THE EFFECT OF SELECTED CHARACTERISTICS OF BUSINESSES AND THE EXTENT OF DATABASE UTILIZATION IN WESTERN WASHINGTON STATE

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PREFACE

This study provided information concerning the extent of database utilization in a random sampling of 49 companies of varying sizes across western Washington state. It is unique in the information it provides concerning database systems and their impact on the business community. Similar studies of like groups and of other specific groups are encouraged.

I wish to express my sincere gratitude to all of the professors who assisted me in this work and during my stay at Oklahoma State University. The helpful assistance and warm hospitality of all whom I met in Stillwater is greatly appreciated. Wherever I am, I will carry warm thoughts of the year I spent in your town.

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CHAPTER I

INTRODUCTION

The microcomputer, minicomputer, small computer, and mainframe computer are now recognized, familiar words to nearly all persons in the business community and in educators. Since the introduction of the minicomputer and microcomputer in the 1970s the influx of computers into the office has been increasing rapidly. According to Silver and Silver (1986), the total dollar value of mainframes sold in this country by the year 1990 will reach $34 billion, an increase from $17 billion in 1980; and sales of personal computers (micros) will reach $50 billion by 1990, up from only $1 billion in 1980. The sale of software applications to accompany this hardware has increased at rapid rate as well. With the increase has come a dedication by vendors to perfect the software package and to increase its capabilities.

Word processing had been a popular application for the office, but the business community was being flooded with other applications useful to it -- payroll packages, accounting records, electronic mail, time managers, report packages, file managers, and more. Not only was this type of application growing in number, but also it became necessary to businesses in order to keep up with the competition and to keep current with a very rapidly changing technology.

From the individual application programs came the integrated software -- compatible applications in one package. Instead of word processing in one, spreadsheet in another, and math capabilities in still another, they were merged into one compatible package. The applications contained more information in a simpler format and with a more attractive price tag.

One of the major problems with all of these data and the increased amount of information exchanging hands was organization. This problem brought about file programs which evolved into database. Database applications became large database programs used by large corporations, and these in turn evolved into systems which needed to be managed by a more complex method -- database management systems. Today, management information systems control the organization of very large corporate records, used for seeking information pertinent to every aspect of the business.

There are some obvious implications involving the users of database management systems as well as those of smaller database systems. The most critical involves keeping current with the technology so that users interact with the system to maximize its efficiency.

This study is designed to determine what database applications and systems are being utilized by businesses and to determine how these systems are being implemented by small to very large corporations.

Need For The Study

The 1980s have been marked by a parade of introductions of packaged database management systems (DBMS) of a seemingly infinite variety. In addition, the microcomputer phenomenon has been accompanied by a deluge of user-oriented software packages that have brought end users headlong into a first-hand acquaintanceship with database software (Fife, Hardgrave, Deutsch, 1986).

The 1980s have shown that DBMS is no longer an application used by a selected group of programmers. Managers and other users are finding themselves in contact with database applications, and they need to be familiar with DBMS applications for performing routine, daily functions.

There are DBMS packages designed for a wide range of sizes and capacities of data storage and systems. The knowledge needed for understanding database models and their schema has increased with the degree of sophistication of user-based database applications. The degree of sophistication available to users has a wide range, from single-user applications to multi-user applications, from basic applications which are easily understood to more complex ones. In addition, there are very complex systems developed and designed by corporation programmers to meet specific needs of Management Information Systems (MIS). From the most basic of the

application systems, many new features are being added, which are available to the user. These include, the use of "What-if" speculations and the ability to make "Queries." In addition, there is a basic demand to know the structure of DBMS by all users and to know how to quickly access information in large quantities and many different formats.

Data management software now commands a comfortably large segment of the software market. In 1984 total DBMS market share was $1.2 billion. By 1990 that figure is estimated to reach $4.6 billion, 14 percent of the total market share (PC World, December 1985).

Data management is the "number one" application in the mainframe world. It rates third in the personal computer world. Data management in any environment is moving away from the "black box" concept where it is out of sight into the concept of interactivity with other applications, such as spreadsheets, where one sees the data (Ben Rosen, Lotus Development Corporation, PC World, December, 1985). William Urschel, in a Review of Data Management, PC World, February, 1987, states that the new systems involve menu-driven modules that include mathematical computations, graphics design, queries, interaction with word processing, and multiple integrated software capabilities.

In larger corporations, the trend is involving database management systems coordinated over

communications networks. These distributed database systems possess sophisticated control functions to locate needed data on the network, to compose necessary queries to the target databases, and to track responses from multiple computers contributing partial answers to an overall query operation (Fife, Hardgrave, and Deutsch, 1986, p. 240).

The Business Administration Index of Dissertations through 1985, The Business Education Index, 1985, The Business Periodicals Index, 1985, 1986, and 1987, show no prior descriptive studies which show the number and types of business database systems and applications in use.

The implications for the user of database systems are complex. The need for qualified users of DBMS will increase as the use of DBMS itself increases. Because of the position of DBMS as supporting the structure of the organization itself, it will be necessary for managers to have knowledge of database technology and design. This study will specifically look at the utilization of database management systems in business and will thus show the impact it has made on businesses.

Statement of the Problem

The problem of this study was to determine the relationship between selected characteristics of various types of businesses and the extent to which database

applications are used in businesses in western Washington state.

Purpose of the Study

The purpose of this study was to provide information which could be used by managers in industry or by educators interested in knowing the impact database systems have made in industry.

By learning the extent and number of database programs being used in local industries and by learning the design and implementation of database programs in these industries, individuals responsible for curriculum in computer-related courses may more accurately decide whether to include, revise, and/or retain the present emphasis in courses where instruction of database education is deemed essential.

Variables

The dependent variables of this study were various characteristics of businesses using a database system. The independent variable was the database system in use.

The independent variables were categorized as follows:

1. The type of the organization
2. The size of the organization
3. The annual net revenue for 1986
4. The geographic location

5. The computer system in use
6. The programming language in use
7. The future plans concerning the database

The dependent variable was the database system in use. This variable was broken down into the following categories:

1. Application package purchased from a Vendor
2. Database system designed in-house
3. BASIS (DEC)
4. IMS
5. INQUIRE (IBM)
6. IDMS
7. MAGNUM
8. SYSTEM 1022 (DEC)
9. SYSTEM 2000
10. TOTAL
11. MODEL 204
12. ADABAS
13. Other

Delimitations

The researcher has placed the following delimitations on this study:

1. The use of a preliminary questionnaire and a final questionnaire as the only data-gathering instruments.
2. A survey of database systems in use by selected

businesses in western Washington state that are listed with the Hugo Dunhill Directory (1987).

3. Data processing managers who are engaged in the supervision or use of database systems.

4. Data processing operators who are engaged in the application of database systems.

5. Only those businesses in western Washington state were surveyed.

6. Only supervisors or database operators were selected as respondents to the questionnaire, thus possibly excluding others who may have knowledge of database applications.

7. The directions given on the questionnaire and the cover letter were the only control over the responses. Further clarification was impossible due to the size of the study.

8. A relatively small sample size was used which may have affected the outcome of this study.

Limitations

This study may be limited by the following factors:

1. No control was possible over who actually responded to the questionnaire.

2. No control was possible over how the questions were interpreted by the readers.

Assumptions

The following assumptions were made by the researcher concerning this study:

1. That each company responding to the questionnaire would be a user of some form of database applications.

2. That database applications will have some similarities from company to company and that most of these will be shown on the questionnaire.

3. That those persons receiving the questionnaire will have knowledge of database technology.

Definitions

There is a wide variety of definitions of terminology used in the microcomputer field. For purposes of this study, the following definitions will apply.

The following is a list of general terms which were unique to this study.

Microcomputer. A microcomputer is a small desk-top system with minimum primary memory storage of 5K bytes and generally costs less than $6,000.

Minicomputer. A minicomputer is a small free-standing computer system which usually has minimum primary memory storage of 48 K, with the capacity to add additional input/output devices and costs less than $25,000.

Mainframe. The traditional computer system used in

most medium and large business organizations for information processing in a distributed or centralized setting and may have data communications applications so that terminals at remote locations may transmit data to a central processing unit.

All of the above definitions should be considered an approximation of computer sizes in business today. The technology changes almost as rapidly as one definition is published and, therefore, the terminology often changes as well.

Other definitions pertinent to this study are:

Database. A self-describing collection of data organized in a structured and integrated form with minimal redundancy for widespread reference and retrieval by an organization or an individual.

Database Management System (DBMS). A general-purpose computer hardware and software system configured to implement the insertion, retrieval, and other usage functions for databases which are required by the management of an organization..

Network Model. A logical representation of a database that permits a hierarchical organization scheme, but also allows more complex differences that are not limited by hierarchical, or level-to-level, designs. Access capabilities are provided by a virtually limitless number of possible parent-child (1:1) relationships within sets; one record type may serve as parent of several

children (1:M), many parents and many children (M:M), or both parent and child of one set (1).

An operational definition for this study is:

Small Companies. Small companies are referred to throughout this study as those with 1000 or fewer employees.

Hypotheses

1. There is no significant difference between the type of organization and the database system in use.
2. There is no significant difference between the size of the organization and the database system in use.
3. There is no significant difference between the annual net revenue and the database system in use.
4. There is no significant difference between the geographic location and the database system in use.
5. There is no significant difference between the computer system in use and the database system in use.
6. There is no significant difference between the use of a programming language by primary users and the database system in use.
7. There is no significant difference between the plan to change the existing database system and the database system in use.

