions which ask managers to rank the importance of job tasks and their perceptions about the future. Figure A-1 is the cover letter which explains the purpose of the survey. This cover letter was accompanied by a personal note addressed to the data processing manager to renforce the importance of his response.

Figures A-2 and A-3 are the front and back pages of the questionare itself. The front side concentrates on questions that indicate the importance of current skills and tasks. The back side asks managers to rank their perceptions about the future.

Survey Techniques

Managers were not selected at random. Although a cross section of the different types of data processing managers was attempted the survey sample was too small to insure complete randomness. Since each manager was addressed by name and position availability of mailing lists was paramount. Once the mailing list was established the author

took pains to insure that adequate numbers of data processing managers from government, industry, and educational instituions were included so that the total response would not be skewed by a particular application point of view.

Each potential respondent was sent a personaly addressed questionare packet that contained the questionaire and a stamped return envelope. As stated before each cover letter contained a personal note explaining the importance of that particular managers participation. The author feels this helped increase the response rate. Total response was 67 out of 95 questionaires sent out, for a response rate of 70.53%. No questionares were returned as undeliverable.

The first questionaire was sent out on September 21 1979 and the last response was received on October 26, 1979. The majority of the questionaires were received within 10 days of the date they were mailed out.

Statistical Significance

The author makes no claim that the sample from the manager survey is truely statistically significant or is an accurate sample of "all" data processing mangers in the United States. However, the cross tabulation of answers by age, experience and equipment managed showed no significant

differences between mangement groups. While not statistically signifcant the survey does show some important perception trends and when evaluated against the already published data serves to support many past findings. In this way the survey was used to aid in the design of the data processing management models.

Respondent Interest

The author was suprised by the amount of interest that the survey caused. 20% of the respondents replied that they wanted a copy of the summary data. A large number provided additional input to the survey through the remarks section. This served to provide a non-numerical backdrop on the manager rankings. Finally, the large response rate can also be attributed to the interest that many data processing managers have in this area of research.

KSU
KANSAS STATE UNIVERSITY

Department of Computer Science

Fairchild Hall
Manhattan, Kansas 66506
913-532-6350

Dear Manager:

With the rapid changes in the Data Processing field and the advent of new concepts such as Distributed Processing, Distributed Data Bases, and nonprocedural languages, many experts predict the role of the ADP manager will change markedly during the next ten years.

I am researching the ADP manager's perception of this changing role and urgently need your feedback.

Enclosed is a short survey which covers the following topics:

1. Background--This information will be used to build a data base profile of successful ADP managers.
2. Required Skills--Your personal perception of the skills required to be a successful ADP manager in the present environment.
3. Role of the ADP manager in the future--Your perception of the future role of the ADP manager and the skills he will require.
4. A space for comments which allows you to address any of the areas covered above or provide any additional ones you feel are important.

Completion of the survey should only take about 15 minutes, and your response will be used to provide input for possible curriculum changes and improved career counseling.

Please! Complete the enclosed questionnaire as soon as possible. A stamped return address envelope has been enclosed for your convenience.

If you have any questions on the status of the survey or about any of the questions, please feel free to call me at the Kansas State University Department of Computer Science (913) 532-6356.

Your cooperation and input will be greatly appreciated.

Sincerely,

GENE N. CARTIER
Research Associate

BETH UNGER
Associate Professor

FIGURE A-1

BACKGROUND

The following questions concern your background and will be used as a data base to build a model of successful ADP managers.

1. What is your age? (Circle one.) under 30 30-40 40-50 over 50

2. What is your job title? _____

3. How long have you been an ADP professional? _____

4. What was your entry level position in the ADP field? (i.e., Programmer, Systems Analyst) _____

5. How many people do you supervise? _____

6. What type of hardware do you manage? _____

7. List your three most important job tasks. _____

_____

JOB SKILLS

Listed below are job attributes and skills many feel a good ADP manager must possess. Please rate your perception of the criticality of these skills on a scale from 1 (not important) to 5 (critical).

RATING	SKILL
_____	Ability to Supervise others
_____	Knowledge of COBOL
_____	Ability to Express Ideas both Orally and in Writing
_____	Knowledge of Operating Systems
_____	Knowledge of Systems Analysis
_____	Knowledge of Data Base Systems
_____	Knowledge of Compiler Design
_____	Knowledge of Software Engineering Techniques
_____	Knowledge of Job Control Language
_____	Knowledge of Assembly Language
_____	Hardware/Software Procurement Techniques
_____	Knowledge of Ethical Moral Issues
_____	Knowledge of Accounting and Finance
_____	Knowledge of ADP Legal Issues
_____	Ability to Deal with Vendors
_____	Other _____
_____	Other _____

FIGURE A-2

THE ADP MANAGER OF THE FUTURE

Listed below are some statements about ADP in the future. On a rating scale from 1 (strongly disagree) to 5 (strongly agree), please rate your responses to the following questions.

QUESTION	RATING
1. By 1990 the ADP manager will play a more important role in corporate decision making than he does now.	_____
2. By 1990 distributed processing will be common.	_____
3. Future ADP managers will have to be more people oriented.	_____
4. Future ADP managers will have to be more technically oriented.	_____
5. The communications/understanding gap between users and ADP professionals will become smaller.	_____
6. By 1985 management will recognize the true cost of software.	_____
7. Data security will be a major concern of the ADP manager of the 1980's.	_____
8. Your organization will have fewer applications programmers in 1985.	_____
9. Operating systems will become simpler and easier to maintain in the 1980's.	_____

10. What do you perceive will change most about your job in the 1980's?

_____

_____

_____

What tasks that you do now do you think will no longer be important?

_____

_____

_____

FIGURE A-3

ANNEX B

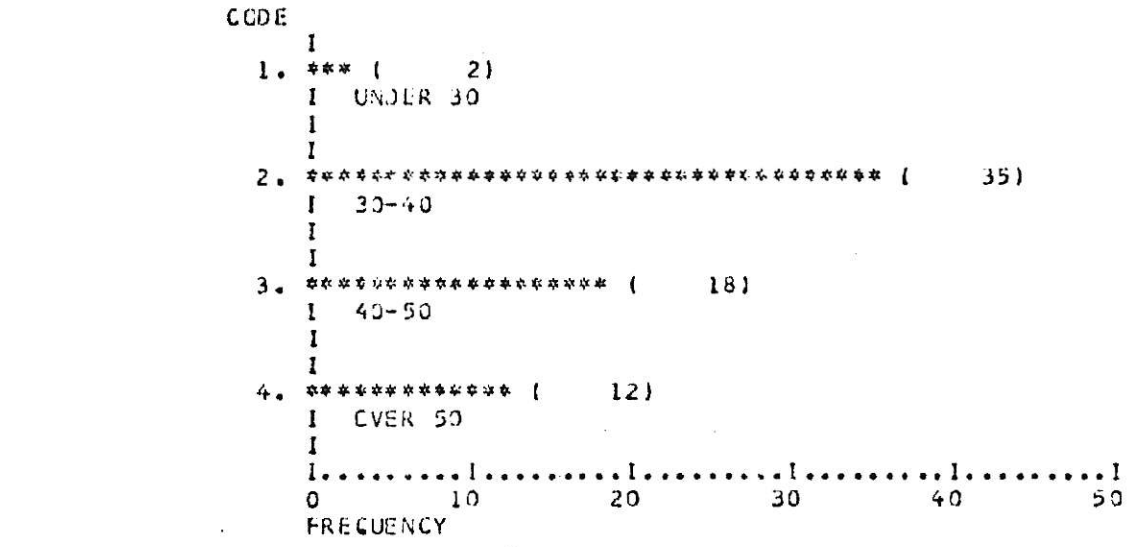
SUMMARY STATISTICAL DATA

This annex contains summary statistical data as processed by the standard Statistical Package for the Social Sciences for OS/360, Version H, Release 8.0 (May 15, 1979). The machine used to process the data was the Itel Advanced System 5 at the Kansas State University Computing Center.

