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Bianca T. Gilyot
Southern University at New Orleans
New Orleans, LA 70126, USA

Wendy Zhang
Southern University at New Orleans
New Orleans, LA 70126, USA

Ghasem S. Alijani
Southern University at New Orleans
New Orleans, LA 70126, USA

Dayanand Thangada
Southern University at New Orleans
New Orleans, LA 70126, USA

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Decision Support System: A Study of Telework Initiatives

Bianca T. Gilyot, Wendy Zhang, Ghasem Alijani, Dayanand Thangada
Graduate Studies Program in Computer Information Systems
Southern University at New Orleans
New Orleans, LA 70126, USA

Abstract

Since the government pushed to expand and integrate the capabilities of the information superhighway, many government agencies have undergone extensive research to study the areas of technology. The concept of telecommuting has particularly become a recent area of focus for many Americans as a justifiable alternative to traditional working conditions. Despite many studies documenting the potential overall benefits to the working community, the telecommuting phenomenon's initiative has not reached a national, mainstream level of success yet. This study examines why certain levels of isolated telecommuting success exists within the United States. Data obtained for this study came from journals, government websites, and magazine articles. This study also examines the extent or lack of effective implementation of telecommuting programs of several state governments in an attempt to rank the programs, according to the chosen criteria. The criteria look at how persuasively those initiatives are being sold to management and agencies in that state. This study has used Decision Support Systems to enhance the existing research on the factors of telecommuting. Further analysis will compare the state rankings according to the factors such as commuting challenges and economic factors. This study should attract interest to all strata of the business, educational, psychological, and legal communities, which attempt to research telecommuting's purpose and scope.

Keywords: decision support system, telecommuting network, telecenter, distance learning

1. INTRODUCTION

For over 40 years computers have aided the decision making process. The evolutionary view of computer-based information systems (CBIS) has a strong logical basis. First, there is a clear cut sequence through time: transaction processing systems appeared in the mid-1950s, management information systems (MIS) followed in the 1960s, office automation systems were developed mainly in the 1970s, and Decision Support Systems (DSS) was a product of the 1970s that was expanded in the 1980s. In the 1990s, we saw group support systems and neutral computing emerging, as well as many hybrid (integrated) computer systems. Entering the twenty-first century, we see a trend toward Web-based applications, use of a knowledge management approach, and incorporation of decision support capability in supply chain management and enterprise resource planning (Aronson, Turban, 2001). The interest in DSS has created a lot of research activity among the academic community. Decision Support Systems has enabled elevated levels of data analysis across many strata of the business and academic community. DSS enables multidimensional analysis of data in a timely way. With the need for real-time data analysis in order to make decisions, the development of DSS has become a necessity for many organizations.

G.A. Gorry and M.S. Scott Morton provided a definition for Decision Support Systems: Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. They comprise a computer-based support system for management decision makers who deal with semi-structured problems (Gorry, Morton, 1989). It should be stressed that the technological capabilities DSS provides cannot substitute the human component of a DSS. Ultimately, the measure of the success of a DSS is determined by how the decision maker uses the information produced by the DSS to make decisions. The data management subsystem can be interconnected with the corporate data warehouse (Aronson, Turban, 2001). W.H. Inmon, who has been acknowledged as the father of data warehousing, defines a data warehouse as a collection of integrated subject-oriented databases designed to support the DSS function, in which each unit of data is non-volatile and relevant to some moment in time (Inmon, 1992).

D.J. Power, the editor of DSSResources.com, has documented the history of spreadsheets and explains the underlying concept of an electronic spreadsheet. An electronic spreadsheet organizes information into software-defined columns and rows. The data can then be added up by a formula to give a total or sum. The spreadsheet program summarizes information from many paper sources in one place and presents the information in a format to help a decision maker see the financial big picture for the company (Power, 2000). Spreadsheets are widely used in end-user developed DSS. The most popular end user tool for developing DSS is Microsoft Excel. Excel includes dozens of statistical packages, a linear programming package (solver), and many financial and management science models. Because packages such as Excel can include a rudimentary database management system (DBMS) or can readily interface with one, they can handle some properties of a database-oriented DSS, especially the manipulation of descriptive knowledge. Some spreadsheet development tools include what-if analysis and goal-seeking capabilities (Aronson, Turban, 2001).

