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Adoption of innovative telecommunications technologies and services by rural Iowa telephone companies

Sami Abdel-Hadi Moustafa El-Ghamrini

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Adoption of innovative telecommunications technologies and services by rural Iowa telephone companies

by

Sami Abdel-Hadi Moustafa El-Ghamrini

A Thesis Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

Department: Sociology
Major: Rural Sociology

Iowa State University
Ames, Iowa

1995
DEDICATION

The Author would like to dedicate his thesis to his parents; his wife, Zinab; his son, Moustafa; and his daughter, Iman.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>v</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vi</td>
</tr>
<tr>
<td></td>
<td>vii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>viii</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>CHAPTER I.</td>
<td></td>
</tr>
<tr>
<td>1.1. Background of the Study</td>
<td>1</td>
</tr>
<tr>
<td>1.2. The Problem</td>
<td>6</td>
</tr>
<tr>
<td>1.3. Objectives of the Study</td>
<td>8</td>
</tr>
<tr>
<td>1.4. Significance of the Problem</td>
<td>8</td>
</tr>
<tr>
<td>CHAPTER II. LITERATURE REVIEW</td>
<td>10</td>
</tr>
<tr>
<td>2.1. Importance of Telecommunications</td>
<td>10</td>
</tr>
<tr>
<td>2.2. Small Rural Telephone Companies</td>
<td>12</td>
</tr>
<tr>
<td>2.3. Difficulties Facing Telephone Companies Working in Rural Areas</td>
<td>15</td>
</tr>
<tr>
<td>2.4. Innovation and Innovativeness</td>
<td>19</td>
</tr>
<tr>
<td>2.5. Telecommunications Technological Innovations, Organization, and Environment</td>
<td>21</td>
</tr>
<tr>
<td>2.6. Small Rural Telephone Company Leadership and Demographics</td>
<td>28</td>
</tr>
<tr>
<td>2.7. Small Rural Telephone Company Structure</td>
<td>39</td>
</tr>
<tr>
<td>2.8. Small Rural Telephone Companies' Activities for Community Development</td>
<td>48</td>
</tr>
<tr>
<td>2.9. Some Important Factors in Choosing New Technology for Small Rural Telephone Company</td>
<td>50</td>
</tr>
<tr>
<td>2.10. Linkages with other Companies outside Service Area</td>
<td>52</td>
</tr>
<tr>
<td>2.11. Inhibiting Federal and State Laws and Regulations</td>
<td>53</td>
</tr>
<tr>
<td>CHAPTER III. METHODS AND PROCEDURES</td>
<td>57</td>
</tr>
<tr>
<td>3.1. The Research Setting</td>
<td>57</td>
</tr>
<tr>
<td>3.2. Variable Operationalization</td>
<td>58</td>
</tr>
<tr>
<td>3.3. Statistical Techniques</td>
<td>77</td>
</tr>
<tr>
<td>CHAPTER IV. FINDINGS AND DISCUSSION</td>
<td>79</td>
</tr>
<tr>
<td>4.1. Zero-Order Correlation Coefficients</td>
<td>79</td>
</tr>
<tr>
<td>4.2. Variables which Predict Small Rural Telephone Company Technological Innovativeness</td>
<td>95</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 3.1. Age of Iowa small rural telephone company managers 62
Table 3.2. Highest level of formal education completed by Iowa small rural telephone company managers 63
Table 3.3. Number of working years spent by Iowa small rural telephone company managers in telecommunications field 64
Table 3.4. Number of years spent by Iowa small rural telephone company managers in the same companies 65
Table 3.5. Number of years spent by Iowa small rural telephone company managers in the same position 65
Table 3.6. Formal training attended by Iowa small rural telephone company managers 66
Table 3.7. Types of formal training attended by Iowa small rural telephone company managers 66
Table 3.8. Different financial assistance sources of Iowa small rural telephone companies 69
Table 3.9. Types of finance other than REA during the past five years 70
Table 3.10. Types of linkages with other companies outside service areas 74
Table 3.11. Benefits of linkages with other companies outside service areas 75
Table 3.12. Inhibiting state regulations as perceived by Iowa small rural telephone company managers 76
Table 3.13. Inhibiting federal regulations as perceived by Iowa small rural telephone company managers 76
Table 4.1. Correlation matrix of all variables