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

AGE MANAGERS AGE



MEAN	2.597	STD ERR	0.103	MEDIAN	2.400
MODE	2.000	STD DEV	0.818	VARIANCE	0.668

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

ADPEXP ADP EXPERIENCE

CODE

1. ****** (5)
   LESS THAN 3 YEARS
2. ********* (8)
   3-6 YEARS
3. ********** (10)
   6-10 YEARS
4. ******************** (18)
   10-15 YEARS
5. ************************** (26)
   MORE THAN 15 YEARS

I.....I.....I.....I.....I.....I
0 10 20 30 40 50
FREQUENCY

MEAN	3.776	STD ERR	0.157	MEDIAN	4.083
MODE	5.000	STD DEV	1.289	VARIANCE	1.661

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

16/79 FILE - STUDY - CREATED 11/16/79

LE JOB TITLE

CODE

1. *** (2)
   MGR SMALL ORG
2. ** (45)
   MGR MED ORG
3. ************ (12)
   MGR LARGE ORGN
4. ********* (8)
   OTHER

0 10 20 30 40 50
FREQUENCY

N	2.388	STD ERR	0.090	MEDIAN	2.200
E	2.000	STD DEV	0.738	VARIANCE	0.544

ID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

ENTLVL ENTRY LEVEL

CODE

1. ********** (37)
   PROGRAMMER
2. ********** (9)
   SYSTEMS ANALYST
3. ********** (10)
   OPERATOR
4. ******* (6)
   ADP CLERICAL
5. ****** (5)
   OTHER

0 10 20 30 40 50
FREQUENCY

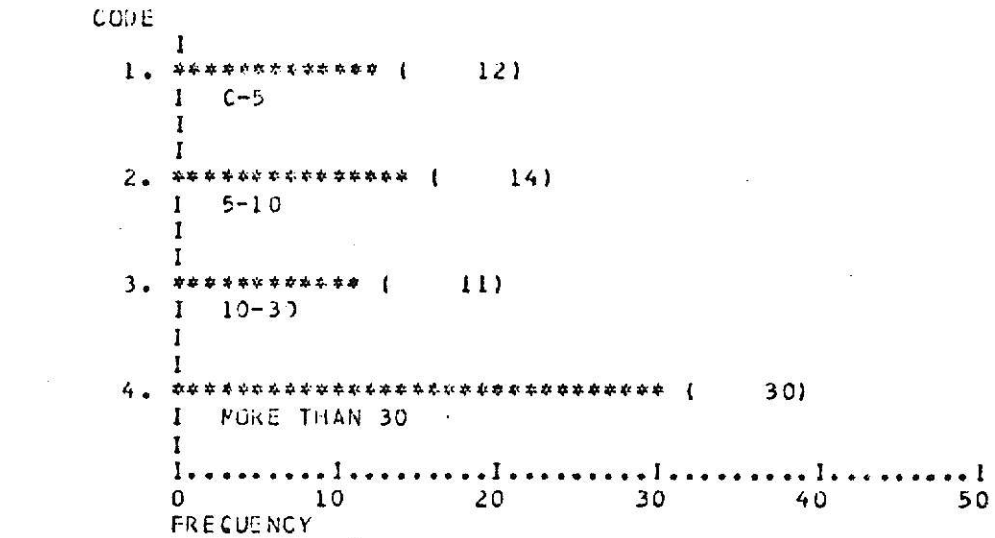
MEAN	2.000	STD ERR	0.162	MEDIAN	1.405
MODE	1.000	STD DEV	1.326	VARIANCE	1.758

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MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

NUMSUP NUMBER SUPERVISED



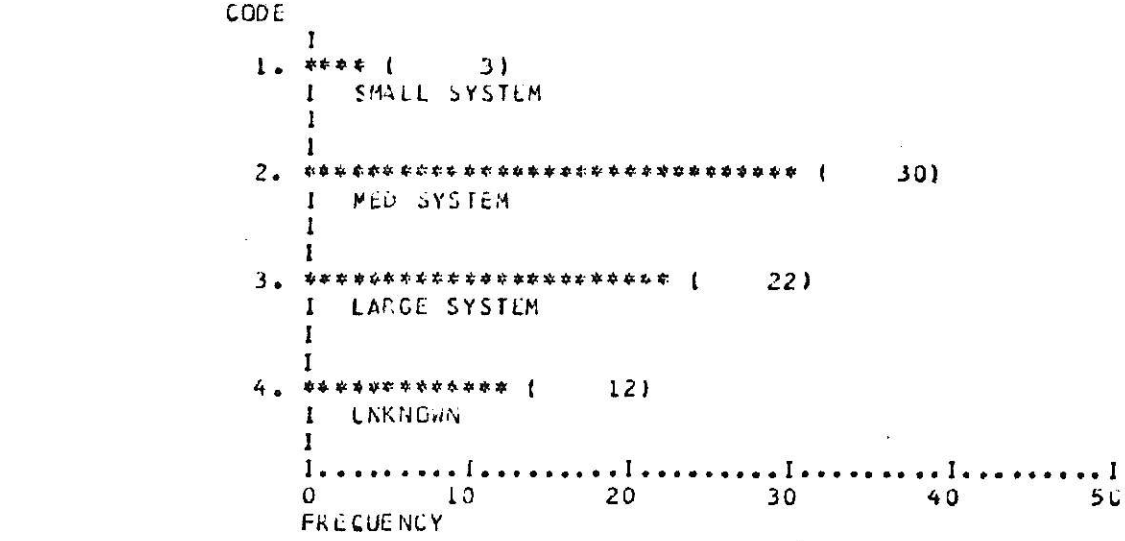
MEAN	2.881	STD ERR	0.143	MEDIAN	3.182
MODE	4.000	STD DEV	1.175	VARIANCE	1.379

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

HARWR HARDWARE MANAGED



MEAN	2.642	STD ERR	0.101	MEDIAN	2.523
MODE	2.000	STD DEV	0.829	VARIANCE	0.688

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

TASK1 MOST IMPORTANT TASK

CODE

```
I
1. ** (     1)
   I  PROBLEM SOLVING
   I
   I
2. ********** (     11)
   I  PLANNING
   I
   I
5. **** (     3)
   I  SYSTEM DEVELOPMENT
   I
   I
6. *** (     2)
   I  SYSTEM DESIGN
   I
   I
7. ********** (     12)
   I  MANAGE
   I
   I
9. ******** (     7)
   I  SUPERVISION
   I
   I
13. ****** (     5)
   I  CONSULTING ON EDP IS
   I
   I
14. ***** (     4)
   I  BUDGETING
   I
   I
15. ** (     1)
   I  DOCUMENTATION
   I
   I
16. ********************** (     21)
   I  OTHER TASKS
   I
   I.....I.....I.....I.....I.....I
   0     10     20     30     40     50
   FREQUENCY
```

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

MEAN	9.985	STD ERR	0.655	MEDIAN	9.143
MODE	16.000	STD DEV	5.361	VARIANCE	28.742
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