The capabilities of data warehousing and spreadsheet technologies can produce an array of meaningful information. The recognition of its capabilities initiated a research effort to apply those technologies to produce useful information concerning the current state of nation-wide telework initiatives.

Early in the 1990s, as a result of its growth, the Internet was recognized as a universal resource applicable to all areas of society. During President Clinton's administration, the telecommuting act of 1992 was passed to ensure that society would assimilate and grow with available technological advances. The Federal Government named Jack Nilles as the father of telecommuting in response to his extensive knowledge in this area. Nilles attributes the explosive increase in the number of telecommuters to the immense growth of the Internet.

The U.S. Office of Personnel Management notes that "Flexible workplace," work-at-home, telecommuting, teleworking all refer to a work situation or an employer/employee relationship in which the location of the work site is shifted away from the traditional office (U.S. Office of Personnel Management, 2001). Telework centers are located in suburbs and outlying cities across the country. They provide an alternative office setting for employees who otherwise face a long commute--in time or distance--between home and work. Telecommuting is moving the work to the workers instead of moving the workers to work; periodic work out of the principal office, one or more days per week either at home or in a telework center. The emphasis here is on the reduction or elimination of the daily commute to and from the workplace (Nilles, 2001). Through telecommunications innovations in information technology, the transfer of information, specifically data, voice, and video, is increasingly becoming a part of the traditional architecture of many businesses (O'Brien, 2002).

2. STATEMENT OF THE PROBLEM

By utilizing the technologies of data warehousing and spreadsheet technologies the resulting information can help make important decisions based on objective data. The scope of this research endeavor focuses on nationwide telework data, particularly data that measures telework initiatives.

Despite being underway for more than a decade, telework programs are still new or non-existent for most State Agencies and corporate organizations. Management is still reluctant to accept the telecommuting concept as a mainstream business practice. Many employers hesitate to integrate telecommuting programs into their business policies because of the expense and restructuring involved in undertaking the telecommuting venture (Ballard, 2001).

There is no significant management to manage workers remotely; "It is still scary to be in a position to manage people you can't see" (OIRM Pilot Study, 2000; HR Magazine, 2001). There are also technological barriers as well as literacy skills that would be needed to successfully implement telecommuting programs that are lacking in some states. It is difficult for eligible teleworkers to find such positions. Careful planning and legal issues have to be considered for a telecommuting program to operate efficiently. Establishment of effective guidance on program practice is a key factor for continued and successful growth of the telework movement. Another problem with telecommuting from the perspective of the employers is the issue of cost sharing of telecommuting equipment. Optimal telecommuting equipment would include a phone line, specifically a DSL line, and hardware, such as the computers and accompanying peripherals (printers, microphones, scanners, and fax machines) (Kistner, 2001). New technology has enabled much of these functions to be accomplished by one system such as the Xerox "Three in One" which prints, copies, scans, and faxes. Some companies offer equipment reimbursement for the telecommuting workforce, but some companies do not offer any type of assistance to telecommuting employees. If companies would see that the overhead cost of setting up home offices is at a fraction of the cost of the traditional offices, they would consider setting this up as an alternative.

Jack Nilles, who has been referred to as the "father of telework", suggests that telecommuting should be increased especially in areas closely affected by the WTC tragedy. Telecommuting would avoid the decreased productivity primarily due to the trauma experienced not only by the New York and Washington area employees, but most of the country (Nilles, 2001). In order for management to retain and recruit professionals in many areas, telecommuting would probably be an attractive benefit to retain top employees and prospects. Information Technology professionals want to have the option to telecommute in their current jobs because they realize that the technology is already in place to realistically complete their work responsibilities by telecommuting (Boyd, 2001).

With the World Trade Center (WTC) tragedy, telecommunication options have been viewed as a priority for global business communications. Before the prioritization of telecommunication options, telecommuting had already started to materialize, mainly in the form of government research projects to test part time and full time telecommuting situations. To integrate the information highway's capabilities into every aspect of society, government studies and statistics are needed to provide telecommuting's effectiveness in business. Various government agencies have published their studies on telecommuting. Agencies such as the Department of Labor, the Office of Personnel Management, and the Department of Transportation have had promising results from their findings. They focus on the benefits and disadvantages of telecommuting specific to their departments. The Department of Labor's study demonstrates that America is going through an historic transformation in the workplace and concludes that telework holds vast potential to benefit workers, employers, and the American workforce as a whole: to help employees balance the demands of work and family, to provide diversity and new opportunities for Americans who are outside the economic mainstream, and to increase worker productivity and to help companies compete in the global marketplace.