Table 4.2. Zero-order correlation coefficients between independent variables and telecommunications technological innovativeness

Table 4.3. Independent variables which predict telecommunications technological innovativeness
| Figure 2.1. Theoretical model used in the Study | 56 |
ABSTRACT

Telecommunications technologies have the potential to encourage development in rural communities by helping them overcome geographic location barriers through access to the information highway. But they also have the potential to further isolate rural areas if adequate telecommunications infrastructure does not exist or is not extended to those communities. Therefore, rural telephone companies play a major role in ensuring that the communities in their service areas can compete in the changing economy of the information age. They must provide a full spectrum of innovative services to their clientele and adopt the necessary advanced technology to improve the company's physical plant to enable it to provide the innovative services.

This study examines the organizational characteristics and environmental factors of Iowa rural telephone companies that relate to the adoption of innovative telecommunications technologies and services. Data were collected in summer 1994 as a part of a project on telecommunications for rural development supported by the Iowa State University College of Agriculture. Telephone interviews were conducted with managers of 131 small rural telephone companies.

The dependent variable, telecommunication technological innovativeness, was measured with a scale that sums the level
of use over nine separate telecommunications technological innovations. Independent variables included perception of telecommunications importance by small rural telephone company managers, demographic attributes of small rural telephone company managers, small rural telephone company structure, small rural telephone company activities for community economic development, linkages with other companies outside service areas, some important factors in choosing telecommunications technological innovativeness for small rural telephone companies, and inhibiting federal and state laws and regulations. Frequency tables, factor analysis, reliability, multiple correlations, and multiple regression were used in the statistical analysis.

It was found that telephone company activities for economic development and size explained twenty-six percent of the variation in telecommunications technological innovativeness. Telephone company size and telephone company activities for economic development together explained 30 percent of the variation in telecommunications technological innovativeness. Implications of the results for rural economic development, policy makers, and future research are discussed.
CHAPTER I. INTRODUCTION

1.1. Background of the Study

Telecommunications is communication over a distance. It diminishes the impact of distance and need for physical proximity (Wilson, 1992). Telecommunications may make it easier for individuals in rural areas to make their needs and wishes known. They may be able to be more effective in claiming their fair share of the national budget. Telecommunications also can be used by state governments to cut costs in service delivery by linking social service field offices with the central offices. Also, telecommunications can be effectively used in distance education. In addition, telecommunications can reduce labor costs, can respond quickly and efficiently to market changes, and can attract businesses to rural areas.

Telecommunications infrastructure in rural America has lagged behind that of urban areas in its capabilities (Adams et al., 1991b). Long distances and sparse population densities did not encourage AT&T, during the monopoly era, to invest in and provide services to those rural areas. In general, quality of services is lower and other information technologies are less prevalent in rural areas than in urban areas. Some independent rural telephone companies tried to fill the gap by investing with the assistance of government
funds.

Small rural telephone companies have symbiotic relationships with their local communities. Sawhney et al. (1991) identified some reasons for this special relationship. First, small rural telephone companies are locally established and owned. As a consequence, their owners are aware of their community service needs. Second, it is of the interest of these rural telephone companies to maximize the business potential of their communities. This maximizes their revenues and adds new clientele in the sparse populations they serve. As an example, one hundred twenty eight companies in the State of Iowa established Iowa Network Services (INS) in order to attract new businesses to the State's rural areas. In general, the future of these companies depends, to some extent, upon local area economic development. Third, some of these telephone companies are community oriented as a result of their access to external sources of financial support in the form of low-interest loans and subsidies. The rural Electrification Administration (REA), for example, has played a vital role in financing plant upgrades in rural areas. And finally, rural communities take a special interest in the well-being of their telephone companies. This comes as a direct consequence of realizing their mutual interest with these small rural telephone companies.