CHAPTER II

REVIEW OF RELATED LITERATURE

This study concerns the differences between the type of businesses in western Washington state and the extent of the utilization of database applications. Taking this into consideration, research and literature were reviewed to obtain information concerning the utilization of database systems within the place of business and to obtain information concerning actual uses of database systems in business and a general understanding of what database systems are.

A review of literature was also completed to show the evolution of database technology and its necessity as a major element in information technology in industry. This included information which is pertinent to this study and to the use of database management systems: file organization, file structure, and database design.

The Evolution of Database Management

Intel introduced the first microprocessors and subsequently the microprocessor chip in the early 1970s, and the Altair 880 was the first production microcomputer introduced in 1975.

With these new systems on the market, the influx of software was soon to follow. Word processing was well integrated into the workplace at this time. The most

popular systems were dedicated terminals, but now the capability to perform multiple functions on a microcomputer terminal was close at hand. (Fernandez, Summers, Wood, 1981, p. 25), (Fife, Hardgrave, Deutsch, 1986, p. 1), (Haugen, 1982, p. 12).

Fife, Hardgrave, and Deutsch (1986) state that database evolved from a continuing series of hardware and software enchancement, such as disk files and operating systems. As the increased usage of files continued, so did the need to organize the files in a structured manner. The need to contain a large collection of data resulted in the design of database management. Files became valuable as a tool for organizing information on the computer. Fife, Hardgrave, and Deutsch (1986) further state,

> "Files first became valuable as assets on their own in the late 1950s, following the introduction of the first random access disk file system--the IBM 305 RAMAC. Almost immediately, computer systems took on a new dimension: Computers could store data for access at random, providing information or supporting business operations." (p. 2).

Awad (1985) states that the general theme behind a database is to handle information as an integrated whole.

> "There is none of the artificiality that is normally embedded in separate files or applications. A database is a collection of interrelated data stored with minimum redundancy to serve many users quickly and efficiently." (p. 332).

Today, database management systems often support a number of applications simultaneously. Fernandez, Summers, and Wood (1981) state, "An essential characteristic of a database is that it supports a number of

different applications, which can be batch or online or both. Often some of these applications must run concurrently." Popyk (1983) concurs with this when she states, "data must be arranged and stored in a way that gives users fast and easy access to it. . . the concept of database arose out of this need." (p. 218)

What Database Management Is

Fife, Hardgrave, and Deutsch (1986 p. 3) state "database management is an innovation in the creation, use and preservation of computerized data. The basic premise that underlies the database management approach is that data are an asset. Data have value to an organization in achieving its goals and continuing its operation in a smooth and reliable way." Fernandez, Summers, and Wood (1981, p. 23) state, "a database is a collection of interrelated data items that represent the information an enterprise needs in order to carry out certain functions. A database may be considered as consisting of information objects, or entities and relationships." Awad (1985, p. 321) states, "Today database is recognized as a standard of MIS (Management Information Systems) and is available for virtually every size of computer."

In the beginning of database applications, the usage was confined to the individual terminal on which it was used. There was no sharing of information across terminals. The database environment was limited to the

memory space available within a given individual system. Awad (1985, p. 331) states, "Before database concept became operational, users had programs that handled their own data independent of other users. It was a conventional file environment with no data integration or sharing of common data across applications."

Database applications have evolved to the point of definite integration within the system. Now the database encompasses many of the functions within an organization, often from numerous departments, inputting and outputting to accommodate the complex needs of upper-level management. This information must be available to many users for many different purposes, often quickly and simultaneously. The database must be organized and structured to allow users to seek out pertinent information. (Popyk, 1983 p. 218-219), (Casady, Sandberg, 1985, p. 13), (Casady, 1984, p. 190).

There are two types of database products, one is a file manager and the other a relational database management system called DBMS. The trend is toward relational databases, which generally cost more but have a great deal of power to back up the cost. With the increasing needs of users, the capability of these systems is in great demand and thus has greatly increaseed their popularity.

"Relational capability links two or more files through common fields for activities such as querying

(selecting data that meet defined criteria) and reporting. It gives the user the chance to instantly view and analyze information in the database from a variety of fresh perspectives. Programming languages in these products have supported a new industry." (Ed Esber, Personal Computing, April 14, 1987).

Relational database systems use chains, pointers, and lists to interrelate items. A chain represents a logical patyh through a database by linking groups of records together for purposes of inquiry or updating. A pointer locates or points to a specific record or entity in a database, and a list is a set of data with pointers indicating the physical location of records with a specific attribute. This method is considered one of the most flexible and user-friendly, thus placing it in the most popular position in the market.

Hierarchical databases. A tree organization permits records to be organized and accessed hierarchically. For eqach item, a record is considered a main or header record that references a series of subordinate data items or records. The header record points to all subordinate data items. (Stern and Stern, 1985, p 627).

Network databases. The most comprehensive form of logical dta organization is the network database. Any data element in a network may be related to any other data element. A record or entity may have any number of pointers into it and leaving it. Networks have the most

sophisticated order and arrangement of entities in a database.

Database Management System. A DBMS is a package that provides users with software needed to implement an integrated management information system. It includes the software necessary for storage, retrieval, inquiry, and reporting from a database. Database management systems are often purchased from a vendor but may also be developed in house by programmers. In-house systems are designed specifically to meet user and corporate needs. (Stern and Stern, Silver and Silver, p 630, p 307).

The Need for Database Management

The very basic need for a database system is so that business can better handle and manage information. There is a need to store, update, manipulate and report on information and this is, put very simply, what a database management system does.

In 1981, businesses used 1.2 million spreadsheet programs and 1.18 million word processors, compared to only 102,000 database managers. The 1985 figures show more than two million spreadsheets and 1.9 million word processors in use, with databases jumping to 1.5 million. (Joanne Kelleher, Personal Computing, April 14, 1987).

The credit for this increase has been given to several factors, among them: more RAM, an increase in the use of hard disks as well as to the improvement in the

database systems themselves. Improvements in the systems have increased the uses of the systems by users and management. Such versatile features as menu-driven query, automatic report formatting, simultaneous sorts across multiple fields, math functions, and application generators that allow multiple functions with a single keystroke response to menu options have appealed to users and managers. In addition, the flexibility with these features has increased from the often cumbersome routines to a few easy-to-learn and perform steps.

Database Objectives

It is generally agreed upon that database operations need to include the support for a large number of different applications, which may run concurrently (essentially, it is able to handle information as an integrated whole). Database/file systems must be flexible to change -- often instant -- and must have the built-in capability to be tailored to the company's needs. (Fernandez, Summers, Wood, 1981), (Awad, 1986, p. 327), (Stern, 1986, p. 578).

Fernandez, Summers, and Wood, (1981), state that a number of different applications supporting different functional areas may be processed within the database. These may include operational applications and management information applications. Deen and Hammersley (1981) state that database design concerns the various tasks

needed to be performed by the DBA (database administrator) for design of a database, and may be viewed as having the following components:

Data analysis

Logical Design

Physical Design

Analysis focuses on the techniques and methods for analyzing the data for a corporation or business with a view to its eventual representation in some structured form. The analysis usually depends on human interpretations of data, events and their significance. Logical design refers to the design of the logical database, independent of any storage consideration -- the ideal global schema; physical to the actual hardware components of the system.

Jack L. Abbott, Byte, May, 1983, stated, "Database management systems, or DBMSs, are general-purpose programs that accept data in a format that determine, process the data according to your requirements, and then output the data in the report format that you specify. Essentially, DBMSs perform four functions: data input, selection and sorting, processing, and report output.

User Needs

Rick Minicucci, Today's Office, July 1986, states that storing and retrieving corporate information takes more than managerial legerdemain. Today's database

management programs offer data-handling sleight of hand that isn't at all slight. Unlocking the information stored in a company's mainframe, minis and personal computers can be a tricky maneuver -- particularly for managers that have little or no programming background. He further states, "The keys that today's DBMSs give users to store, modify and selectively retrieve information are as many and as varied as the DBMS programs themselves." Knowing how to work with a database management system is the key to using one to its fullest capabilities. Frank Freudberg, Words, March, 1985, states that the first and most important step in searching a database is to clearly define your problem or question. The more you know about what you need to know, the simpler it will be to find the appropriate database -- and the easier it will be to find the needed information.

Wayne Erickson, Microrim's CEO, stated in High Technology, November, 1985, that the definition of DBMS keeps expanding. At one end we have people who are more or less professional programmers . . . at the other end of the spectrum we have people who have a job they need to do, but have never had to think about a database before. David Kalman, editor in chief of the dBased Advisor (San Diego) states that the new database applications for microcomputers are essentially small models of the mainframe databases. These scaled down DBMSs are designed to emulate the larger database systems.

Rick Cook in High Technology, November, 1985, was predicting the trends of database systems on micros when he stated, "Ultimately, microcomputers will probably have enough power to knit all of the DBMS trends together into a single program. This "superprogram" will be able to handle multimillion-record databases and import information from mainframes, have the software development features micro programmers want, be able to manipulate special data structures like freeform text and graphics. . but until such a product appears, users will have to fit the product that best fits their capabilities and needs. Users will have the difficult task of sifting through the wide range of products available and once they find a product, of learning the wide range of its features."

The Range of Database Systems

"A Database in has no widely accepted definition...a database is intertwined with the concept of information resource management -- treating data (or information..) as a corporate resource. The promise of a database is its ability to share consistent and timely data throughout the organization, to enable users to access that data directly without technical assistance, and to easily evolve so that it meets changing business requirements." (Robert M. Curtice, Datamation, October 1, 1987).