Telework's success depends on a collective collaboration of educational institutions, corporations, technological advances, and the government (U.S. Department of Labor, 2000). Immediately after the tragedy, corporate America felt a need to assure that their data was secure. Corporations turned to many areas of technology such as the educational, industrial, and analytical for answers. Three key elements to assure the recovery of data and voice networking include: redundancy, backup, and geographic disbursement (Freund, 2001). The U.S. Department of Personnel Management's study presents examples of telework success stories from a variety of jobs and work situations. The Department of Personnel Management realizes its leadership role in expanding telecommuting options in businesses (U.S. Office of Personnel Management, 2001). The Department of Transportation's study closely examines the transportation and environmental benefits of telecommuting. This study focuses on the increase in productivity by telecommuting instead of physically commuting to the traditional workplace. The study also suggests that overall emissions of pollutants are projected to increase by almost 40 percent by 2010 because we are driving more and under more congested conditions (U.S. Department of Transportation, 2000).

3. STATEMENT OF THE OBJECTIVE

The purpose of this study is to take raw telework initiative data and produce useful information for data analysts, telework policy makers and persons who are interested in the dynamics of telecommuting. Data warehousing, as well as spreadsheet technologies, was implemented to help this research process.

A recent study entitled, "Telework Initiatives: A Comparison of State Rankings" (Gilyot, Lagrange, Zhang, 2002) analyzed the telework initiatives of 33 selected states.

This study measures the telework initiatives of all 50 states plus the District of Columbia, enabling a more objective data analysis of telework initiatives. This study examines the degree of nation-wide as well as statewide telecommuting by analyzing each state's telework initiative based on the chosen criteria. These criteria measure how persuasively those initiatives are being sold to management and agencies in that state. Further analysis will compare the state rankings according to the factors such as commuting challenges and economic factors. The trends identified in this study will help public and private sector human resource departments make strategic decisions in order to implement or enhance telework programs in their states.

This study should be of interest to all areas of the business, legal, psychological, and educational communities who are willing to increase their level of understanding of telecommuting's scope and efficiency. This study will use techniques of data warehousing and data mining to enhance the existing research on the factors of telecommuting.

4. RESEARCH ISSUES EXAMINED

Five major research issues about nationwide as well as statewide telework initiatives were examined in this study. The telework initiative data warehouse and the spreadsheet capabilities produced information in the form of reports, charts and tables that were used for examining the issues. The five issues examined are as follows:

1. States with strong economies, high commuting issues, and a progressive distance-learning program are predicted to have a progressive telework initiative.
2. States with weak economies are predicted not to have a progressive telework initiative.
3. States with progressive distance learning programs are predicted not to have a regressive telework initiative.
4. States with high commuting issues are predicted not to have a regressive telework initiative.
5. States with strong economies are predicted not to have a regressive telework initiative.

5. METHODOLOGY

The objective of this study was to examine the degree of nation-wide as well as statewide telecommuting by analyzing each state's telework initiative based on chosen criteria. These criteria measure how persuasively those initiatives are being sold to management and agencies in that state. A data warehouse was designed as well as spreadsheet capabilities in order to help achieve the objective of transforming raw data into meaningful telework initiative information. Figure 5.1 provides an illustrative overview of the hierarchical structure of the variables and sub variables identified as they correlate to statewide Telework initiatives. Correlation is a statistical technique, which can show whether and how strongly pairs of variables are related. The variables that were identified were economy, commuting challenges and distance learning. The economy variable has three sub variables: the number of people unemployed, the average annual pay, and the poverty rate. The commuting challenge variable also has three variables: the number of people who worked at home, the population density, and the travel time to work. The distance learning variable also has three sub variables: the highest degree offered, library services, and bookstore services.