TASK2 2ND MOST IMPORTANT TASK

CODE

1. **** (1)
   PROBLEM SOLVING

2. ********** (6)
   PLANNING

3. ****** (2)
   ORGANIZING

4. ****** (2)
   IMPROVE

5. ****** (2)
   SYSTEM DEVELOPMENT

6. ****** (2)
   SYSTEM DESIGN

7. ********** (7)
   MANAGE

8. ********* (3)
   SOFTWARE DEVELOPMENT

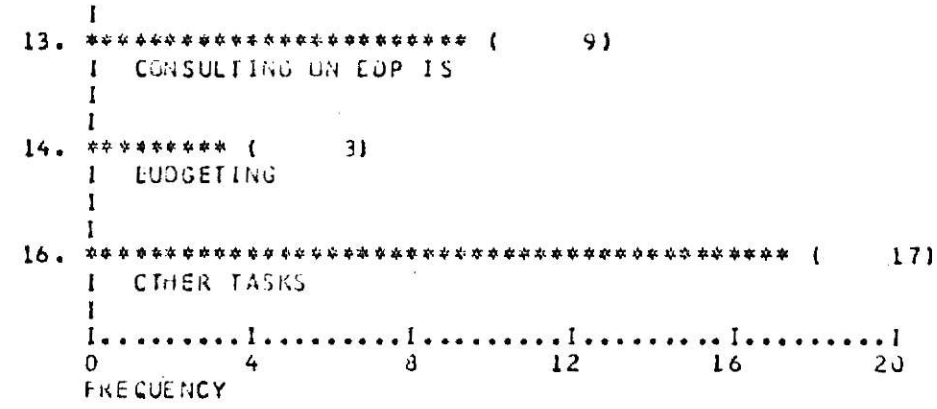
9. ********** (5)
   SUPERVISION

10. ********* (3)
    PERFORMANCE EVALUATI

12. ********** (5)
    STAFF COORDINATION

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79



MEAN	10.269	STD ERR	0.593	MEDIAN	11.600
MODE	16.000	STD DEV	4.851	VARIANCE	23.533

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

TASK3 3RD MOST IMPORTANT TASK

CODE

1. ****** (2)
   PROBLEM SOLVING

2. ********** (7)
   PLANNING

4. ********* (3)
   IMPROVE

5. ********** (4)
   SYSTEM DEVELOPMENT

7. ********** (5)
   MANAGE

8. ****** (2)
   SOFTWARE DEVELOPMENT

9. ********* (3)
   SUPERVISION

10. ********** (6)
    PERFORMANCE EVALUATI

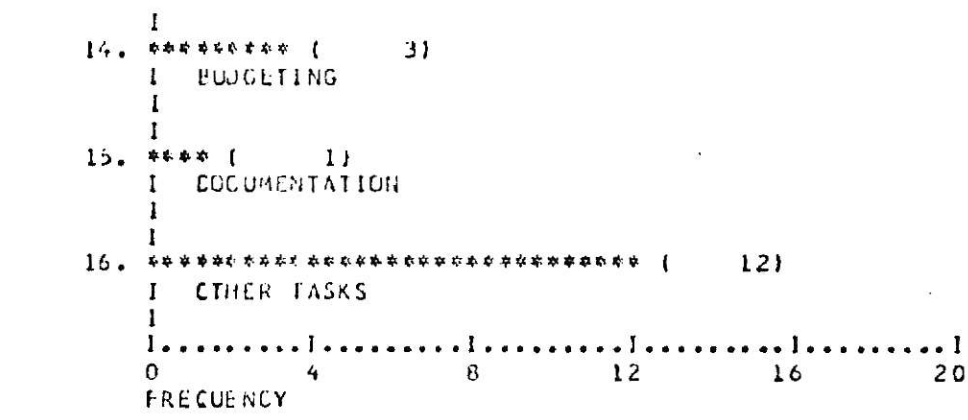
11. **** (1)
    COST EFFECTIVENESS

12. **** (1)
    STAFF COORDINATION

13. ********** (17)
    CONSULTING ON EDP IS

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79



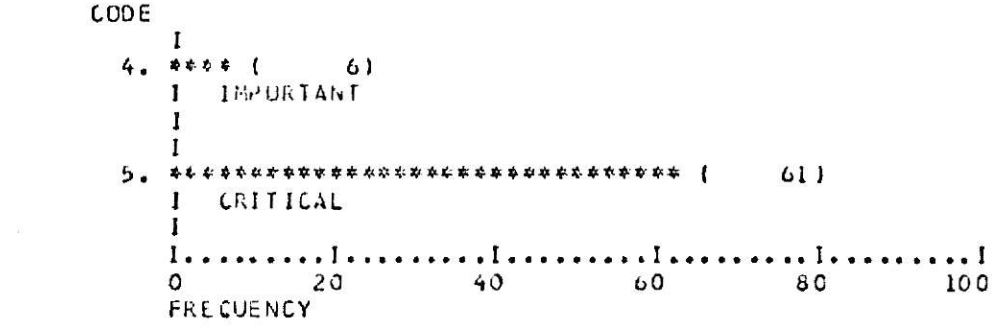
MEAN	10.134	STD ERR	0.589	MEDIAN	12.000
MODE	13.000	STD DEV	4.824	VARIANCE	23.270

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

SUPSK SUPERVISORY SKILLS

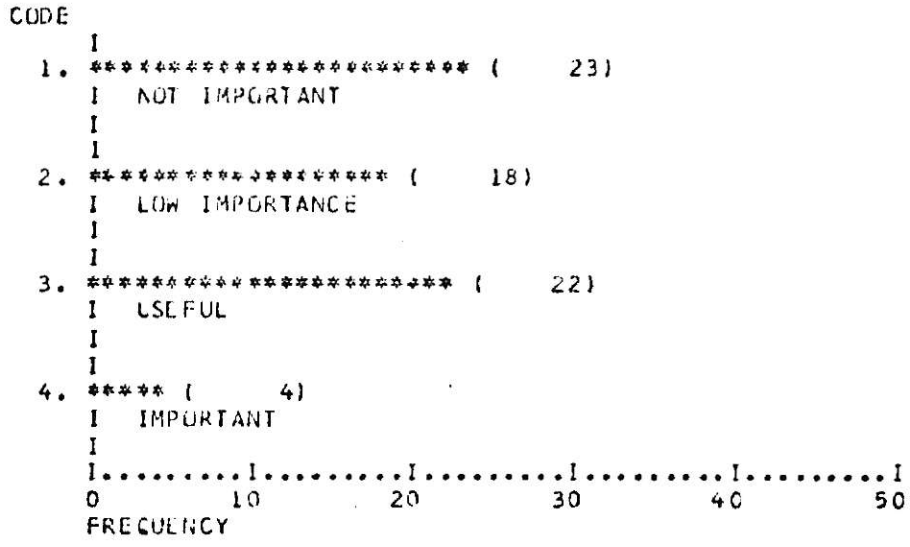


MEAN	4.910	STD ERR	0.035	MEDIAN	4.951
MODE	5.000	STD DEV	0.288	VARIANCE	0.083
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

COBOL KNOWLEDGE OF COBOL



MEAN	2.104	STD ERR	0.117	MEDIAN	2.083
MODE	1.000	STD DEV	0.956	VARIANCE	0.913

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

IDEAS EXPRESSION OF IDEAS

CODE

```
      I
  3.  ** (      1)
      I  USEFUL
      I
      I
  4.  ******** (     14)
      I  IMPORTANT
      I
      I
  5.  ************************** (     52)
      I  CRITICAL
      I
      I.........I.........I.........I.........I.........I
      0         20        40        60        80        100
      FREQUENCY
```

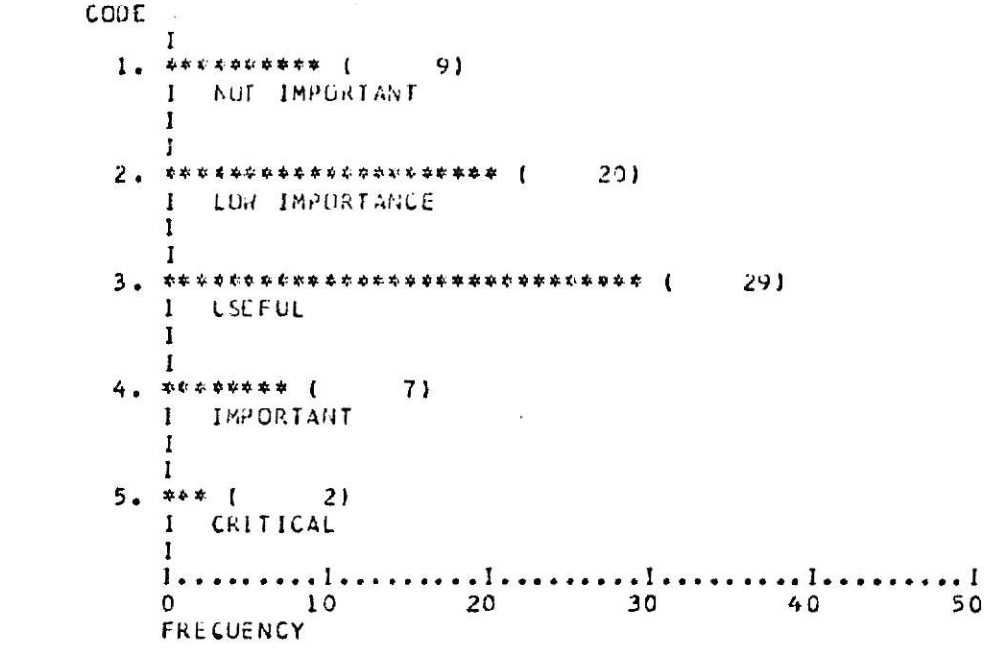
MEAN	4.761	STD ERR	0.057	MEDIAN	4.856
MODE	5.000	STD DEV	0.464	VARIANCE	0.215