While many user needs are satisfied and many of yesterday's requirements have been met, users still look

for their database systems to do more. "Minicomputer and mainframe-based DBMS packages are often criticized for their incompatible data structures and inflexible user interface problems commonly associated with micro-based DBMSs such as managing sophisticated programming tasks." (Matthew T. Schroeder, Datamation, December 1986).

A lack of standards and an absence of data integrity and security functions, as well as advertising by vendors of non-relational systems as relational and incompatible data structures of different vendors' DBMSs have been common problems associated with large-scale systems. Incompatibility has occurred not just because of software problems, but because of an array of different machine architectures.

Many of the problems of the past were answered by the relational database system. A true relational DBMS implements a concept called data independence, which means the logical database structure is buffered from the physical database design. A true relational DBMS is also best suited to handling ad hoc queries and databases that require constant updating. Relational DBMSs are touted as godsends for programmers because of their abundance of tools designed to reduce development time and maintenance costs. (Matthew T. Schroeder)

However, this rather time-consuming procedure is changing with the advent of database management systems.

Distributed Database Management Systems

Retrieving information from a database has in the past been the responsibility of data processing/management information systems departments. This was usually done through one of two ways: assigning a programmer to write a program to interact with the database or a user who accessed data through a product such as Focus. Any retrieval or manipulation of data was not an easy matter. As with any improvements in systems, one improvement simply leads to another need and users demand easy control and quick access as well as flexibility in their systems.

Localized databases. "The question is not whether today's centralized databases will become localized, but how the changeover will occur. The centralized database is a holdover from the days when computing resources were the limiting factor in data processing. Hardware was so expensive that it had to be conserved and guarded." (Peter Lisker, PC Week, January 1987).

Today, we see just the opposite. Custom software and programs are becoming increasingly expensive as the hardware prices drop. These custom software programs--in particular the database systems--have become more complex to meet user needs and with this complexity have come database management systems which are moving toward distributed DBMSs.

Most innovations in relational DBMSs are in the minicomputer arena. The strongest contender at the moment

is relational architecture in use with IBM's Structured Query Language (SQL).

Many organizations are already doing futuristic planning for the issues which will arise when distributed software systems are on the market. "Relational technology has been adopted by vendors of DBMSs for minicomputers because of the relatively short history of these machines in commercial settings." (George Schussel, President of Digital Consulting Associates, Computer Decisions, August 1986).

As with the system announced by Ingres/Star, the ideal distributed database systems will be able to simultaneously access multiple databases residing on different commputers running under different operating systems--the bottom line for a distributed DBMS. Those first released, however, will probably not include such cababilities as supporting capabilities that span a single system or provide for data fragmentation--supporting a single table over multiple sites. Other difficulties are spanning relational with hierarchical systems.

Summary

A review of literature has shown that small businesses and large corporations are impacted by the use of database applications and large scale database management systems. During the past twenty years, since the first database program, database systems have

increased in their flexibility and in the complexity of uses available to management and users. It further shows that the diversity and continually changing structure of these systems impact the users in terms of maximizing the DBMS and database application potential. Users are demanding more and more from their systems as more is offered from vendors.

As we enter a period of growth in the development of 4th generation languages, artificial intelligence, and speech recognition as well as other enhancements to our systems, the foresight and futuristic attitudes of management, users, and trainers will be critical.

Therefore, it is important to assess the effect of database applications and DBMS on businesses. This study will provide information useful not only to those in business, but also to educators concerned with training users.

CHAPTER III

DESCRIPTION OF RESEARCH PROCEDURES

This study was designed as a descriptive study in order to obtain data from businesses in western Washington state concerning their utilization of database applications. Data were obtained from the respondents concerning the type of database system in use and the type of system on which the database was being used, among other questions related to the database and the type of organization. Through the descriptive data obtained from the returned questionnaires, it was possible to tabulate the number of firms by location, type, and size of organization which use database applications and the extent to which they use them.

This chapter describes the research procedures which were used in this study by elaborating on each of the steps employed in completing this research.

Development of the Research Questionnaire

The research instrument designed to gather data for this study was a questionnaire developed through a review of the literature, through a review of similar questionnaires used to obtain data from businesses, and through consultations with Oklahoma State University faculty members.

A pilot study was conducted in western Washington

state by sending the questionnaire to selected businesses which were listed in the Hugo Dunhill Directory (1987). A copy of the piloted questionnaire and cover letter are included in Appendices A28 through A30. After the piloted questionnaires were returned, the questionnaire was revised slightly and reprinted. Every effort was be made to develop a questionnaire tool that was easy to follow and understand and not too long, yet contained all of the pertinent information necessary for this study. Every attempt was made to state questions clearly and concisely, leaving out any ambiguities.

The final questionnaire was printed on both sides of 8 1/2 x 11 inch paper. To protect their anonymity, respondents were not asked to provide their names or the name of their employer.

The questionnaire included information gathering questions designed for testing the hypotheses stated in this study as well as additional questions designed to provide information of general interest to readers. All questions were to be completed by all respondents who supervise the operation of database systems. The questions were designed to be consistent with current database terminology as researched in a thorough review of current literature. (See Appendix A30 for the final questionnaire.)

Preparation of the Cover Letter and Follow-up Letter

The cover letter was developed to encourage the businesses receiving it to take the time necessary to respond to the questionnaire. It was written in the form and style of a business letter, on university letterhead, and was concise and explanatory. The letter was also co-signed by the dissertation advisor, Dr. Richard Aukerman. (Appendix A28 for a copy of the final cover letter.)

The follow-up letter was also written to be explanatory, to-the-point, and in a business format. It contained encouragement for the businesses to respond to the questionnaire as soon as possible. This letter was also reproduced on College of Business Administration stationery and was co-signed by the dissertation advisor, Dr. Richard Aukerman. (See Appendix A29 for a copy of the follow-up letter.)

Selection of the Sample

In selecting businesses, the researcher used all cities west of the Cascade mountain range in Washington state. Hugo Dunhill (1987) was used to obtain the names and addresses of the businesses to be used in the sample. Companies having from 100 to 10,000+ full-time employees were chosen from the list. A random selection of each size category on the list within western Washington state was completed by Hugo-Dunhill.

A total of 1500 names was selected. The participants in the pilot study were chosen by randomly selecting the number 7 out of 10 numbers and then selecting every seventh name horizontally on the list up to 50 names. A response rate of 15 percent was received from the pilot study. Very few changes were required on the questionnaire. The first round of questionnaires was mailed to 250 persons by selecting every seventh name on the mailing list. Following the first round returns, a followup letter was mailed. A total response of 20 percent was received. This was approved by statisticians at Oklahoma State University as enough response to proceed to findings.

Discussion of the Measurement of Variables

From the completed questionnaires, it was possible to analyze the responses and the measure the independent variables in the following categories: An analysis of the differences between the type of organization and the database system in use; an analysis of the differences between the size of the organization and the database system in use; an analysis of the differences between the annual net revenue and the database system in use; an analysis of the geographic location and the database system in use; an analysis of the computer system in use and the database system in use; an analysis of the differences between the programming language used and the

database system in use; an analysis of the plan to change the existing database system and the current database system in use.

Each of these variables was measured against the independent variable of database system in use, which was broken down into the following categories: Application package purchased from a vendor, database system designed in-house, BASIS (DEC), IMS, INQUIRE (IBM), IDMS, MAGNUM, SYSTEM 1022 (DEC), SYSTEM 2000, TOTAL, MODEL 204, ADABAS, Other.

Statistical Measurement

The above seven items on the questionnaire were compared with the computer system in use using the Chi-Square test of independence, including tests for the Degree of Freedom, the Significance Level, and the Minimum Expected Frequency. Cramer's V and a Contingency Coefficient were used as post hoc tests. These tests shows the level of independence that exists between two variables based on the expected and observed frequencies and the ability to predict one variable based upon the strength of another.

Because the sample size was small in this study, some additional statistical tests were used to find a measure of association between the variables. The Cramer's V test of association was done giving a ranking of association between 0 to 1. A test for contingency coefficient was

also performed. On a scale of 0 to 1 it shows how much knowledge of one variable can be predicted based on knowledge of another.

CHAPTER IV

FINDINGS

Twenty percent of the questionnaires were returned following two mailings. Some inconsistencies in the data should be noted to shed light on the findings. Approximately 26.5 percent of the returns were from companies with 50 to 100 full-time employees (See Table 1). Fifty-five percent of those responding use an IBM PC or compatible microcomputer (See Table 2). Either the questionnaire tool used was not specifically directed to those in larger companies or smaller companies respond more frequently than do larger organizations since a random sampling across all sizes of organizations was done. Therefore, the findings of this study may be biased toward the small organization using a microcomputer.

The response rate was also lower for some sensitive questions and other questions which involved more time with which to respond. These questions were reporting of revenue for 1986, checking the reasons for accessing the system, and stating the primary functions performed on the system, although the latter two received better response than did reporting revenue (See Tables 3, 4, and 5).

Two hundred fifty mailings were randomly sent throughout western Washington. A first and follow-up mailing were done with a total response rate of 20 percent (See Appendix A).