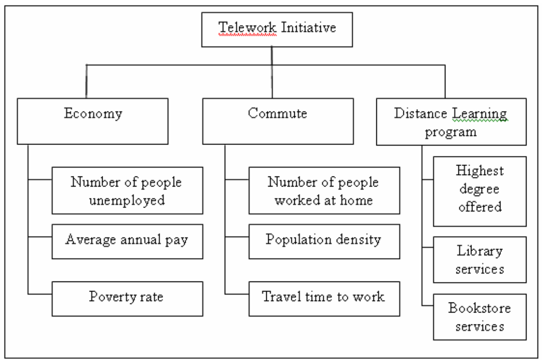

Figure 5.1 Variable Hierarchy

The population size included all 50 states of the United States plus the district of Columbia. Figure 5.2 displays the regional divisions of the United Sates according to the 2000 US Census.

Source: U.S. Census Bureau, 2000

Figure 5.2 U.S. Regional Divisions

The regional divisions identified include: Midwest, Northeast, South and West. The data for all of the sub variables of the economy and the commuting challenges variables were obtained from the 2000 US Census except for the average annual pay sub variable data, which were obtained from the Bureau of Labor Statistics for the year 2000. The sub variables concerning each state's distance learning program were obtained differently from the previous sub variables. In order to choose a public university to evaluate for each state, each public university's enrollment was evaluated and the institution with the highest enrollment was chosen. The enrollment data were obtained from the Yahoo education directory. Each chosen institution's distance learning program was evaluated by obtaining the information from their website (U.S. Census Bureau, 2000; Bureau of Labor Statistics, 2000; Yahoo, 2003).

6. METHOD OF ANALYSIS AND PRESENTATION

6.1 Raw Database

A database was created as the first step towards the transformation of the raw data gathered into information useful for measuring telework initiatives. The data entered into the form were automatically updated into the *TELEWORK_RAW_DATA* table. The T*ELEWORK_RAW_DATA* table was exported to a spreadsheet in order to analyze the data.

The *MINIMUM, MEDIAN,* and *MAXIMUM* values were computed for each numerical sub variable value. In order to assign points to the sub variables, it was necessary to calculate ranges for each sub variable. The 0 through 4^{th} quartiles were computed for each numerical sub variable in order to determine the range values. The distribution of the data sets was divided into four. The four divisions are known as quartiles. The median is the second quartile, or 50 % of the distribution. The variation of the data can be summarized in the interquartile range, which is the distance between the first and third quartile. The *TELEWORK_RAW_DATA* table was then normalized according to the main variables; economy, commute and distance learning.

6.2 Sub- variable Calculations

The raw data of the economy sub variables were assigned points according to the qualifying ranges, which are displayed in Table 6.1. The unemployment rate ranges from 1.9% to 5.6%. The average annual pay ranges from $25,194 to $56,024. The poverty rate ranges from 5.5 % to 17.7%. For the number unemployed, the states with the range of 13,453 to 36,334 received zero points. For the average annual pay, the states with the range of $25,194 to $28,986 received zero points. For the poverty rate sub variable, the states with the range of 5.5% to 9.0% received zero points. This process was repeated for each range level for the 1 point range and the 2 point range.

Number Unemployed	
Range	**Points**
1.9------------------2.3	=2
2.4------------------2.9	=1
3.0------------------5.6	=0
Average Annual Pay	
Range	**Points**
25,194-----------28,986	=0
28,987-----------36,640	=1
36,650-----------56,024	=2
Poverty Rate	
Range	**Points**
5.5------------------9.0	=0
9.1-----------------13.1	=1
13.2-----------------17.7	=2

Table 6.1 Sub Variable Points Range Table

The total points were calculated by summing the points assigned for each sub variable. The 0 through 4^{th} quartiles of the values in the total points column were computed. The total economy value was figured according to the qualifying range, which is illustrated in Table 6.2.

In order to assign a letter evaluation (S, A, W: Strong, Average, Weak) for each state's economy variables, the EV_LETTERS table was created. Data from the EV_POINTS table were transformed into letter assignments based on the point to letter qualifiers, which are illustrated in Table 6.3. Each economy sub variable received a letter evaluation as well as the economy variable.