Basically, small rural telephone companies provide job
opportunities for rural residents. They can enhance their community's human capital through their in-house training. These companies have the tendency to invest in their human capital because rural communities have much lower turnover rates than urban areas. In addition, it is very difficult and expensive for these companies to attract skilled workers, except for retirees, from other telecommunications companies or areas. Theoretically, under full regulations, rural areas benefited from price averaging. Price averaging keeps rates in low-density areas affordable while allowing local exchange companies to invest in stringing wire and maintaining plants in rural areas (Briesemester et al., 1989). Rate-of-return regulation limited rates to revenues needed to cover cost plus a fair return on the capital investment made by rural telephone companies.

With the divestiture of AT&T, only long distance telephone service only was deregulated. This study was conducted when local telephone service was regulated, and the companies that provided local service had monopolies. Therefore, the companies that are included in this research did not have competition. On June 15, 1995 complete Telecommunications Deregulation Act was announced by the Congress. Uncertainty and confusion have accompanied this act.

It is expected that complete deregulation may represent a
threat to rural areas and small rural telephone companies. It is also expected that there will be concentration of power in the hands of very few large telecommunications companies (McNamara, 1991). Telephone services may not reach some rural areas with low density population. Alliances and joint programs are expected to increase. Consumers may benefit from the competition and low prices offered for services. On the other hand, some experts predict that consumers will pay higher prices for services they do not need. In addition, low density population areas may be seriously hurt.

This expected scenario in telecommunications is similar to the 1978 Airline Deregulation Act. As a result of the deregulation, the airline industry entered into a period of fierce competition, characterized by a rapid increase in the number of air carriers and rapid reduction of fares. The new entrants taking advantages of low operating costs, quickly expanded their markets by offering low prices. The major pre-deregulation carriers, in an effort to retain their traditional markets, offered discount fares that were even below their cost of providing services. The industry as a whole operated at a loss between 1979 and 1982 (Chen et al., 1991).

Sawhney et al. (1991) argued that price-cap-regulation will permit price increases only up to a maximum that is less than the rate of inflation. This policy may force rural
telephone companies to reduce investment and maintenance in order to increase their profits. Furthermore, regulatory actions that favor consumers' short-term interests may be harmful in the long run by undermining investment and modernization (Mueller, 1993). Price deaveraging may work against most rural areas, harming their ability to take advantage of the freedom of location that telecommunications should offer. In addition, elasticity of demand for rural users is very low, and perhaps lower than that for urban users. This may increase the possibility of rural residents paying more for inferior services than those offered in urban areas. It may obstruct economic development of isolated and less-populated rural areas. Regulatory uncertainty and the new congressional proposals of federal budget cuts may further aggravate the problem.

As a consequence of divestiture, state governments became actively involved in telecommunications as important users and some developed specific policies toward this end. These governmental policies not only determine the pricing of telecommunications, but also influence the long-term development of telecommunications infrastructure. They include both economic efficiency and social equity (Twenbafel et al., 1989).
1.2. The Problem

Adams et al. (1991a) argued that there are four difficulties facing telephone companies working in rural areas: (1) financial support by the Rural Electrification Administration (REA) is uncertain with the continuous federal budget cuts; (2) rural companies fear losing the benefits of long-distance rate averaging where prices are based on distance rather than transmission cost; (3) there is some additional pressure from long-distance carriers to reduce the access charges they pay to local phone companies; and (4) traditional depreciation policies threaten the ability of local exchange companies in rural areas to modernize their facilities.

Uncertainty implies a lack of predictability, structure, and information (Rogers, 1983). Uncertainty can be technical, financial, or social. Technological innovation can be identified as an activity characterized by great uncertainty about the final outcome and amount and type of resources which are necessary to invest to obtain a commercially profitable result (Hope, 1988).

Under the present conditions of great regulatory and technical uncertainty, the small rural telephone companies no longer have a defined place in the social order. They are monopoly utilities and their investments, rates, services, and profits are supervised by state commissions, the Federal
Communications Commission (FCC), and the Department of Justice. In the near future, they will be in a competitive arena where they compete against each other, against new telecommunications businesses, and also against the impending marriage between computer and telecommunications technologies. In this sense, small rural telephone companies will have to overcome brutal environmental competition in order to survive.