Table 1

Number of Full-Time Employees in the Firm

Value Label	Frequency	Percent	Valid Percent	Cum Percent
Greater than 1 but Fewer than or Equal to 20	3	6.1	6.3	6.3
Greater than 20 but Fewer than or Equal to 50	5	10.2	10.4	16.7
Greater than 50 but Fewer than or Equal to 100	13	26.5	27.1	43.8
Greater than 100 but Fewer than or Equal to 250	9	18.4	18.8	62.5
Greater than 250 but Fewer than or Equal to 500	4	8.2	8.3	70.8
Greater than 500 but Fewer than or Equal to 1000	5	10.2	10.4	81.3
Greater than 1000 but Fewer than or Equal to 5000	7	14.3	14.6	95.8
Greater than 5000 but Fewer than or Equal to 10000	1	2.0	2.1	97.9
Greater than 10000	1	2.0	2.1	100.0
	1	2.0	Missing	
Total	49	100.0	100.0	

Table 2

Type and Number of Microcomputers used with Database

Computer	Frequency	Percent	Valid Percent	Cum Percent
Type:				
Apple II	6	12.2	16.2	16.2
Mackintosh	1	2.0	2.7	18.9
IBM or Compatible	27	55.1	73.0	91.9
* Other	3	6.1	8.1	100.0
	12	24.5	Missing	
Total	49	100.0	100.0	
Number:				
One in Use	7	14.3	18.9	18.9
Two in Use	5	10.2	13.5	32.4
Three in Use	1	2.0	2.7	35.1
Four in use	2	4.1	5.4	40.5
Five in Use	3	6.1	8.1	48.6
Six to Ten in Use	3	6.1	8.1	56.8
11 to 20 in Use	7	14.3	18.9	75.7
20 to 40 in Use	1	2.0	2.7	78.4
40 to 60 in Use	2	4.1	5.4	583.8
Greater than 60 in Use	4	8.2	10.8	94.6
* Other	2	4.0	4.7	100.0
	12	24.4	Missing	
Total	49	100.0	100.0	

* Other Type: Hewlett-Packard Vectra
NCR
Honeywell DPS 6

* Other Number: 145 in use (IBM or compatible)
300 in use (IBM or compatible)

Table 3

Reported Net Revenue in 1986

Net Revenue 1986	Frequency	Percent	Valid Percent	Cum Percent
Less than or Equal to $1 million	5	10.2	12.5	12.5
Greater than $1 million but Less than or Equal to $2 million	2	4.1	5.0	17.5
Greater than $2 million but Less than or Equal to $5 million	5	10.2	12.5	30.0
Greater than $5 million but Less than or Equal to $15 million	7	14.3	17.5	47.5
Greater than $15 million but Less than or Equal to $25 million	3	6.1	7.5	55.0
Greater than $25 million but Less than or Equal to $50 million	8	16.3	20.0	75.0
Greater than $50 million	8	16.3	20.0	95.0
* Other	2	4.1	5.0	100.0
	9	18.3	Missing	
Total	49	100.0	100.0	

* Other: not applicable, a non-profit organization

Table 4

Primary Reason for Access by Upper-Level Management
Where Multiple Responses Were Allowed

Management Access	Frequency	Percent	Valid Percent	Cum Percent
Inquiry	15	30.6	100.0	100.0
Long-Term Goals and Objectives	5	10.2	100.0	100.0
Daily Observance of Operations	18	36.7	100.0	100.0
Short-Term Decision Making	8	16.3	100.0	100.0
* Other	2	4.1	100.0	100.0

* Other: Not used (1 case)
Used to Review Printouts from Information Systems Department (1 case)

Table 5

Primary Job Functions of those Utilizing the Database Where Multiple Responses Were Allowed

Job Functions	Frequency	Percent	Valid Percent	Cum Percent
Clerical	26	53.1	100.0	100.0
Data Processing	30	61.2	100.0	100.0
Word Processing	19	38.8	100.0	100.0
Data Entry	26	53.1	100.0	100.0
Programming	17	34.7	100.0	100.0
Systems Analysi	14	28.6	100.0	100.0
Database Manage	12	24.5	100.0	100.0
Executives	10	20.4	100.0	100.0
* Other	6	12.2	100.0	100.0

* Other:	Administration	2
	Manufacturing, Finance and Sales	1
	Decision Support	1
	Operations Staff	1
	Comment: "Micro databases are very job related"	
	Total	5

The chi square test of independence was performed on the following hypotheses. It was used because both variables were qualitative in nature. From the chi square test, chi square significance was determined. To add to the degree of reliability, Cramer's V, showing the measure of association between two variables from 0 to 1 was used and a contingency coefficient, showing the strength of predicting one variable on another was also included, although the chi-square statistic was used for drawing conclusions.

Some findings to keep in mind in this study include the fact that it may be biased toward larger metropolitan areas. Seattle and Tacoma, western Washington's two largest cities, were 64.3 percent of those reporting. Seventy-three percent of the microcomputers in use were IBM PCs and compatibles (See Table 2). Over 50 percent of the database packages in use were used on microcomputers (See Table 6).

Table 7 shows the Chi-Square statistic, Degree of Freedom, Significance, Cramer's V, and the Correlation Coefficient for each of the following hypotheses. Table 8 depicts these figures graphically.

Hypothesis 1. A chi square test of independence was performed on the difference between the type of organization and the database system in use. As shown in Table 1, the observed chi square statistic was 17.66667. Using an Alpha Level of .05 for 21 degrees of freedom,

this level was lower than the critical value. Significance level was .6700. Cramer's statistic yielded a value of .37445. The contingency coefficient was .54414. The nature of the difference was such that manufacturing companies using vendor purchased packages yielded the highest percentage at 26.28. As shown in Appendix Q (A15), vendor purchased packages and those from the Other category yielded 38.1 percent each. The differences in identification with the type of organization and the database system in use were minimal. The null hypothesis was therefore accepted.

Hypothesis 2. A chi square test of independence was performed on the difference between the size of the organization and the database system in use (See Tables 10 and 6). The observed chi square statistic was 21.04005. Using an alpha level of .05 for 24 degrees of freedom, this level was lower than the critical value. Significance was .6364. Cramer's statistic yielded a value of .40864. The contingency coefficient was .57772. The nature of the relationship was such that 23.8 percent of companies reporting had 50 to 100 full-time employees and 38.1 percent used a vendor purchased package with another 38.1 percent using a package falling under the Other category. The differences in identification with the number of employees and the database system in use were minimal. The null hypothesis was therefore not rejected.

Table 6

Type of Database System in Use

System	Frequency	Percent	Valid Percent	Cum Percent
Vendor Package	16	32.7	38.1	38.1
Database System Designed in-house	9	18.4	21.4	59.5
Inquire (IBM)	1	2.0	2.4	61.9
* Other	16	32.7	38.1	100.0
	7	14.2	missing	
Total	49	100.0	100.0	

* Other:		
	ADR's DATA Com/DB	1
	FOCUS	1
	Paradox	1
	DBase III+	1
	SQL/DS (IBM)	1
	CPF/IDU (IBM)	1
	IBM's CPF	1
	DEC ADB & Rally	1
	Hewlett-Packard IMAGE	1
	Total	16

Table 7

The Chi Square Test of Independence
on the nine Hypotheses

Hypothesis	Chi-Square	D.F.	Sign.	Cramer's	Contingency Coefficient
1. There is no significant difference between the type of organization and the database system in use	17.66667	21	.6700	.37445	.54414
2. There is no significant difference between the size of the organization and the database in use	21.04005	24	.6364	.40864	.57772
3. There is no significant difference between the annual net revenue and the database system in use	23.19579	21	.3336	.45713	.62076
4. There is no significant difference between the geographic location and the database system in use	22.85737	27	.6927	.42592	.59365
5. There is no significant difference between the microcomputer system in use and the database system in use	51.56496	30	.0085	.71101	.77630
6. There is no significant difference between the minicomputer in use and the database system in use	6.47659	15	.9706	.20990	.34168
7. There is no significant difference between the mainframe in use and the database system in use	10.01786	6	.1239	.34956	.41201
8. There are no significant differences between the programming language used and the database system in use	25.79355	15	.0402	.47567	.63587
9. There are no significant differences between the plan to change the existing database system and the database system in use	6.15556	6	.4060	.39229	.48512