EVP_TOTAL_POINTS	
Range	**Points**
0---------------------1.9	=0
2.0---------------------3.9	=1
4.0---------------------6.0	=2

Table 6.2 Economy Variable Total Points Range Table

Economy		
Abbr.		**Points**
W	Weak	=0
A	Average	=1
S	Strong	=2

Table 6.3 Economy Point-Letter Qualifier Table

Number Worked At Home	
Range	**Points**
0.8-----------------1.2	=0
1.3-----------------1.9	=1
2.0-----------------3.2	=2
Population density	
Range	Points
1.1----------------41.3	=0
41.4--------------202.8	=1
202.9-------------9316.4	=2
Travel time to work	
Range	**Points**
15.8------------------21.7	=0
21.8------------------25.5	=1
25.6------------------31.7	=2

TABLE 6.4 Commute Range Table

In order to assign points to each state's commute variables, the CV_POINTS table was created. The raw data of the commute sub variables were assigned points according to the qualifying ranges, which are illustrated in Table 6.4. The commute range table consists of the ranges of the commute sub variables. The sub variables were evaluated and the points were assigned for each state. The sub variables are the number of people who worked at home, the population density, and the travel time to work. The range of possible points is from zero to two points.

The total points were calculated by summing the points assigned for each sub variable. The 0 through 4th quartiles of the values in the total points column were computed. The total commute value was figured according to the qualifying range, which is illustrated in Table 6.5.

CVP_TOTAL_POINTS	
Range	**Points**
0---------------------1.9	=0
2.0---------------------3.9	=1
4.0---------------------6.0	=2

Table 6.5 Commute Variable Points Range Table

In order to assign a letter evaluation (*H, M, L*: High, Medium, Low) for each state's commute variables, the *CV_LETTERS* table was created. Data from the *CV_POINTS* table were transformed into letter assignments based on the point to letter qualifiers, which are illustrated in Table 6.6. Each commute sub variable received a letter evaluation as well as the commute variable.

Commute		
Abbr.		**Points**
L	Low	=0
M	Medium	=1
H	High	=2

Table 6.6 Commute Point-Letter Qualifier Table

In order to assign points to each state's distance learning program variables, the *DLV_POINTS* table was created. The raw data of the distance learning sub variables were assigned points according to the qualifying ranges, which are illustrated in Table 6.7. The Distance learning range table illustrates the range of possible points for each of the sub variables of the distance learning variable. The sub variables are; highest degree offered, library services, and bookstore services.

Highest Degree Offered		
Abbr.		**Points**
N	None	=0
U	Undergrad	=1
G	Graduate	=2
Library Services Offered		
Abbr.		**Points**
N	No	=0
Y	Yes	=2
Bookstore Services Offered		
Abbr.		**Points**
N	No	=0
Y	Yes	=2

Table 6.7 Distance Learning Range Table

The total points were calculated by summing the points assigned for each sub variable. The 0 through 4th quartiles of the values in the total points column were computed. The total distance learning value was figured according to the qualifying range, which is illustrated in Table 6.8.

DLVP_TOTAL_POINTS	
Range	**Points**
0---------------------1.9	=0
2.0---------------------3.9	=1
4.0---------------------6.0	=2

Table 6.8 Distance Learning Variable Points Range Table

In order to assign a letter evaluation (*P, O, R*: Progressive, Ordinary, Regressive) for each state's distance learning variables, the *DLV_LETTERS* table was created. Data from the *DLV_POINTS* table were transformed into letter assignments based on the point to letter qualifiers, which are illustrated in Table 6.9.

Each distance learning sub variable received a letter evaluation as well as the distance-learning variable. The *TELEWORK_STATUS* table illustrates the overall letter as well as point evaluations.

Distance Learning		
Abbr.		**Points**
R	Regressive	=0
O	Ordinary	=1
P	Progressive	=2

Table 6.9 Distance Learning Point-Letter Qualifier Table

6.3 Star Schema Model

The tables were exported from the spreadsheets to the database in order to implement the data warehouse. The data warehouse was designed using the Star schema model. The Star schema is a data modeling technique used to map multidimensional decision support data into a relational database. Star schemas yield an easily implemented model for multidimensional data analysis while still preserving the relational structures on which the operational database is built. The basic Star schema has four components: facts, dimensions, attributes, and attribute hierarchies (Coronel, Rob, 1997).