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

OPSYS KNOWLEDGE OF OPS SYSTEMS



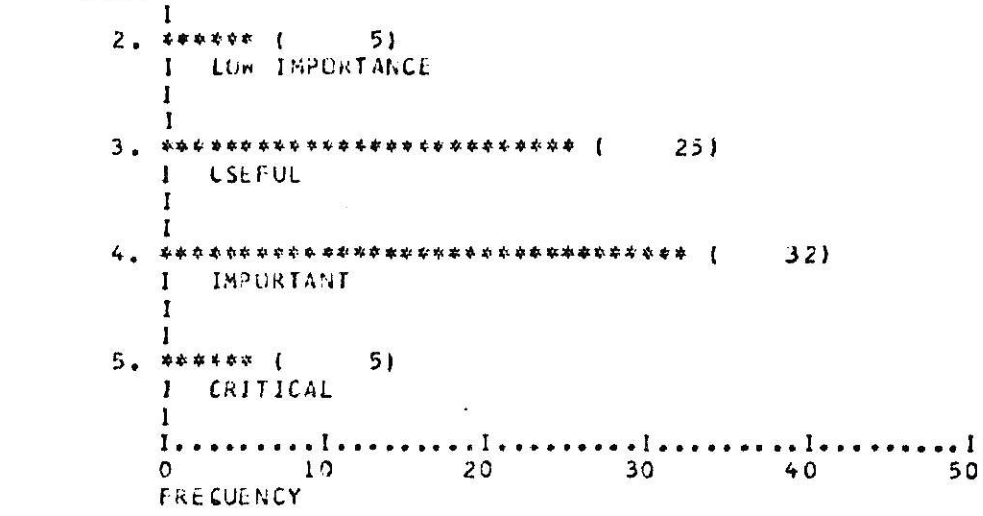
MEAN	2.597	STD ERR	0.117	MEDIAN	2.655
MODE	3.000	STD DEV	0.954	VARIANCE	0.911

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

SYSANL KNOWLEDGE OF SYSTEMS ANALYSIS

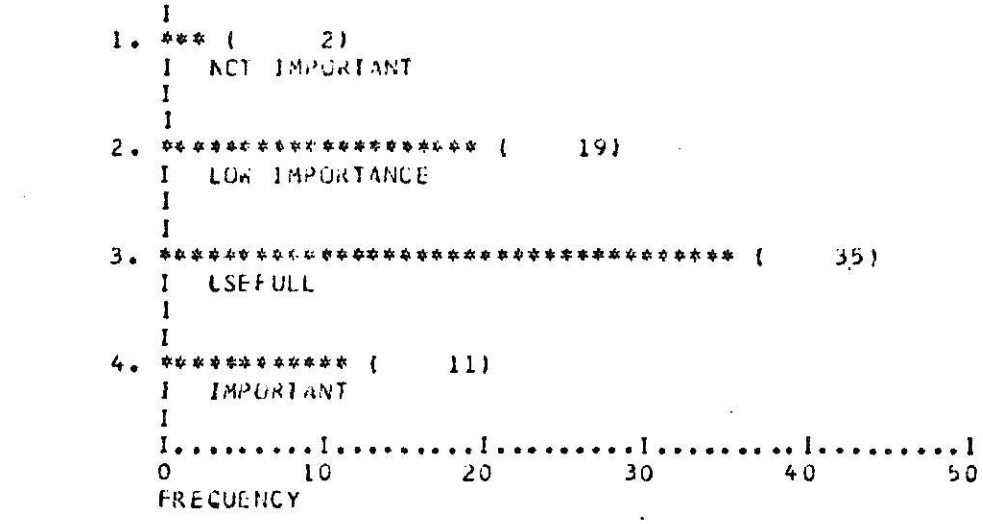


MEAN	3.552	STD ERR	0.091	MEDIAN	3.609
MODE	4.000	STD DEV	0.744	VARIANCE	0.554
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

DBMS KNOWLEDGE OF DBMS



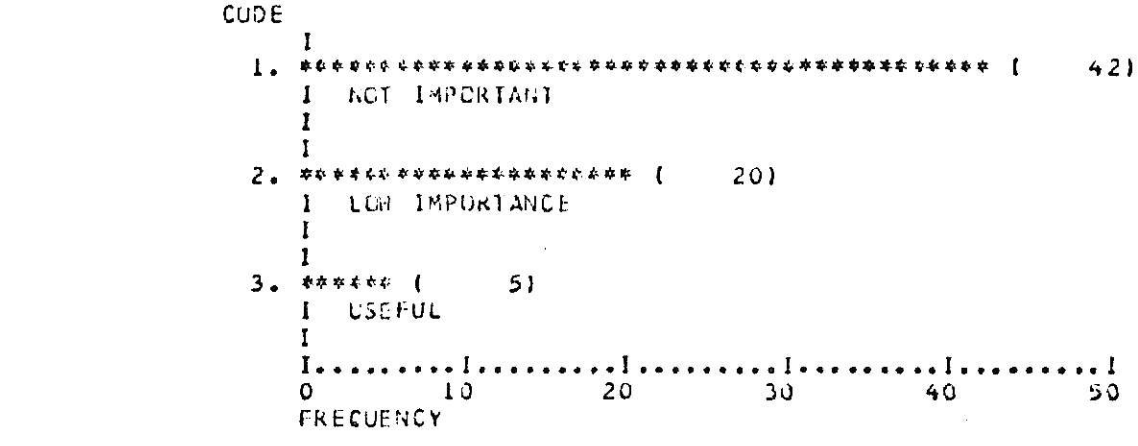
MEAN	2.821	STD ERR	0.090	MEDIAN	2.857
MODE	3.000	STD DEV	0.737	VARIANCE	0.543

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

CS700 KNOWLEDGE OF COMPILER DESIGN



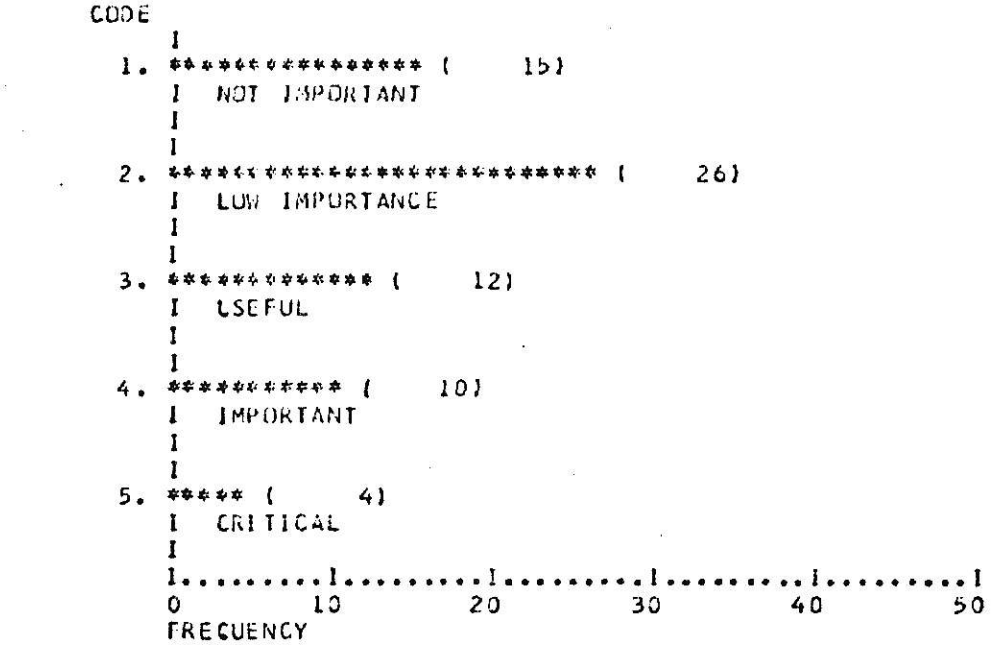
MEAN	1.448	STD ERR	0.078	MEDIAN	1.258
MODE	1.000	STD DEV	0.634	VARIANCE	0.403