Figure 1

Observed and Expected Chi-Square

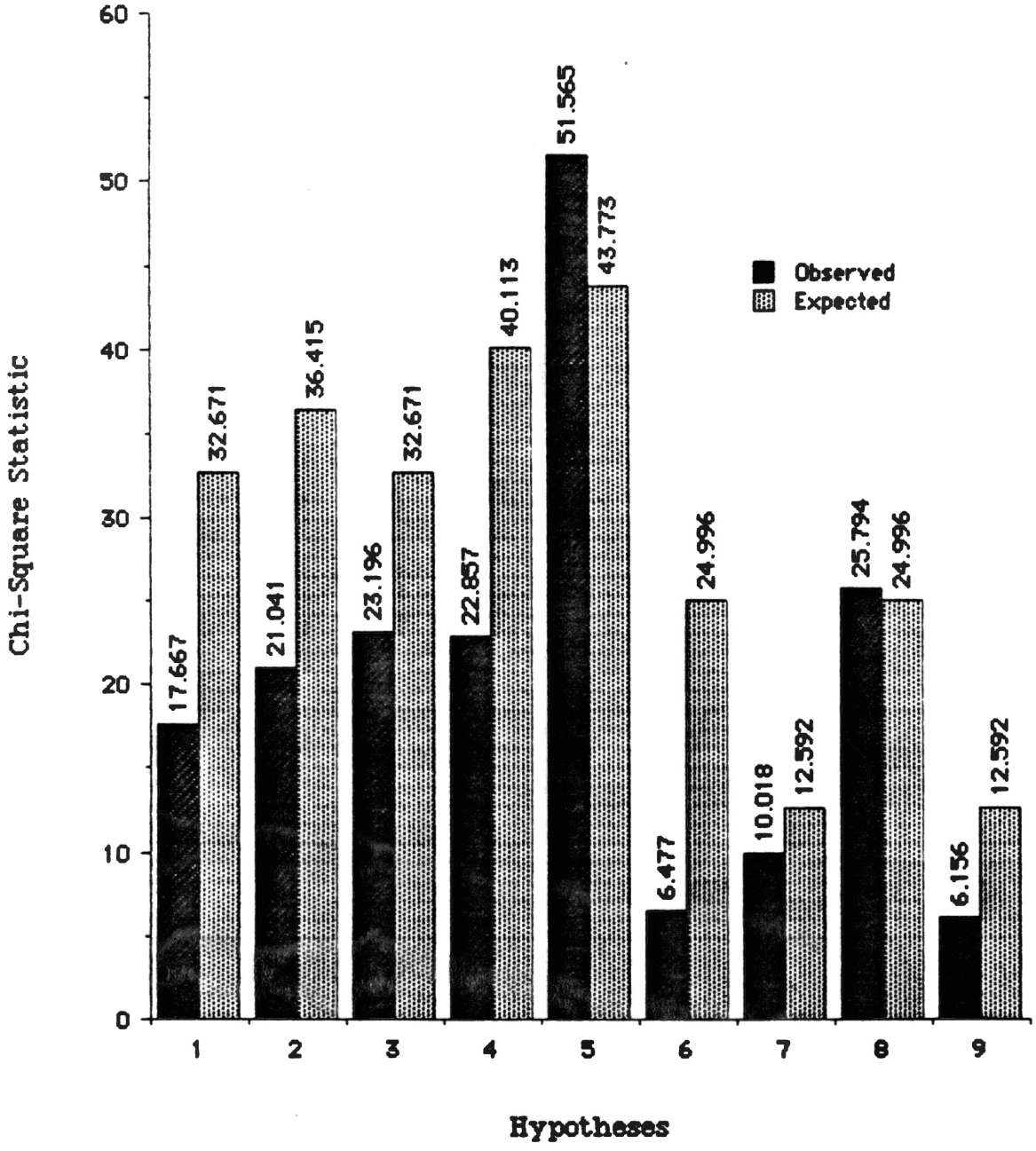

Table 9

Frequencies of the Type of Organization

Service	Frequency	Percent	Valid Percent	Cum Percent
Other Mfg (non data processing)	11	22.4	22.9	22.9
Government	2	4.1	4.2	27.1
Trade: Whls & Retail	7	14.3	14.6	41.7
Med & Legal Services	4	8.2	8.3	50.0
Transportation	6	12.2	12.5	62.5
Construction	1	2.0	2.1	64.6
Financial Services	5	10.2	10.4	75.0
* Other	12	24.5	25.0	100.0
	1	2.0	Missing	
Total	49	100.0	100.0	

* Other categories reported were:

Other Service	Frequency
Newspaper Publisher	1
Bowling and Entertainment	1
Port District	1
Nursing Home	1
Warehousing	2
Hotel	1
Beauty School	1
Oil Refining	1
Vehicle Emissions	1
Entertainment	1
Import/Export	1

Hypothesis 3. A chi square test of independence was performed on the difference between the annual net revenue and the database system in use (See Tables 3 and 6). The observed chi square statistic was 23.19579. Using an alpha level of .05 for 21 degrees of freedom, this level was lower than the critical value. Cramer's statistic yielded a value of .45713. The contingency coefficient was .62076. The nature of the difference was such that 21.6 percent of those reporting fell equally into the 25 million to 50 million dollar category and the greater than 50 million dollar category. The differences in identification with the net revenue as a function of the database system were minimal. The null hypothesis was therefore not rejected.

Hypothesis 4. A chi square test of independence was performed on the difference between the geographic location and the database system in use (See Table 6). The observed chi square statistic was 22.85737. Using an alpha level of .05 for 27 degrees of freedom, this level was lower than the critical value. Cramer's statistic yielded a value of .42592. The contingency coefficient was .59365. The nature of the difference was such that 33.3 percent of those responding came from Tacoma and 31.0 percent from Seattle, the two largest metropolitan areas in western Washington. The differences in identification with the city as a function of the database system in use

Table 10

Number of Full-Time Employees in the Department

Full-Time Employees	Frequency	Percent	Valid Percent	Cum Percent
Greater than 1 but Fewer than or Equal to 10	33	67.3	68.8	68.8
Greater than 10 but Fewer than or Equal to 20	8	16.3	16.7	85.4
Greater than 20 but Fewer than or Equal to 30	3	6.1	6.3	91.7
Greater than 30	4	8.2	8.3	100.0
	1	2.0	Missing	
Total	49	100.0	100.0	

were minimal. The null hypothesis was therefore not rejected.

Hypothesis 5. A chi square test of independence was performed on the difference between the microcomputer system in use and the database system in use (See Tables 2 and 6). The observed chi square statistic was 51.56496. Using an alpha level of .05 for 30 degrees of freedom, this level was higher than the critical value. Cramer's statistic yielded a value of .71101. The contingency coefficient was .77630. There were significant differences in identification of the microcomputer system in use and the database system in use. A figure of 54.1 percent of the microcomputers reported were IBM PCs and compatibles. A total of 41.2 percent of those using a microcomputer use a Vendor purchased package. The null hypothesis was therefore rejected.

Hypothesis 6. A chi square test of independence was performed on the difference between the minicomputer in use and the database system in use (See Tables 11 and 6). The observed chi square statistic was 6.47659. This was lower than the critical value. Cramer's statistic yielded a value of .20990. The contingency coefficient was .34168. The nature of the difference was such that 52.4 percent of the companies reported using 1 minicomputer. A total of 47.6 percent of the minicomputers in use were in the Other category. The differences in identification with the number of minicomputers in use and the database system

Table 11

Type and Number of Minicomputers in use with Database

Computer	Frequency	Percent	Valid Percent	Cum Percent
Type:				
Hewlett Packard 3000/70	3	6.1	11.5	11.5
Digital	3	6.1	11.5	23.0
Hewlett-Packard	2	4.1	7.7	30.7
IBM 36	2	4.1	7.7	38.4
DEC/VAX	1	2.0	3.8	42.2
Series1	1	2.0	3.8	46.0
Wang	1	2.0	3.8	49.8
Wang VS65	1	2.0	3.8	53.6
Ultimate 340	1	2.0	3.8	57.4
Basic 4	1	2.0	3.8	61.2
Prime	1	2.0	3.8	65.0
Data General	1	2.0	3.8	68.8
MV8000	1	2.0	3.8	72.6
MV10000	1	2.0	3.8	76.4
Digital/VAX 11/780	1	2.0	3.8	80.2
IBM System/38	1	2.0	3.8	84.0
IBM Series 1	1	2.0	3.8	87.8
Tandem Nonstop II	1	2.0	3.8	91.6
DEC PDP 11/44	1	2.0	3.8	95.4
Quantel	1	2.0	3.8	100.0
	23	47.0	missing	
Total	49	100.0	100.00	

used were minimal. The null hypothesis was not rejected.

Hypothesis 7. A chi square test of indpendence was performed on the difference between the use of mainframe and the database system in use (See Tables 12 and 6). The observed chi square statistic was 10.01786. This was lower than the critical value. Cramer's statistic yielded a value of .34956. The contingency coefficient was .41201. The nature of the difference was such that 72.78 percent of the companies reported using 1 mainframe. 63.6 percent of these mainframes fell into the Other category. The differences in identification with the number of mainframe computers in use and the database system in use were minimal. The null hypothesis was therefore not rejected.

Hypothesis 8. The observed chi square statistic was performed on the difference between the programming language in use and the database system in use (See Tables 13 and 6). The chi square statistic was 25.79355. Using an alpha level of .05 for 15 degrees of freedom, this level was lower than the critical value. Cramer's statistic yielded a value of .47567. The contingency coefficient was .63587. The nature of the difference was such that 44.78 percent of those reporting fell into the Other category. The differences in identification with the programming language in use and the database system in use were significant. The null hypothesis was not rejected.

Table 12

Type and Number of Mainframes in Use with Database

Computer	Frequency	Percent	Valid Percent	Cum Percent
IBM	4	8.2	25.0	25.0
IBM 32	1	2.0	6.3	31.3
IBM 43XX	1	2.0	6.3	37.6
IBM 4381 P14	2	4.1	12.5	50.1
IBM 3081	2	4.1	12.5	62.6
Honeywell	1	2.0	6.3	68.9
Amdahl	3	6.1	18.8	87.7
Wang VS65	1	2.0	6.3	94.0
* Other	1	2.0	6.3	100.0
	33	67.3	missing	
Total	49	100.0	100.0	

* Other: 1 report of 125 IBM 4341s in use was left out of the above frequencies to provide a more balanced picture.