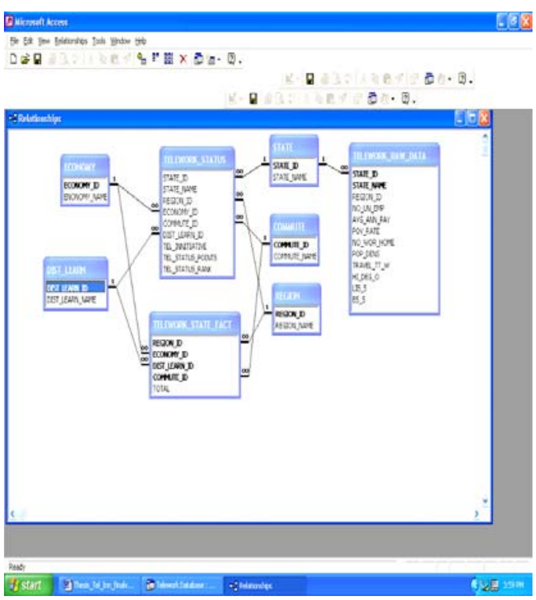

Figure 6.1: Star Schema model

Figure 6.1 illustrates the resulting Star schema model in which the data warehouse was based. According to Figure 6.1, the tables that make up the operational database include; *STATE, TELEWORK_RAW_DATA*, and *TELEWORK_STATUS*. Facts are numeric measurements (values) that represent a specific business aspect or activity.

Facts are normally stored in a fact table that is the center of the Star schema. The fact table contains facts that are linked through their dimensions. According to Figure 6.1, the fact table is identified as *TELEWORK_STATE_FACT*.

Dimensions are qualifying characteristics that provide additional perspectives to a given fact. Dimensions are stored in dimension tables. According to Figure 6.1, the four dimension tables are identified as; *REGION, ECONOMY, COMMUTE* and *DIST_LEARN*. Each dimension table contains attributes. Attributes are used to search, filter, or classify facts. Dimensions provide descriptive characteristics about the facts through their attributes. According to Figure 6.1, the *REGION* dimension attributes include *REGION_ID* and *REGION_NAME*. The *ECONOMY* dimension attributes include *ECONOMY_ID* and *ECONOMY_NAME*. The *COMMUTE* dimension attributes include *COMMUTE_ID* and *COMMUTE_NAME*. The *DIST_LEARN* dimension attributes include *DIST_LEARN_ID* and *DIST_LEARN_NAME*.

The Star schema, through its facts and dimensions, can provide the data when needed and in the required format. The Star schema can provide this data without imposing the burden of additional and unnecessary data that commonly exist in operational databases. Dimensions can be perceived as the magnifying glass through which the facts are studied. Fact and dimension tables are related by foreign keys and are subject to the primary key/foreign key constraints. The primary key on the one side, the dimension table, is stored as part of the primary key on the many side, the fact table. The fact table is related to many dimension tables; therefore the primary key of the fact table is a composite primary key. Figure 6.1 illustrates the relationships between the *TELEWORK_STATE_FACT* table and the *REGION, ECONOMY, COMMUTE,* and *DIST_LEARN* dimension tables. The composite key for the *TELEWORK_STATE_FACT* table is composed of *REGION_ID, ECONOMY_ID, COMMUTE_ID,* and *DIST_LEARN_ID*. Each record in the *TELEWORK_STATE_FACT* table is uniquely identified by the combination of values for each of the fact table's foreign keys. Combining the foreign keys pointing to each dimension table to which it is related forms the fact table's primary key. Because the dimension tables contain only non-repetitive information (all unique regions, all unique economies, etc.), the dimension tables are smaller than the fact table.

7. FINDINGS

Using the telework data warehouse implemented, this research project examined nation-wide as well as statewide telework initiatives. Five research issues were examined. Analysis of the nationwide as well as statewide telework initiatives showed different levels of telework initiatives.

The cross-reference analysis diagram as illustrated in Table 7.1 is the most revealing indicator. It is designed to take a three dimensional view of the telework initiative factors. There are three factors: economy, commuting issues, and distance learning with three levels of evaluation (top, bottom, middle) for each factor. This yields 27 possibilities of arrangements (3^3). This matrix enables a multidimensional analysis.