Information represents one of the means of reducing uncertainty. The greater the degree of technological uncertainty, the greater the learning or knowledge pressure facing these companies. On the other hand, a technological innovation embodies information and thus reduces uncertainty. In general, adoption of a technological innovation by a small rural telephone company is expected to result in a change that might affect its performance. Small rural telephone companies that adopt technological innovations earlier may have a better chance to survive and make a profit than those that adopt later (Rogers, 1983). Adoption of advanced telecommunications technologies may help economic development and improve life in rural areas. In general, new telecommunications technological innovations have impacts on economic benefits and extended reach of rural telephone companies (Sawhney et al., 1991).

The main concern of policy makers is to ensure affordable services for consumers while allowing telephone companies a fair return on their investment. By identifying barriers and
problems facing these small rural telephone companies, it is easier for policy makers to develop policies that may help small rural telephone companies overcome obstacles and facilitate their technological innovativeness. On the other hand, policy makers should include in their considerations all benefits provided by small rural telephone companies to rural areas. Regulatory actions should alleviate uncertainty and reinforce stability needed for these companies.

1.3. Objectives of the Study

This study examines several factors thought to be related to rural Iowa telephone companies' innovativeness. The specific objectives of this study are: (1) to apply the organization-innovation model to rural Iowa telephone companies; (2) to examine factors related to innovativeness of those small rural telephone companies in an era of environmental uncertainty; and (3) to provide policy makers with recommendations, based on the research results, to facilitate innovations among small rural telephone companies.

1.4. Significance of the Problem

This study examines different factors that affect adoption of telecommunications technological innovations and services by Iowa rural telephone companies. The study will show the degree to which the organization-innovation model
applies to these small rural telephone companies. Theoretically, small rural telephone companies that adopt new telephone technologies relatively earlier may have a better chance of survival than those that adopt later. From a practical standpoint, prosperity of those small rural telephone companies and the availability of innovative telecommunications technologies and services to local subscribers may have a positive impact in Iowa's rural economy. Furthermore, rural telecommunications policy makers are in need of more information related to small rural telephone companies. The results of this research on innovative actions of small rural telephone companies can provide policy makers with insight to develop appropriate policies for rural telecommunications.

This thesis consists of five chapters. Chapter II outlines the relevant literature, including previous research, theoretical orientations to technological innovativeness of small rural telephone companies, and statement of the hypotheses; chapter III outlines the methodology of this study; chapter IV presents the findings and their significance; and chapter V provides a summary of the study and empirical findings, with a discussion of implications, some limitations of the study, and directions for future research.
2.1. Importance of Telecommunications

Hudson (1981) showed benefits of telecommunications as: (1) importance for secondary (manufacturing) and the tertiary (government, finance, and services); (2) substitution for travel and potential energy saving; (3) decentralization of business and industry; (4) benefits to consumers in providing information and facilitating accurate ordering and delivery of goods; (5) maintenance and expansion of tourism. Expansion of tourism has the capability to expand and improve the service sector; (6) increased efficiency and geographic coverage for governmental administration and delivery of services; (7) organizational Impacts on agricultural production through improvements in ordering, and delivery of services. Availability of marketing information is an important agricultural benefit accrued from telecommunications; (8) improved cost-effectiveness of rural social service delivery and rural economic activities; and (9) more equitable distribution of economic benefits.

Briesemeister et al. (1989) argued that telecommunications can be used by state governments to cut costs in service delivery by linking social service field offices with the central offices. This makes those social services less costly with faster delivery. Also,
telecommunications can be used effectively in distance education.

There is a link between telecommunications and economic development in that telecommunications offers pronounced capabilities for distributing resources and encouraging investments in different areas. Hardy (1980), and Saunders et al. (1983) found that there is a strong relationship between telephone penetration ratios and gross national product (GNP). Some states use education as a stimulus for telecommunications industry to invest by providing degrees in education using curricula disseminated through telecommunications. Also, state governments use telecommunications to improve service delivery within their borders.

Twenbafel et al. (1989) mentioned that telecommunications serves a function similar to the function railroads served in the American economy. The railroads were a vital infrastructure for the American mass production to be distributed to different outlets all over the country. The production processes of that era required the development of a transportation infrastructure as economic growth was relying intensively on growing markets and mass production techniques. Thus, railroads provided an advantage of economies of scale and linked industries to dispersed geographical demands. Today, American manufacturing relies much less on mass production than before. Telecommunications can reduce labor
costs and can respond quickly and efficiently to market changes. An advanced telecommunications network is necessary to provide the American industry with the flexible production processes and segmented markets. Currently, the American industry cannot compete in mass production goods but it can compete in technologically evolving markets where quality is the first standard. In general, telecommunications provides the American industry with all the viable elements for its dominance in the world market (Twenbafel et al., 1989).