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

SOFTE KNOWLEDGE OF SOFTWARE ENGINEERING

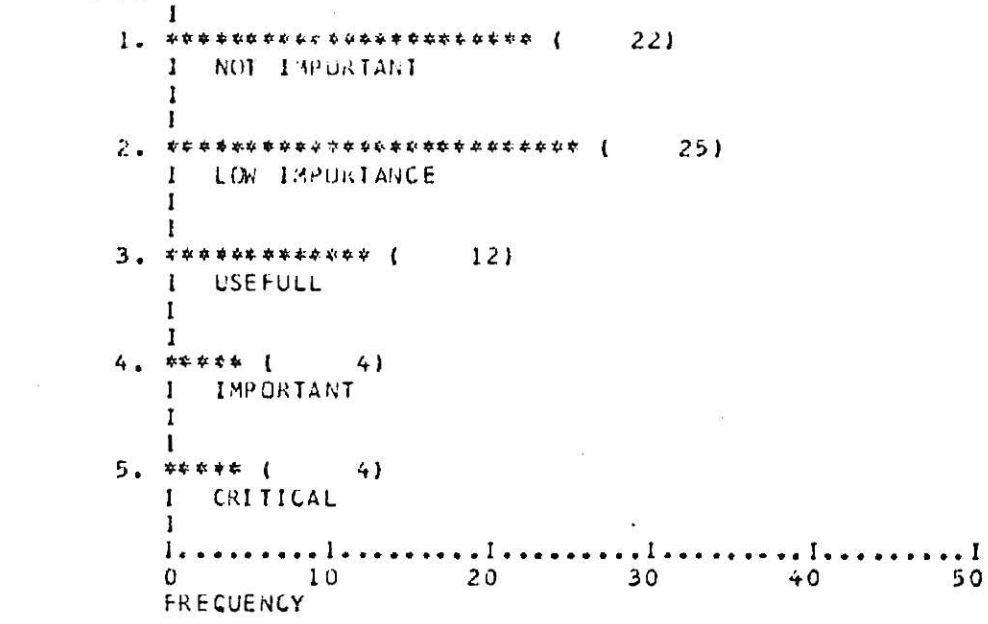


MEAN	2.433	STD ERR	0.143	MEDIAN	2.212
MODE	2.000	STD DEV	1.171	VARIANCE	1.370
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

JCL KNOWLEDGE OF JCL

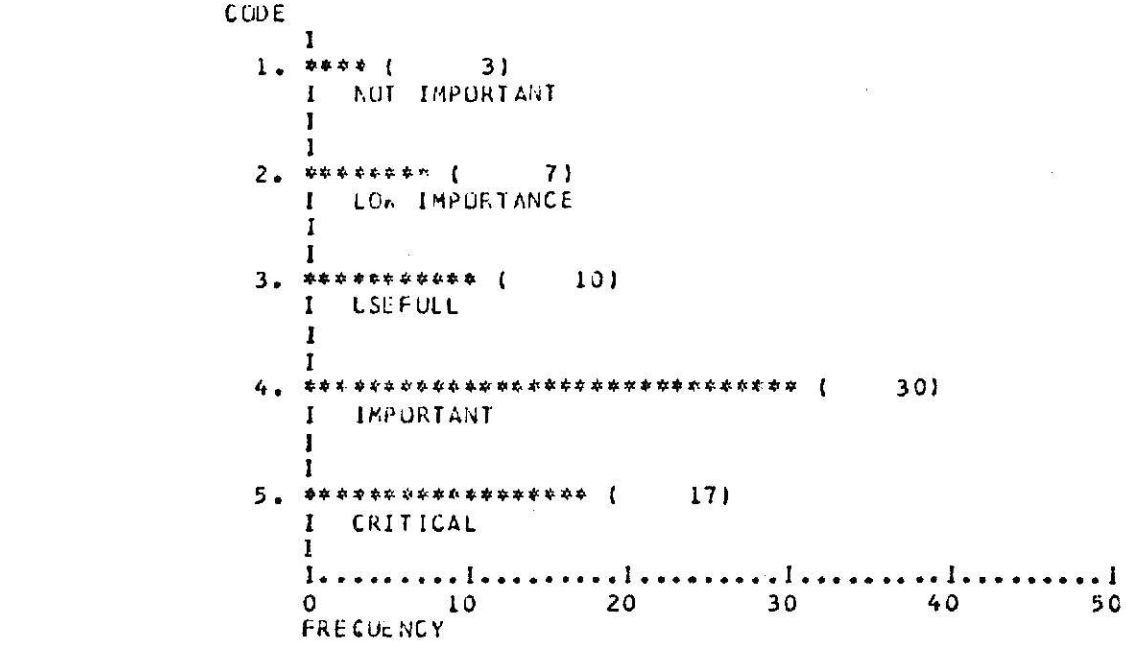


MEAN	2.149	STD ERR	0.138	MEDIAN	1.960
MODE	2.000	STD DEV	1.132	VARIANCE	1.280
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

BUY PROCUREMENT AGILITY



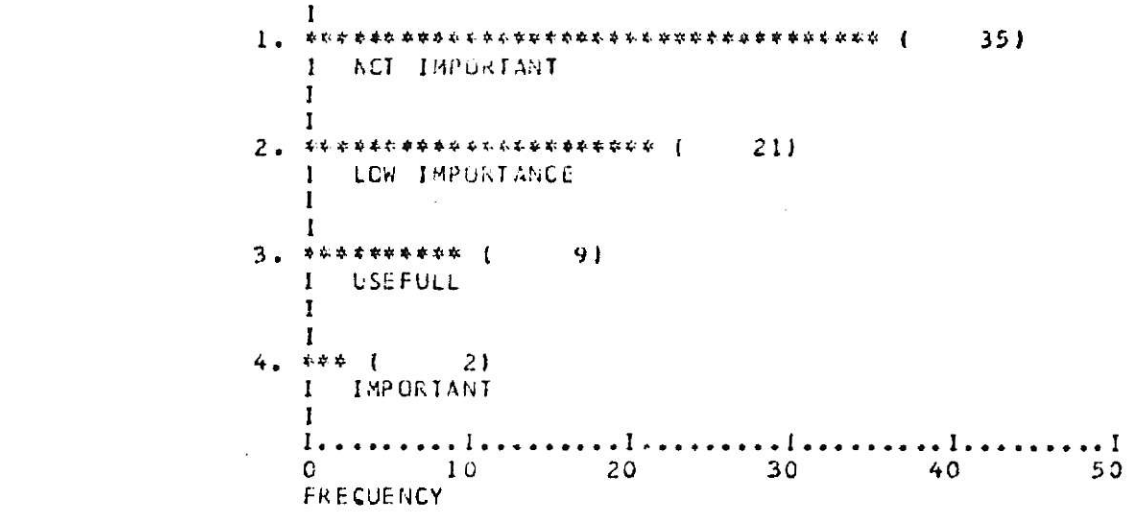
MEAN	3.761	STD ERR	0.133	MEDIAN	3.950
MODE	4.000	STD DEV	1.088	VARIANCE	1.185