The abbreviations for the economy variable are represented by S-Strong, A- Average, W- Weak. The Commute variable is represented by L-Low, M-Medium, H-High. The Distance Learning variable is represented by P-Progressive, O-Ordinary, R-Regressive. The totals are represented for all three variables. This type of representation of the point totals of the variables is an early start to the data visualization. All the States are represented in this matrix. The totals for the commute and the distance learning variables are totaled horizontally. The total for the economy variable is totaled vertically. This enables an easier correlation analysis. The purpose of correlation is to identify the relationship between variables. The totals for the Low commute variable were 6, 2, and 1. The totals for the Medium commute variable were 80, 8, and 16. The totals for the High commute variable were 70, 4, and 15.

COMM	DIST. LEARN	Economy			Totals
		S	A	W	
L	P		UT (3) AK (3)		6
M	P	MT (5) WV (5) TN (5) MI (5) MS (5) TX (5) OR (5)	VT (4) ND (4) AR (4) IN (4) KY (4) NC (4) SC (4) WY (4) WI (4)	SD (3) IA (3) NE (3)	80
H	P	WA (6) MA (6) HI (6) OH (6) IL (6) NY (6)	DE (5) CO (5) GA (5) MD (5) VA (5) PA (5) FL (5) OH (5)		70
L	O		NV (2)		2
M	O	LA (4)			8
H	O		CT (4)		4
L	R		KS (1)		1
M	R	NM (3) AZ (3)	ID (2) MO (2) OK (2) ME (2) RI (2)		16
H	R	CA (4) DC (4)	NJ (3)	NH (2) MN (2)	15
Totals		87	102	13	202

Table 7.1 Cross Reference Analysis Diagram

The first research issue predicted that states with strong economies, high commuting issues, and a progressive distance-learning program would have a progressive distance-learning program. Table 7.1 illustrates that this prediction is true. The point tallies, as illustrated in Table 7.2 for each combination, were looked at in terms of percentage of the total possible points from that category. The economy variable is either S- Strong, A- Average, or W- Weak. The Distance Learning variable is represented by either P-Progressive, O- Ordinary, R- Regressive. The commute variable is represented by either L-Low, M- Medium, H- High.

		Points	%
ECONOMY	S	87	43.1
	A	102	50.5
	W	13	6.4
DIST. LEARN	P	156	77.2
	O	14	7
	R	32	15.8
COMMUTE	L	9	4.5
	M	104	51.5
	H	89	44

Table 7.2 Point Total by Item

Table 7.2 shows that 43.1% of the total possible economy points are associated with the states with the strongest economies as opposed to 6.4% of the total possible economy points that are associated with the states with the weakest economies. Table 7.2 also illustrates that 77.2% of the total possible distance learning points are associated with the states with the most progressive distance learning programs as opposed to 15.8% of the total possible distance learning points that are associated with the states with the regressive distance learning programs. Table 7.2 also demonstrates that 44% of the total possible commuting issue points are associated with the states with the highest commuting issues as opposed to 4.5% of the total possible commuting issue points that are associated with states with the lowest commuting issues.

A SELECT query named Hypothesis 1 was created; The output from this query is illustrated in Table 7.3. The query output in Table 7.3 displays five records of progressive telework initiative, therefore hypothesis 1 is true.

STATE_ID	ECONOMY_ID	COMMUTE_ID	DIST_LEARN_ID	TEL_INITIATIVE
HI	S	H	P	Progressive
ID	S	H	P	Progressive
ME	S	H	P	Progressive
NM	S	H	P	Progressive
WA	S	H	P	Progressive

Table 7.3 Hypothesis 1: Query Output

8. CONCLUSIONS, FUTURE RESEARCH, AND LIMITATIONS

Five major issues were examined in this study using the information produced from the telework data warehouse. The more progressive a state tends to be, the more pronounced level of telework initiative the state will have. It is important to mention that the southern and western regions of the United States received the highest points, while the northeastern region received the lowest points, which means that the southern region and the western region are more progressive in terms of its telework initiatives.

As Figure 8.1 shows, if the strong economy is selected from the possible choices, the southern and western regions have the strongest economies. The economy factor seems to be a strong indicator of the progressiveness of telework initiative.

As Figure 8.2 shows, if the high commuting challenge option is selected from the possible choices, the Southern and the Western regions has the highest commuting challenges. The high commuting challenge factor seems to be a strong indicator of the progressiveness of telework initiative.