Sawhney et al. (1991) found that investments in telephone technological innovations have created some impacts including: (1) rural area economic development; (2) internal efficiency of telephone networks; (3) creating future demands; and (4) increasing partnerships among those telephone companies.

On the other hand, Parker et al. (1989) argued that the present levels of recognition and public commitment to rural areas for new telecommunications in the United States has a history of fewer than fifty years.

2.2. Small Rural Telephone Companies

Telecommunications infrastructure in rural America has lagged behind that of urban areas in its capabilities. Long geographic distances and low population densities did not encourage AT&T, during the monopoly era, to invest in and provide services to those rural areas. Some independent
telephone companies tried to fill the gap by investing through the assistance of government funds. Also, there have been cooperative financial efforts by rural residents such as buying stocks to finance a rural telephone company, or establishing a new company such as Iowa Network Services (INS) in Iowa. In general, quality of services is lower and other information technologies are less prevalent in rural areas than those in urban areas.

Briesemeister et al. (1989) argued that the inequalities between rural and urban American telecommunications systems are becoming a hot political issues from two different arguments. On the one hand, telecommunications may increase the attractiveness of rural areas. This attraction may occur as a consequence of lower land values. On the opposite side there is much concern that rural areas will see less competition for providing service as a result of its dispersed population and the fewer number of subscribers. In general, competition is expected to be intensified in urban areas where the high volume of traffic, businesses, and population make telecommunications investment more profitable.

Sawhney et al. (1991) found that small rural telephone companies are deserving of more attention than they usually receive from policymakers and rural sociologists. Complete deregulation and open competition can severely harm those small rural telephone companies. These companies are locally
owned, have a great awareness of their local areas' needs, and are highly responsive to these needs. They are highly interested in maximizing the business potential of the communities they serve because these are the only market they can access. They provide job opportunities and in-house-training for residents in rural areas.

Rural communities, in turn, often take a special interest in the well-being of these telephone companies. This comes from realizing their mutual interdependence and symbiotic relationship with these small rural telephone companies.

Hage et al. (1970) found that the following characteristics are highly correlated to organizational innovativeness: (1) high complexity; (2) high decentralization of power; (3) low formalization; (4) low stratification; (5) low emphasis on efficiency in the cost of production or service; (6) low emphasis on volume, as opposed to quality, of production; and (7) a high level of job satisfaction on the part of rural telephone company members.

Low centralization, high complexity, and low formalization facilitate the initiation in the innovation process, but these same structural characteristics make it difficult for an organization to implement an innovation (Zaltman et al., 1973; Rogers, 1983). The basic reason for this is that each organization structural characteristic is related to innovation in one direction during initiation, and
in the opposite direction during implementation.

Rogers (1983) found that the initiation of an innovation in a centralized organization is less frequent than in a decentralized one. On the other hand, the centralization may actually encourage the implementation of innovation once the innovation decision is made.

2.3. Difficulties Facing Small Telephone Companies Working in Rural Areas

Briesemeister et al. (1989) suggested that under full regulations, rural areas benefit from price averaging, which keeps rates in low-density areas affordable and allowing local exchange companies to invest in and maintain the physical infrastructure. Sawhney et al. (1991) suggested that rate-of-return regulation limited rates to the revenues needed to cover costs plus a fair return on the capital investment. On the other hand, price cap regulation, the suggested alternative, will modify rate-of-return to permit price increases only up to a maximum that is less than the rate of inflation. Thus, in order for the telephone carriers to maintain current levels of return on investment, they should achieve cost reduction and/or productivity gains.

Price deaveraging works against most rural areas, harming their ability to take advantage of the freedom of location telecommunications should offer. In addition, elasticity of
demand for rural users is very low, and perhaps lower than that for urban users. This may raise the possibility of forcing rural residents to pay more for inferior services than those offered in urban areas. Teske (1990) suggested that it may be necessary to subsidize rural customers to make the large increases in their cost-based access prices on an incremental basis.