Table 13

Programming Languages in Use

Language	Frequency	Percent	Valid Percent	Cum Percent
SQL	3	6.1	7.1	7.1
COBOL	6	12.2	14.3	21.4
BASIC	8	16.3	19.0	40.5
RPG	5	10.2	11.9	52.4
4th Generation Languages	2	4.1	4.8	57.1
* Other	18	36.7	42.9	100.0
	7	14.2	missing	
Total	49	100.0	100.0	

* Other: (Where some reported using more than 1)

RBase	1
DBase III+ (IBM)	2
4th Dimension (Macintosh)	1
Speedware	1
Assembler	1
Easytrieve	1
FOCUS	1
Fox Base	1
Present	1
RBase 5000	1
Recall	1
Update	1
Info	1
Transx	1
System V	1
TAL	1
Report Writer	1
Datatrieve	1
Proprietary	1
Adabas/Natural	1
Easytrieve	1
Cognos/Powerhouse	1
AIMS	1

Hypothesis 9. The chi square test of independence was performed on the difference between the future plans to change the existing database and the database system in use (See Tables 14 and 6). The observed chi square statistic was 6.15556. Using an alpha level of .05 for 6 degrees of freedom, this level was lower than the critical value. Cramer's statistic yielded a value of .39229. The contingency coefficient was .48512. The nature of the difference was such that 50 percent of those reporting fell into the Other category and 25 percent fell into plans for Expanding the Entire System. The differences in the identification with plans for changing the system in the future and the database system in use were minimal. The null hypothesis was not rejected.

Table 14

Future Plans for the Database System
Where Multiple Responses Were Possible

Future Plans	Frequency	Percent	Valid Percent	Cum Percent
Redesign System	4	8.2	100.0	100.0
Add New Applications to the Database System	12	24.5	100.0	100.0
Purchase Additional Hardware and/or Software	12	24.5	100.0	100.0
Expand Entire System	11	22.4	100.0	100.0

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to investigate the difference between the use of database systems in western Washington state and several variables within the business environment. In order to do this, a questionnaire was developed and randomly sent to industries across western Washington.

Nine specific hypotheses were tested. The following is a restatement of the hypotheses developed for this study along with a summary of the findings of each:

Hypothesis 1: There is no significant difference between the type of organization and the database system in use.

Summary: The observed significance was lower than the expected in this observation. The type of organization did not make a significant difference on the database system in use.

Hypothesis 2: There is no significant difference between the size of the organization and the database system in use.

Summary: The observed significance was lower than the expected in this observation. The size of the organization did not make a significant difference on the database system in use.

Hypothesis 3: There is no significant difference

between the annual net revenue and the database system in use.

Summary: The observed significance was lower than the expected in this observation. The net revenue did not make a significant difference on the database system in use.

Hypothesis 4: There is no significant difference between the geographic location and the database system in use.

Summary: The observed significance was lower than the expected in this observation. The geographic location did not make a significant difference on the database system in use.

Hypothesis 5: There is no significant difference between the micro computer system in use and the database system in use.

Summary: The observed significance was higher than the expected in this observation. The microcomputer used did make a significant difference on the database system in use. The greatest number of microcomputers observed were IBM PCs and compatibles used in conjunction with vendor purchased database packages.

Hypothesis 6: There is no significant difference between the mini computer system in use and the database system in use.

Summary: The observed significance was less than the expected in this observation. The minicomputer did not

make a significant difference on the database system in use.

Hypothesis 7: There is no significant difference between the mainframe computer in use and the database system in use.

Summary: The observed significance was less than the expected in this observation. The mainframe computer did not make a significant difference on the database system in use.

Other systems in this category were: Mainframe in conjunction with minicomputer and a second category, supercomputer. These two categories showed observed frequencies so low that the findings were insignificant.

Hypothesis 8: There is no significant difference between the programming language used and the database system in use.

Summary: The observed significance was less than the expected in this observation. The programming language used did not make a significant difference on the database system in use.

Hypothesis 9: There is no significant difference between the plan to change the existing database system and the database system in use.

Summary: The observed frequency was lower than the expected in this observation. The plans for changing the database system in the future did not make a significant difference on the existing database.

Microcomputers using a variety of vendor purchased database packages played a major role in the responses received from this questionnaire.

The two largest cities in western Washington, Seattle and Tacoma, were the two greatest participants in the study.

Conclusions

The analysis of the data provided the basis for the following conclusions for the population of this study:

Through the findings of this study, the conclusion can be drawn that in western Washington small organizations are utilizing vendor-purchased database systems on microcomputers. They are using their systems primarily for inquiry and daily observance of operations. We can also say that small companies in western Washington will add to their existing database systems in the future, either by adding software or hardware.

Recommendations

This investigation was restricted to a descriptive study of cities only in western Washington State. It was also restricted to a small sample size of the population. In this respect, many questions which received a very low response in this study may in effect really go unanswered. Therefore, the following are recommendations offered based on the findings and conclusions of this study.

1. The study should be repeated under similar circumstances using a larger sample size. A study focusing on companies of a specific size rather than the broad base of this study may show a different relationship between computers in use and database systems.

2. The study should be repeated with companies offering specific services, such as hospitals, data processing/computer and software manufacturers, etc., on an individual basis, rather than grouping all companies together.

3. A study should be conducted using a larger population base.

4. A study should be conducted utilizing the benefits of on-site interviews and telephone followups.

5. A study should be conducted which focuses on a few specific questions, rather than many questions with a broader range. Specific questions and thus a shorter questionnaire may yield a higher response rate and thus affect the outcome of a study such as this one.

6. A study should be conducted to further explore the use of in-house designed database programs and in-house training programs.

7. A study should be conducted to further examine the entry-level training needs of those utilizing database systems.

8. A study should be conducted to focus specifically on future needs of database users and managers.

9. A study should be conducted of database end-users looking specifically at their uses of database systems.

10. A study should be conducted which focuses on the systems analysts' approach to designing database environments.

11. A study should be conducted to collect data on database instruction in educational institutions.

12. A study should be conducted which compares database education in the public sector with database uses in the private sector.

13. A study should be conducted which compares the instructional methods of numerous database courses in schools.

14. A study should be conducted which looks at database education and support offered in industry.

Implications

This study shows only a small portion of the population in western Washington state. It does, however, represent a wide cross-section of businesses from numerous cities across western Washington.

Although the findings show only one significant result -- the use of microcomputers with a database system -- this in itself is of some importance. It shows the high use of micros with vendor-purchased database systems and thus proves their popularity in the market.

Other results of this study show the incredible variety of systems, hardware, languages, skills, and plans that exist in business and show that the use of systems and software is as varied as the needs of the user.

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APPENDIX A

TITLES OF THOSE FILLING OUT THE QUESTIONNAIRE

Table 15

Titles of Those Filling Out the Questionnaire

Title	Frequency
Controller	5
Data Processing Manager	5
President	4
Accountant	3
Director, Information Systems	2
Manager, MIS	2
Office Manager	2
Administrator	2
Information and Systems Manager	1
Accounting Supervisor	1
Data Systems Coordinator	1
MIS Director	1
General Supervisor of Systems and Computing	1
Region Automation Specialist	1
Auditor	1
Inventory Systems Controller	1
Managing General Partner	1
Special Functions Manager	1
Assistant Vice President - Systems	1
Systems Manager	1
Planning and Control Manager	1
Administrative Specialist	1
Owner	1
Plant Manager	1
Manager, Administration and Finance	1
Manager, Technical Services	1
Director of Data Processing	1
Administrative Assistant	1
Technical Support Supervisor	1
Director of Data Processing	1
Data Processing Manager of Operations	1
Accountant	1
Total	49

APPENDIX B

DEPARTMENT TITLE OF THOSE FILLING OUT THE QUESTIONNAIRE

Table 16

Department Title of Those Filling Out the Questionnaire

Department Title	Frequency	Percent	Valid Percent	Cum Percent
Data Proc Center	9	18.4	20.0	20.0
Computer Center	1	2.0	2.2	22.2
Info Proc Center	3	6.1	6.7	28.9
Dept of Info Sys	9	18.4	20.0	48.9
* Other	23	46.9	51.1	100.0
	1	2.0	Missing	
	3	6.1	Missing	
Total	49	100.0	100.0	

* Other categories reported were:

Department	Frequency
Planning and Control	1
Region Operations	1
Accounting	5
MIS Department	1
Special Functions	1
Management Information Systems	1
Finance and Administration	1
Administration	4
Seattle Operations	1
Business Services	1
Business Office	1
DP Operations and Production	1
Main Office	1
Finance and Information Management	1
Data Processing Department	1
Executive Management	1
Total	23

APPENDIX C

PRIMARY JOB FUNCTION OF THOSE RESPONDING

Table 17

Primary Job Function of Those Responding

Job Function	Frequency	Percent	Valid Percent	Cum Percent
MIS Management	15	30.6	32.6	32.6
MIS Staff	1	2.0	2.2	34.8
Database Administrator	2	4.1	4.3	39.1
General Corporate Management	6	12.2	13.0	52.2
Financial Management	10	20.4	21.7	73.9
Administrative/Operational/ Technical	9	18.4	19.6	93.5
Information Operations Mgt	3	6.1	6.5	100.0
	3	6.1	Missing	
Total	49	100.0	100.0	

APPENDIX D

TOTAL YEARS THE COMPANY HAS BEEN IN BUSINESS

Table 18

Total Years the Company has been in Business

Total Years	Frequency	Percent	Valid Percent	Cum Percent
Greater than 2 but Fewer than or Equal to 5	5	10.2	10.4	10.4
Greater than 5 but Fewer than or Equal to 10	5	10.2	10.4	20.8
Greater than 10 but Fewer than or Equal to 20	10	20.4	20.8	41.7
Greater than 20	27	55.1	56.3	97.9
* Other	1	2.0	2.1	100.0
	1	2.0	Missing	
Total	49	100.0	100.0	