This study can be expanded by creating a Web enabled telework decision support system in order to contribute to understanding the technological implications of data analysis. Researching other factors that affect telework initiatives can also expand the study.

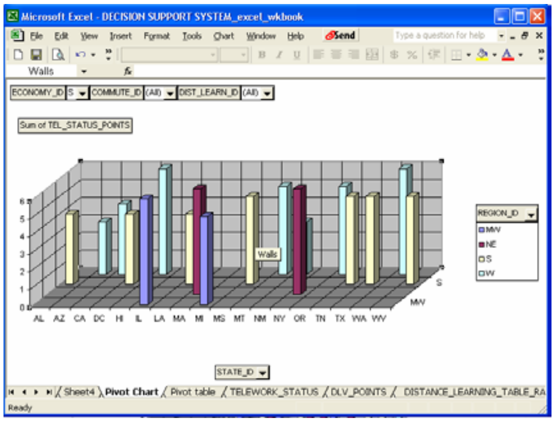

Figure 8.1: Strong Economy Indicator

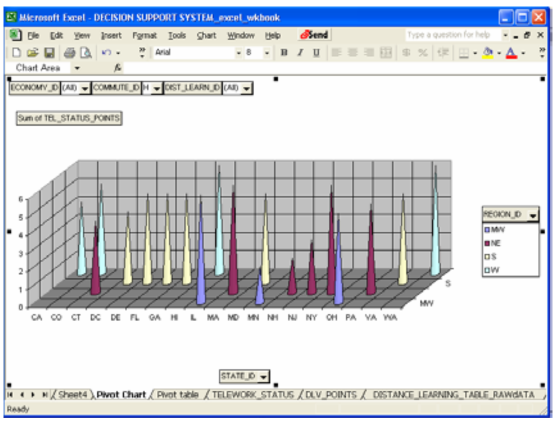

Figure 8.2: High Commuting Challenge Indicator

The limitation to this study is the time dimension. Data used in this study were collected for only one year. An important characteristic of a data warehouse is the time dimension. In future studies the time dimension will be included in order to conduct a time series analysis.

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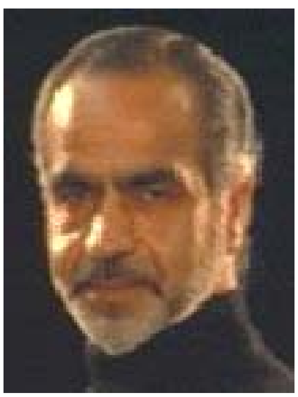
Bianca Gilyot holds a Masters degree in Computer Information Systems from Southern University at New Orleans. She is currently working on a PhD in Information Systems at Nova Southeastern University, FL. She is Assistant to the director of the Information Technology Center at Southern University at New Orleans. Her research interests are in the areas of database design, decision support systems, geographic information systems, and web development.

Dr. Wendy Zhang is an Assistant Professor of Computer Information Systems at Southern University at New Orleans. She has a Doctor of Science degree in Computer Science from University of Houston, Texas. Dr. Zhang was NASA faculty research fellow for the 2002 and 2003 summer. Her research works are in data mining, compiler-driven data I/O optimization, remote sensing, and GIS.



Dr. Ghasem (David) S. Alijani is a professor of Computer Information Systems at Southern University at New Orleans. He received his PhD in Computer Science from Wayne Sate University. His research interests include Adaptive Learning Process, Distributed Information Systems, Networking and Security, Decision Support Systems, and E-Commerce. He is a member of ACM, AGU, EDSIG, and AITP.

Mr. Dayanand Thangada holds a Masters degree in Computer Science from Jackson State University (Mississippi). He is currently working as an Assistant Professor of Computer Information Systems at Southern University at New Orleans. He has taught Systems Analysis and Design, Advanced COBOL, Assembly Language, FORTRAN, Information Processing, Principles of Computer Programming, and Algorithm Design. He also designed Curriculum for the four-year degree program in Computer Information Systems, and developed Student Appointment Card System for the Data Processing Center at SUNO. From 1986 to 1991 on weekends he taught disadvantaged young students how to use Computers. He is also a member of the India Association, and enjoys reading periodicals, table tennis, music, and travel.