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

ASSY KNOWLEDGE OF ASSY LANGUAGE



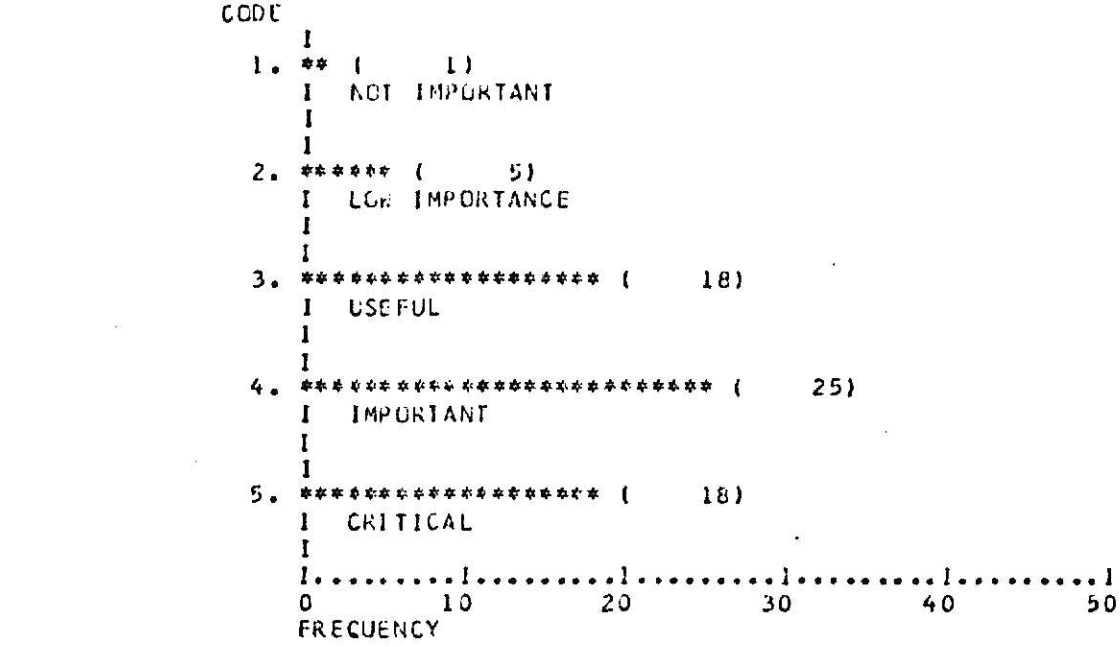
MEAN	1.672	STD ERR	0.101	MEDIAN	1.457
MODE	1.000	STD DEV	0.824	VARIANCE	0.678

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

MORAL MORAL ISSUES



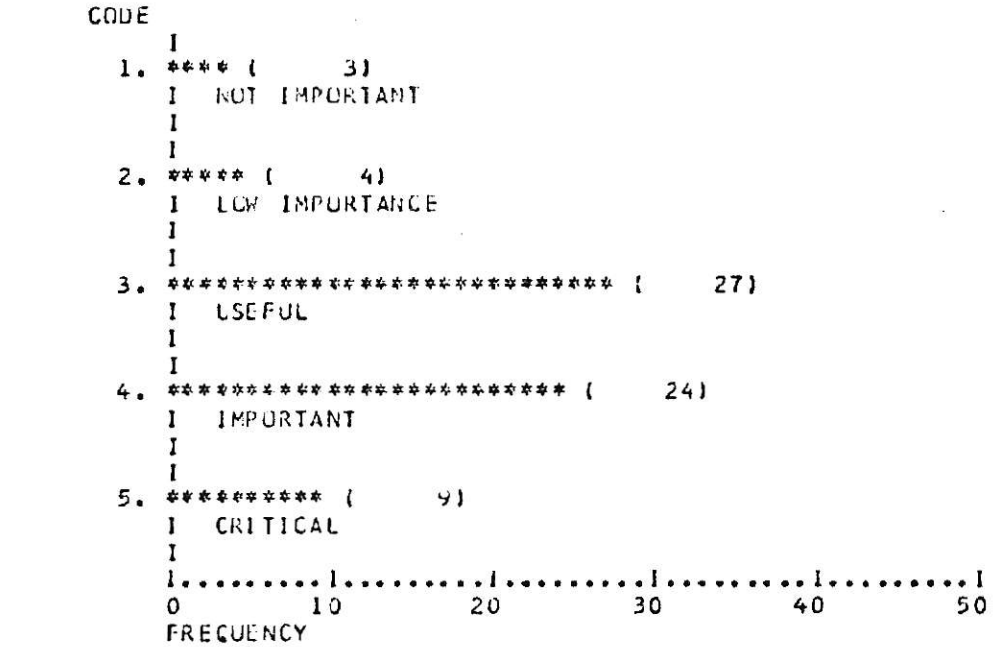
MEAN	3.806	STD ERR	0.119	MEDIAN	3.880
MODE	4.000	STD DEV	0.973	VARIANCE	0.947

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

MONEY KNOWLEDGE OF ACCOUNTING

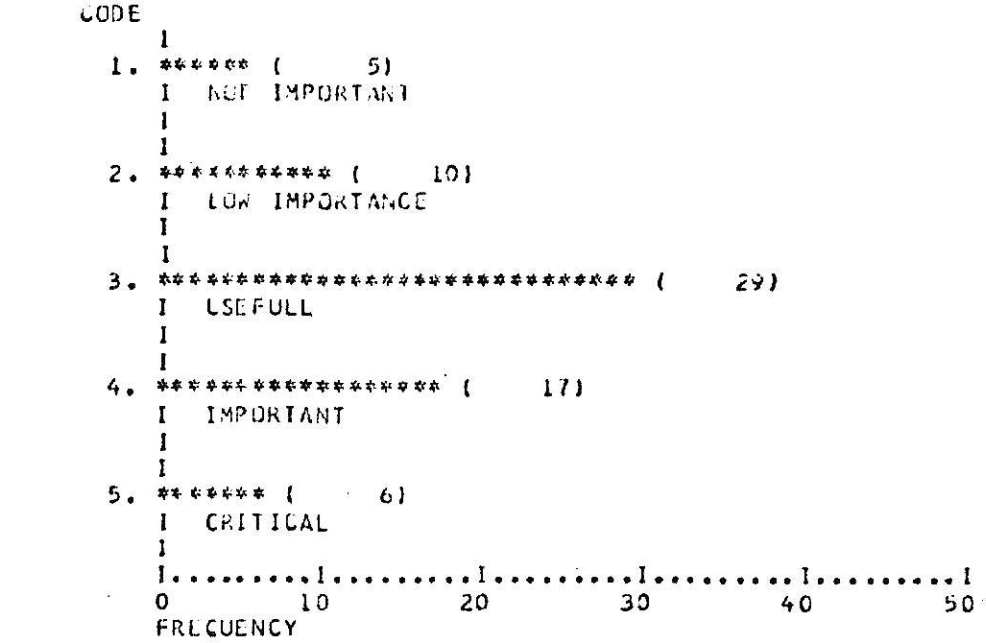


MEAN	3.478	STD ERR	0.117	MEDIAN	3.481
MODE	3.000	STD DEV	0.959	VARIANCE	0.920
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

LAW LEGAL ISSUES



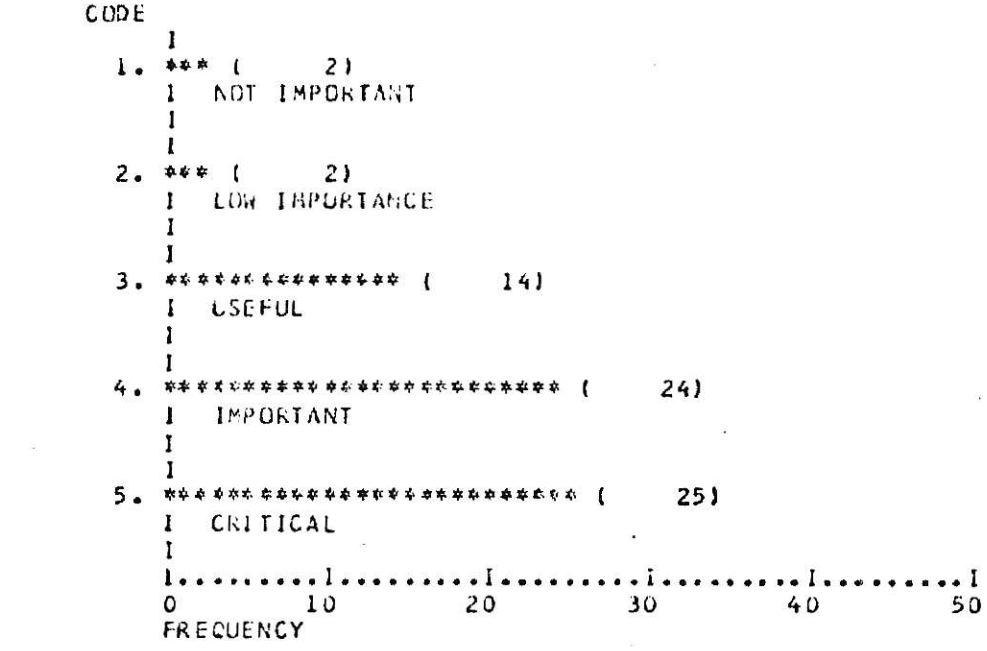
MEAN	3.134	STD ERR	0.126	MEDIAN	3.138
MODE	3.000	STD DEV	1.028	VARIANCE	1.057