* 100 plus years in business

APPENDIX E

EDUCATION REQUIRED FOR AN ENTRY-LEVEL POSITION

Table 19

Education Required for an Entry-Level Position

Education	Frequency	Percent	Valid Percent	Cum Percent
High School	3	6.1	6.4	6.4
High School and On-the-Job Training	9	18.4	19.1	25.5
Community College	16	32.7	34.0	59.6
4 Year University	13	26.5	27.7	87.2
Graduate School	2	4.1	4.3	91.5
Vocational School	2	4.1.	4.3	95.7
* Other	2	4.1	4.3	100.0
	2	4.0	Missing	
Total	49	100.0	100.0	

* Other: No entry-level work available
4 year university plus 9 years' experience

APPENDIX F

PLANS FOR IMPLEMENTING A DATABASE SYSTEM

Table 20

Plans for Implementing a Database System

Implementation	Frequency	Percent	Valid Percent	Cum Percent
Within 6 Months	2	4.1	18.2	18.2
Within 1 Year	3	6.1	27.3	45.5
2 to 4 Years	3	6.1	27.3	72.7
* Other	1	2.0	9.1	81.8
No Plans	2	4.1	18.2	100.0
	38	75.5	Missing	
Total	49	100.0	100.0	

* Other: Already in use

APPENDIX G

NUMBER OF MINI/MAINFRAMES IN USE WITH A DATABASE

Table 21

Number of Mini/Mainframe Combinations in Use with Database

Computer	Frequency	Percent	Valid Percent	Cum Percent
Name not give	1	2.0	Missing	
	48	98.0	Missing	
Total	49	100.0	100.0	

APPENDIX H

DATABASE STRUCTURE IN USE

Table 22

Database Structure in Use

Structure	Frequency	Percent	Valid Percent	Cum Percent
Hierarchical	6	12.2	16.7	16.7
Relational	22	44.9	61.1	77.8
Network	5	10.2	13.9	91.7
* Other	3	6.1	8.3	100.0
	13	26.5	missing	
Total	49	100.0	100.0	

* Other: Use of both Hierarchical and Relational (2 cases)
Use of "File Manager" (1 case)

APPENDIX I

PERCENTAGE OF THE DAY SPEND ACCESSING THE DATABASE

Table 23

Percentage of the Day Spent Accessing the Database

Access Time	Frequency	Percent	Valid Percent	Cum Percent
Upper-Level Management:				
0 - 25 percent	36	73.5	92.3	92.3
25 - 50 percent	2	4.1	5.1	97.4
50 - 75 percent	1	2.0	2.6	100.0
	10	20.4	missing	
Total	49	100.0	100.0	
Mid-Management: (Department Directors)				
0 - 25 percent	27	55.1	67.5	67.5
25 - 50 percent	9	18.4	22.5	90.0
50 - 75 percent	4	8.2	10.0	100.0
	9	18.3	missing	
Total	49	100.0	100.0	
Operational Level: (Supervisors)				
0 - 25 percent	17	34.7	41.5	41.5
25 - 50 percent	13	26.5	31.7	73.2
50 - 75 percent	8	16.3	19.5	92.7
75 - 100 percent	2	4.1	4.9	97.6
	8	16.3	missing	100.0
Total	49	100.0	100.0	
Staff: (clerical, DP, WP, etc.)				
0 - 25 percent	8	16.3	19.0	19.0
25 - 50 percent	7	14.3	16.77	35.7
50 - 75 percent	16	32.7	38.1	73.8
75 - 100 percent	11	22.4	26.2	100.0
	7	14.2	missing	
Total	49	100.0	100.0	

APPENDIX J

PERCENTAGE OF TIME THE DATABASE IS UTILIZED

Table 24

Percentage of Time the Database System is Utilized

DBase Utilization	Frequency	Percent	Valid Percent	Cum Percent
Greater than 0 but Less than or Equal to 25 percent	5	10.2	11.1	11.1
Greater than 25 percent but Less Than or Equal to 50 percent	8	16.3	17.8	28.9
Greater than 50 percent but Less than or Equal to 75 percent	18	36.7	40.0	68.9
Greater than 75 percent but Less than or Equal to 100 percent	12	24.5	26.7	95.6
* Other	1	2.0	2.2	97.8
	5	10.1	missing	100.0
Total	49	100.0	100.0	

* Other: In one case, the system was being used to 50 percent with programming in progress which would increase the use.

APPENDIX K

DATABASE SKILLS APPLIED BY PRIMARY USERS

Table 25

Database Skills Applied by Primary Users
Where Several Answers Were Possible

Value Label	Frequency	Percent	Valid Precent	Cum Percent
Security and Access:				
Security	15	30.6	100.0	100.0
Access	34	69.4	100.0	100.0
File Structure Design:				
File Creation	20	40.8	100.0	100.0
File Index	15	30.6	100.0	100.0
File Organization	17	34.7	100.0	100.0
File Backup	26	53.1	100.0	100.0
File Recovery	16	32.7	100.0	100.0
* Other	2	4.1	100.0	100.0
Communications:				
Transmitting and Receiving Data	25	51.0	100.0	100.0
Data Environment:				
Managing Data	25	51.0	100.0	100.0
Defining Data	11	22.4	100.0	100.0
Queries	23	46.9	100.0	100.0
Memory Management	6	12.2	100.0	100.0

* Other: File Access and Data Access
Report Writing

APPENDIX L

TECHNOLOGICAL SKILLS NEEDED BY USERS

Table 26

Technological Skills Needed by Users
Where Multiple Responses Were Possible

Skills	Frequency	Percent	Valid Percent	Cum Percent
Word Processing	16	32.7	100.0	100.0
Spreadsheet	18	36.7	100.0	100.0
Graphics	3	6.1	100.0	100.0
Communication Technology	3	6.1	100.0	100.0
Operating System	24	49.0	100.0	100.0
* Other	7	14.3	100.0	100.0

* Other:		
	Data Entry	1
	DBMS Knowledge	1
	Intellect Training	1
	Knowledge of Applications	1
	Data Processing	1
	DBase III+ language	1
	Training on Database in use	1
	Total	7

APPENDIX M

MANAGEMENT SKILLS REQUIRED OF USERS

Table 27

Management Skills Required of Users
Where Multiple Responses Were Possible

Management Skills	Frequency	Percent	Valid Percent	Cum Percent
Program Management:				
Project Planning	17	34.7	100.0	100.0
Control Techniques	6	12.2	100.0	100.0
Analysis of Current System:				
Data Collection	20	40.8	100.0	100.0
Identificaiton of Problems	17	34.7	100.0	100.0
Design of Modified or Newly Proposed System:				
Database Specifications	10	20.4	100.0	100.0
Input/Output Specifications	17	34.7	100.0	100.0
Programming Specs	8	16.3	100.0	100.0
Implementation:				
Building Test Data Sets	11	22.4	100.0	100.0
System Performance Evaluation	16	32.7	100.0	100.0
Communications:				
User Interviews	10	20.4	100.0	100.0
Documentation	13	26.5	100.0	100.0
Writing Manuals	12	24.5	100.0	100.0
Presentations & Proposals	12	24.5	100.0	100.0

APPENDIX N

ADDITIONAL SKILLS NEEDED BY USERS

Table 28

Additional Skills Needed by Users
Where Multiple Responses Were Possible

Additional Skills	Frequency	Percent	Valid Percent	Cum Percent
Better Terminology/Concepts	28	57.1	100.0	100.0
Computer Systems Config.	11	22.4	100.0	100.0
Systems Analysis and Design	13	26.5	100.0	100.0
Flow Charting	10	20.4	100.0	100.0
Database Management	13	26.5	100.0	100.0
Understanding of Computer Languages	12	24.5	100.0	100.0
Understanding of Management Information Systems	22	44.9	100.0	100.0
* Other	2	4.1	100.0	100.0

* Other: Better Understanding of their own business functions and their applications.

More sophisticated inquiry and reporting capabilities

APPENDIX O

INITIAL COVER LETTER

Dear Data Processing Manager

The process of maintaining accurate and current statistics on the storage of data is critical today. Not only is it critical for the business person, such as yourself, but it is also critical for the educators who assist in training and providing information for students on trends and techniques critical to the success of businesses.

A necessary step in keeping the communication open between education and industry, and in successfully meeting each other's needs is research. To increase our knowledge and hopefully to provide you with valuable statistics as a result, a questionnaire is enclosed. This questionnaire will result in a descriptive study of the database management systems in use in western Washington.

The enclosed questionnnaire is the only one you will receive. We would like to have your input as an expert in the field. This will be the only questionnaire you will receive. This questionnaire will be sent to approximately three to four hundred other businesses of all sizes in western Washington. If you wish, you may receive results of the final survey free of charge. Simply include your name and address on the last page of the questionnaire.

Your time in filling out this questionnaire and sharing your expertise is greatly appreciated. Please return it by the first week in November. Again, this survey will assist many in education and industry and is one way to keep the communication lines between the two open.

A stamped, self-addressed envelope is enclosed for your convenience.

Sincerely,

Janet Wilson
Doctoral Student

Richard Aukerman
Committee Advisor

APPENDIX P

FOLLOW-UP LETTER

Dear Data Processing Manager

A necessary step in keeping the communication open between education and industry, and in successfully meeting each other's needs is research. Two weeks ago you received a questionnaire. We would greatly appreciate your input through that questionnaire as a valued expert in the field.

Your time in filling out this questionnaire and sharing your expertise is greatly appreciated. Please return it by the first week in February. Again, this survey will assist many in education and industry and is one way to keep the communication lines between the two open.