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

SALES ABILITY TO DEAL WITH VENDORS

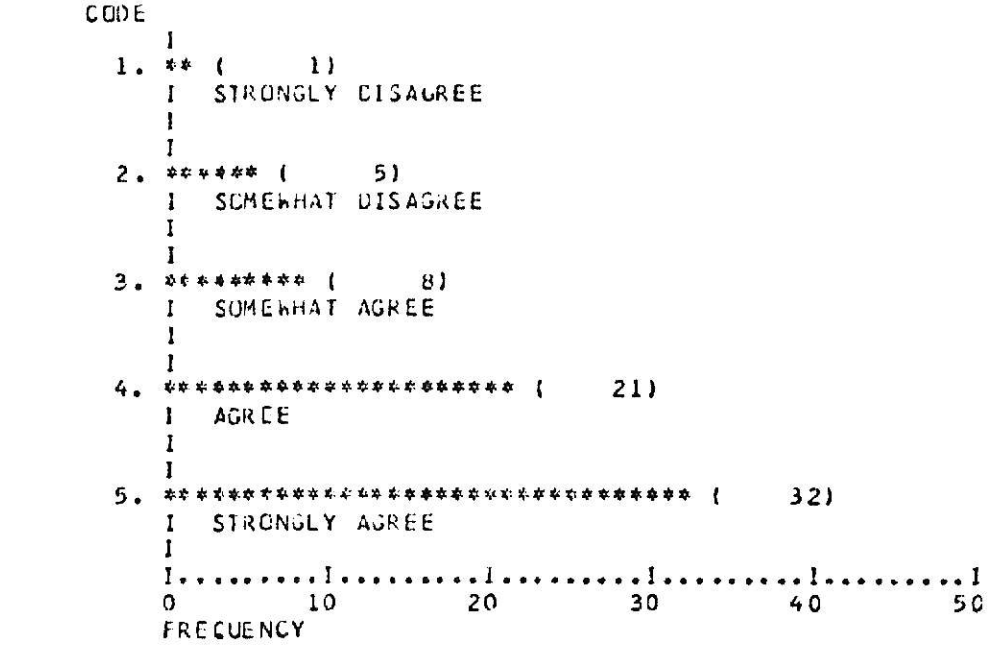


MEAN	4.015	STD ERR	0.121	MEDIAN	4.146
MODE	5.000	STD DEV	0.992	VARIANCE	0.985
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

ROLE ADP MANAGER MORE IMPORTANT

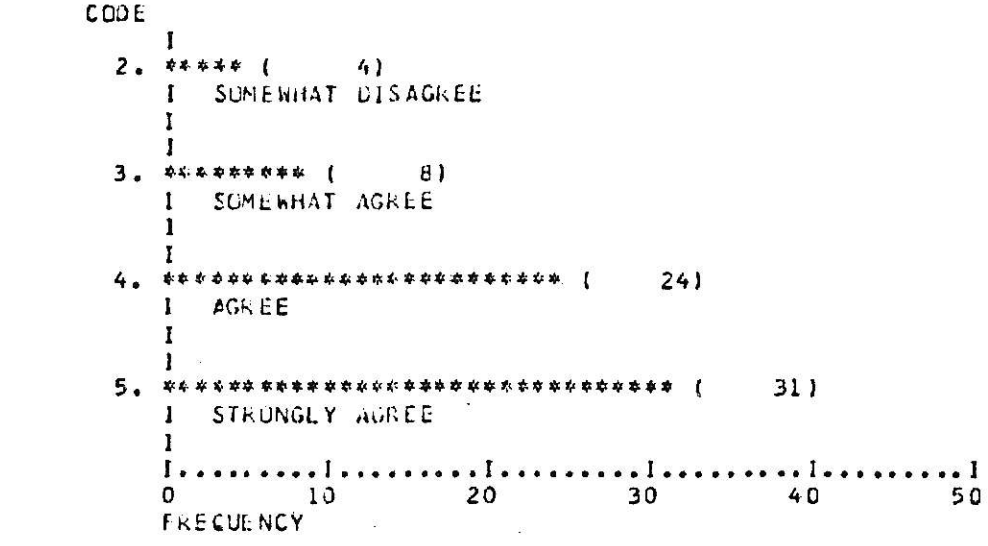


MEAN	4.164	STD ERR	0.123	MEDIAN	4.425
MODE	5.000	STD DEV	1.009	VARIANCE	1.018
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

DIST DISTRIBUTED PROCESSING COMMON

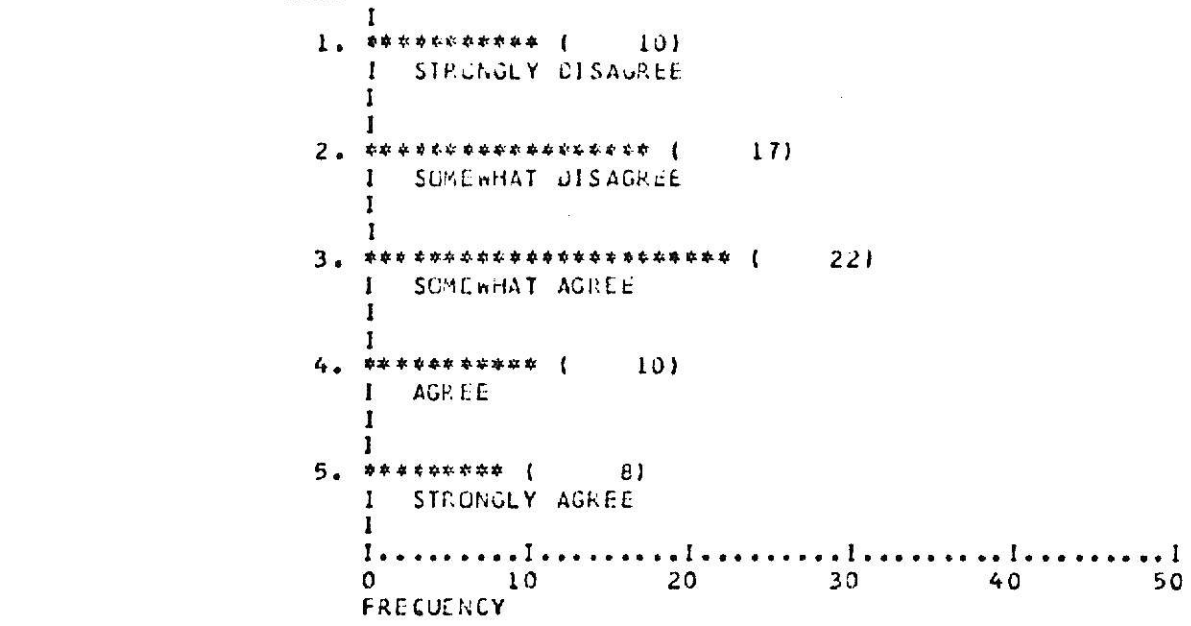


MEAN	4.224	STD ERR	0.108	MEDIAN	4.356
MODE	5.000	STD DEV	0.885	VARIANCE	0.782
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

TECH ADP MANAGER MORE TECHNICALY ORIENTED



MEAN	2.836	STD ERR	0.148	MEDIAN	2.795
MODE	3.000	STD DEV	1.214	VARIANCE	1.473
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

FOLKS ADP MANAGER MORE PEOPLE ORIENTED

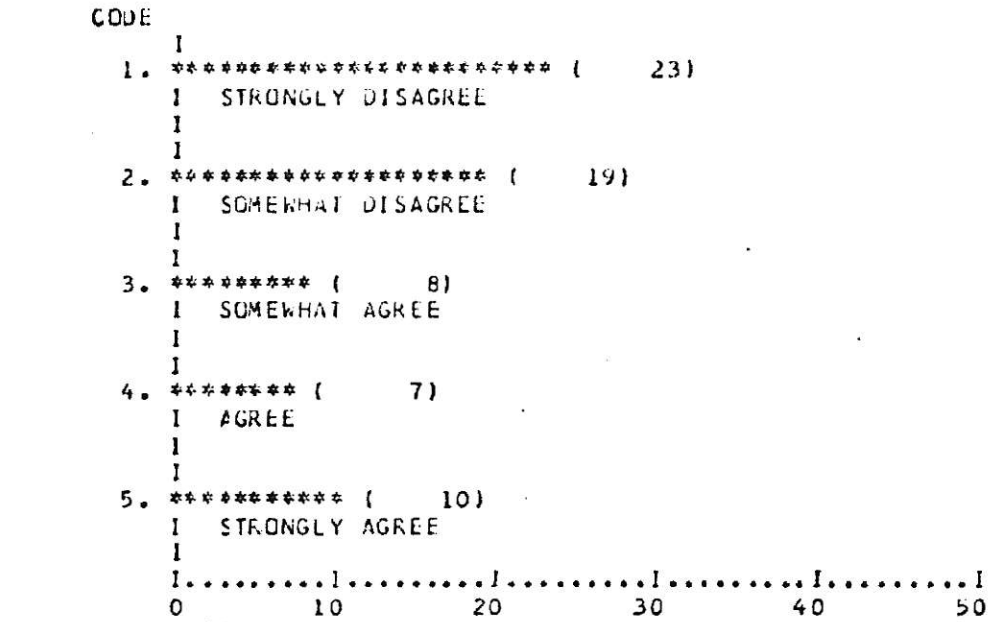
```
CODE
     I
  1. ** (      1)
     I  STRONGLY DISAGREE
     I
     I
  2. *** (      2)
     I  SOMEWHAT DISAGREE
     I
     I
  3. ********** (     10)
     I  SOMEWHAT AGREE
     I
     I
  4. ********** (     15)
     I  AGREE
     I
     I
  5. ****************************************  (     39)
     I  STRONGLY AGREE
     I
     I.........I.........I.........I.........I.........I
     0         10        20        30        40        50
     FREQUENCY
```

MEAN	4.328	STD ERR	0.115	MEDIAN	4.641
MODE	5.000	STD DEV	0.944	VARIANCE	0.891
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

FEW FEWER PROGRAMMERS



MEAN	2.433	STD ERR	0.176	MEDIAN	2.053
MODE	1.000	STD DEV	1.438	VARIANCE	2.067

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

SIMPOS OPS SYSTEMS SIMPLER

CODE

1. ********** (20)
   STRONGLY DISAGREE
2. ********** (13)
   SOMEWHAT DISAGREE
3. ********** (10)
   SOMEWHAT AGREE
4. ********** (11)
   AGREE
5. ********** (13)
   STRONGLY AGREE

I.....I.....I.....I.....I.....I
0 4 8 12 16 20
FREQUENCY

MEAN	2.761	STD ERR	0.186	MEDIAN	2.550
MODE	1.000	STD DEV	1.518	VARIANCE	2.306
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

SECUR SECURITY MAJOR CONCERN IN BOS

```
     CODE
          I
       2. ******* (      6)
          I  SOMEWHAT DISAGREE
          I
          I
       3. ************** (     14)
          I  SOMEWHAT AGREE
          I
          I
       4. ************ (     12)
          I  AGREE
          I
          I
       5. *********************************** (     35)
          I  STRONGLY AGREE
          I
          I.........I.........I.........I.........I.........I
          0         10        20        30        40        50
          FREQUENCY
```

MEAN	4.134	STD ERR	0.127	MEDIAN	4.543
MODE	5.000	STD DEV	1.043	VARIANCE	1.088

VALID CASES 67 MISSING CASES 0

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

COST MANAGEMENT AWARE OF SE COST BY 1985

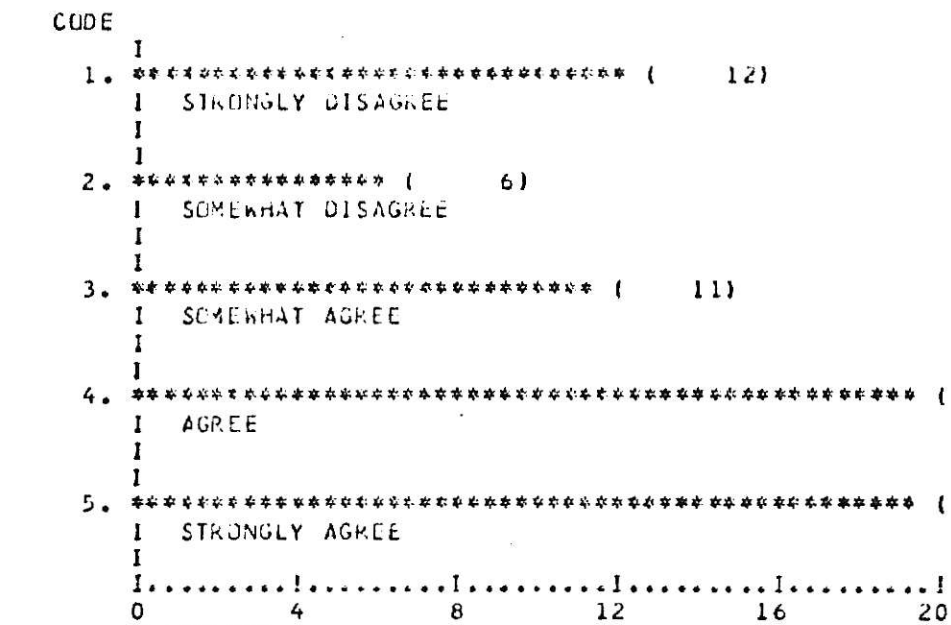
```
CODE
     I
  1. ************ (     12)
     I  STRONGLY DISAGREE
     I
     I
  2. ********** (      9)
     I  SOMEWHAT DISAGREE
     I
     I
  3. ************************** (     27)
     I  SOMEWHAT AGREE
     I
     I
  4. ************ (     12)
     I  AGREE
     I
     I
  5. ******** (      7)
     I  STRONGLY AGREE
     I
     I.........I.........I.........I.........I.........I
     0         10        20        30        40        50
     FREQUENCY
```

MEAN	2.896	STD ERR	0.148	MEDIAN	2.563
MODE	3.000	STD DEV	1.208	VARIANCE	1.459
VALID CASES	67	MISSING CASES	0		

MANAGER PERCEPTIONS

11/16/79 FILE - STUDY - CREATED 11/16/79

COMMC USER - ADP COMMC BETTER



MEAN	3.403	STD ERR	0.177	MEDIAN	3.737
MODE	4.000	STD DEV	1.447	VARIANCE	2.093
VALID CASES	67	MISSING CASES	0		

A MODEL OF THE DATA PROCESSING MANAGER IN THE 1980's

by

GENE N. CARTIER

B.B.A., University of Mississippi, 1972

AN ABSTRACT OF A MASTERS REPORT

Submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Computer Science

Kansas State University
Manhattan, Kansas
1980

MODEL OF THE DATA PROCESSING MANAGER IN THE 1980´S

by

GENE N. CARTIER

ABSTRACT

The next decade will see a marked change in the way data processing assets are used. This is because of rapidly advancing technology that will allow greater flexibility in the physical allocation of computer assets. This report examines the role of the data processing manager in the present centralized data processing environment, investigates changes that will cause his role to change and establishes a model for data processing managers in the 1980´s.

The report uses information obtained by a questionaire sent to data processing managers nationwide to establish a profile of current data processing managers and help develop the model of future managers. Information developed indicates that current data processing managers lack the technical and organizational skills to easily move into an era of distributed processing and direct participation as part of a management team.

The report contains reccommedations for preparation of

future data processing managers, through curriculum modification, continuing education and certification. A statistical summary of the survey is provided as an appendix.