A stamped, self-addressed envelope is enclosed for your convenience.

Sincerely,

Janet R. Wilson
Doctoral Student

Richard Aukerman
Committee Advisor

APPENDIX Q

QUESTIONNAIRE TOOL

ID No._____

QUESTIONNAIRE ON DATABASE MANAGEMENT SYSTEMS
For: Oklahoma State University
College of Business
Stillwater, Oklahoma 74075

RETURN TO: Janet R. Wilson
817 - 30th Avenue South
Seattle, WA 98144

Questionnaire No._____

This questionnaire is a survey of Database Managers to determine what database systems are in use in businesses in western Washington State. If you are presently using a database system, please complete this questionnaire by checking the appropriate response.

Please return this questionnaire no later than
Friday, February 5, 1988.

1. Please check the description below that most accurately describes the service performed or product manufactured by your company. (Check only one)

____ Manufacturing: Computers & DP
____ Computer & DP Services
____ Other Manufacturing (non-DP)
____ Government
____ Trade: Wholesale & Retail
____ Medical and Legal Services
____ Utilities
____ Transportation Services
____ Construction
____ Financial Services
____ Other (please specify): _____

2. What is your title?_____

3. Which of the following best describes the title of your department:

____ Data Processing Center
____ Computer Center
____ Computer and Data Processing Center
____ Information Processing Center

____ Department of Information Systems
____ Other (please specify): _____

4. Which title among the following most closely describes your job function or responsibility? (Check only one)

____ MIS Management
____ MIS Staff
____ Database Administrator

____ General/Corporate Management
____ Financial Management
____ Administrative/Operational/Technical
____ Consultant

____ Information Operations Management
____ Information Operations Staff
____ Other (please specify): _____

5. How many years has your company been in business?

____ Less than 1 year
____ more than 1 year but fewer than or equal 2 years
____ more than 2 years but fewer than or equal 5 years
____ more than 5 years but fewer than or equal 10 years
____ more than 10 years but fewer than or equal to 20 years
____ more than 20 years
____ Other (please specify): _____

6. How many full-time employees are there in your firm?

____ 1 or more but fewer than or equal to 20
____ more than 20 but fewer than or equal to 50
____ more than 50 but fewer than or equal to 100
____ more than 100 but fewer than or equal to 250
____ more than 250 but fewer than or equal to 500
____ more than 500 but fewer than or equal to 1000
____ more than 1000 but fewer than or equal to 5000
____ more than 5000 but fewer than or equal to 10,000
____ more than 10,000 (please specify approximate number):_____

7. How many employees are in your department?

____ 1 or more but fewer than or equal to 10
____ more than 10 but fewer than or equal to 20
____ more than 20 but fewer than or equal to 30

____ more than 30 (please specify approximate number):_____

8. What is the approximate 1986 net revenue of your firm?

____ less than or equal to $100 thousand
____ less than or equal to $1 million
____ more than $1 million but less than or equal to $2 million
____ more than $2 million but less than or equal to $5 million
____ more than $5 million but less than or equal to $15 million
____ more than $15 million but less than or equal to $25 million
____ more than $25 million but less than or equal to $50 million
____ more than $50+ million
____ Other (please specify):_____

9. What is the highest educational level completed by those hired for entry-level work with database systems within your department?

____ high school
____ high school plus on-the-job education
____ community college education
____ four-year university
____ graduate school
____ vocational
____ Other (please specify): _____

10. Do you now use some form of database system within your organization? If yes, continue to the next question. If no, do you have plans for implementing a database system in your organization within the next,

____ 6 months
____ 1 year
____ 2 to 4 years
____ Other (please specify):_____
____ No plans

11. Check the type of computer system on which you run your database system. Check all that apply:

	Approximate Number in Use:
(a) Microcomputers (personal computers):	
____ Apple II	_____
____ Apple III	_____
____ Mackintosh	_____
____ IBM Personal or compatibles	_____
____ TRS-80	_____
Other (please specify):_____	_____

(b) ____ Minicomputer

Brand Name: _____
Approximate number in use:_____

(c) ____ Minicomputer in conjunction with a mainframe

Brand Name: _____
Approximate number in use:_____

(d) ____ Mainframe

Brand Name: _____
Approximate number in use:_____

(e) ____ Supercomputers

Brand Name: _____
Approximate number in use:_____

12. Which of the following most closely describes the design of your database system?

____ Application package purchased from a Vendor.
Please specify application name:_____

____ Database system designed in-house.

____ BASIS (DEC)
____ IMS
____ INQUIRE (IBM)
____ IDMS
____ MAGNUM
____ SYSTEM 1022 (DEC)
____ SYSTEM 2000
____ TOTAL
____ MODEL 204
____ ADABAS

____ Other (please specify): _____

13. Is your database system design:

____ Hierarchical
____ Relational
____ Network
____ Other (please specify): _____

14. What are the primary job functions of those utilizing database facilities for daily operations in your organization? Check all that apply.

____ Clerical
____ Data processing
____ Word processing
____ Data entry
____ Programming
____ Systems analysis
____ Database managers
____ Executives
____ Other (please specify): _____

15. Is your database system accessed regularly by upper-level management? If no, continue to the next question. If yes, is the primary purpose for accessing the database for:

____ Inquiry
____ Decision making for long-term goals and objectives
____ Daily observation of operations
____ Short-term decision making
____ Other (please specify):_____

16. To the best of your knowledge, what approximate percentage of the work day is spent by the following levels of management in direct access with the database system:

	0-25%	25-50%	50-75%	75-100%
Upper-level management (presidents, CEOs, VPs)				
Middle-management (department directors)				
Operational-level management (supervisors)				
Staff (clerical, DP, WP, etc.)				
Other (please specify):				

17. To the best of your knowledge, to what ultimate abilities is your database system being utilized?

____ more than 0 percent but less than or equal to 25 percent
____ more than 25 percent but less than or equal to 50 percent
____ more than 50 percent but less than or equal to 75 percent
____ more than 75 percent but less than or equal to 100 percent
____ Other (please specify):_____

18. To the best of your knowledge, which of the following database related skills are applied by the primary users of the database system? (Check all that apply.)

(a) Security and Access:
____ Security
____ Access
____ Other (please specify): _____

(b) File Structure Design:
____ File creation
____ File indexing
____ File organization
____ File backup
____ File recovery
____ Other (please specify): _____
_____

(c) Communications:
____ Transmitting and receiving data

(d) Data Environment:
____ Managing data
____ Defining data
____ Queries
____ Memory management

19. Which computer languages are utilized by the primary users of the database system? (Check all that apply)

____ SQL
____ COBOL
____ FORTRAN
____ BASIC
____ PASCAL
____ PL/1
____ RPG

____ 4TH Generation language (please specify):_____
____ Other (please specify): _____
____ Not in use

20. What technological related skills, if any, are needed by the primary users of the database system? (Check all that apply)

____ Word processing
____ Spreadsheet
____ Graphics
____ Communications technology
____ Operating system
____ Other (please specify): _____

21. Are the any of the following management related tasks required of the primary users of the database system? If no, continue to the next question. If yes, check all that apply.

(a) Program management:
____ Project planning
____ Control techniques
____ Other (please specify):_____

(b) Analysis of current system:
____ Data collection
____ Identification of problems
____ Other (please specify): _____

(c) Design of modified or newly proposed systems:
____ Database specifications
____ Input/output specifications
____ Programming specifications
____ Other (please specify): _____

(d) Implementation:
____ Language selection
____ Building tests data sets
____ System performance evaluation
____ Other (please specify): _____

(e) Communications:
____ User interviews
____ Documentation
____ Writing manuals
____ Presentations and proposals
____ Other (please specify): _____

23. Which of the following skills do you feel would be beneficial to the persons utilizing the database -- beyond what they already know. (Check all that apply)

____ Better understanding of basic concepts and terminology
____ Computer systems configuration
____ Systems analysis and Design
____ Flow charting
____ Database management
____ Understanding of computer languages
____ Understanding of management information systems
____ Other (please specify): _____
____ Not needed

24. Do you plan to change your database system in the near future? If no, you have completed the questionnaire. If yes, how?

____ Redesign the database system
____ Add new applications to the database system
____ Purchase additional hardware and/or software
____ Expand the entire system
____ Other (please specify): _____

VITA

Janet Ruth Wilson

Candidate for the Degree of

Doctor of Education

Thesis: THE EFFECT OF SELECTED CHARACTERISTICS OF BUSINESSES AND THE EXTENT OF DATABASE UTILIZATION IN WESTERN WASHINGTON STATE

Major Field: Business Education

Biographical:

Personal Data: Born in Vancouver, Washington, December 16, 1949, the daughter of Richard R. Wilson and Eleanor J. Hiebert.

Education: Graduated from W. F. West High School, Chehalis, Washington, in June, 1968; received Bachelor of Arts Degree in Education from Central Washington University in December, 1975; received Master of Education Degree from Seattle University in June, 1981; completed requirements for the Doctor of Education Degree at Oklahoma State University in July, 1988.

Professional Experience: Teaching Assistant, College of Business, Oklahoma State University, August, 1986, to May, 1987; Instructor, Department of Computer Studies, Lake Washington Vocational Technical Institute, September, 1981, to August, 1986; Computer Consultant, July, 1980, to August, 1981; Instructor, ITT Technical Institute, September, 1977, to July, 1980; Part-time Instructor, Bellevue and Edmonds Community Colleges, 1977 to 1980.