Adams et al. (1991a) argued that there are four difficulties facing telephone companies working in rural areas: (1) financial supports by the Rural Electrification Administration (REA) are uncertain with the continuous federal budget cuts; (2) small rural telephone companies fear losing the benefits of long-distance rate averaging where prices are based on distance rather than transmission cost; (3) there is some additional pressure from long-distance carriers to reduce the access charges they pay to rural telephone companies; and (4) traditional depreciation policies threaten the ability of local exchange companies in rural areas to modernize their facilities. Mueller (1993) warned that regulatory actions that favor consumers' short-term interests may be harmful in the long run by undermining telecommunications investments and modernization.

Under the present conditions of great uncertainty, small rural telephone companies no longer have a defined place in the social order. They have been monopoly utilities and their
investments, rates, services, and profits are supervised by state commissions, the Federal Communications Commission (FCC), and the Department of Justice. After the recent proclamation of telecommunications deregulation act by the Congress (June, 1995) they will be involved in a fierce competitive arena where they will compete against each other, against new telecommunications businesses, and also against the marriage between computer and telecommunications technologies. It is expected that small rural telephone companies will face fierce environmental competition and will struggle hard to survive.

McKlevey et al. (1983) argued that there are four principles that determine which organizations will survive and which will not. These principles are, first, variation which can be divided into: (a) purposeful variation which occurs when environmental pressures cause selection of adaptations, and (b) blind variation which occurs independent of environmental or selection pressures. The second principle is natural selection in which variations differ in the degree to which they enable organizations to acquire resources from the environment. Useless or harmful variations are likely to bring in fewer and fewer resources and thus reduce the chances of survival. With the passage of time, organizations that survive are likely to have beneficial variations. Resource acquisition involves other resources, in addition to financial
ones. Other resources would include personnel power, political support, and legitimation. The third principle is retention and diffusion which includes the transmission of knowledge and skills to succeeding members of organizations over generations. Competencies are diffused to other organizations as skilled and knowledgeable people change jobs and work for new and different organizations. The fourth principle is the struggle for existence which includes competing with other organizations in the niche for scarce resources. Adoption of different telecommunications technological innovations and services by small rural telephone companies may help alleviate environmental uncertainty and provide them with better vision.

Similar to the individual adoption category, small rural telephone companies that adopt telecommunications technological innovations earlier, the early adopters, may have a better chance to survive and make a profit than those that adopted later (Rogers, 1983).

Under full deregulation and competition, it is expected that subscribers will pay more for additional services they do not need, a few large companies will dominate the market, and some isolated rural areas with few subscribers will not be wired or will not have good telecommunications services. On the other hand, there are few expectations of telephone price decrease.
2.4. Innovation and Innovativeness

Innovation is defined as an idea, or practice, or object that is perceived as new by an individual or other unit of adoption (Rogers, 1983:11). It is a departure from existing practices or technologies to other ones (Kimberly, 1981). Rosenfeld et al. (1991) argued that conception, invention, and exploitation are the three inseparable components of innovation. Innovation means changes. Such changes can be incremental or radical, evolutionary or revolutionary, enabling or disruptive. They can have different effects upon both producers and users (Pearson, 1991).

An organizational innovation is the implementation of an internally generated or borrowed idea—whether pertaining to a product, device, system, process, policy, program, or service—that was new to the organization (Thompson, 1965; Zaltman et al., 1973). Zaltman et al. (1973) identified three forms of innovation that can take place in organizations: (1) a programmed innovation or one planned through product or service research and development; (2) a non-programmed innovation which occurs when organizations have more slack resources than needed (they are unplanned because the organization cannot anticipate when more resources are available); and (3) a distressed innovation which happens when a crisis is perceived and new actions are taken. In addition, innovation can be developed within an organization or be
imposed by other organizations in the same niche. Some federal regulations may impose innovations on telephone companies.

Innovations can be divided in two types. The first type is an incremental innovation which introduces minor changes to the existing system. It reinforces the existing organizational system and adds some changes or modifications (Ettlie et al., 1984; Tushman et al., 1986; Hage, 1980). The second type is a radical innovation which reflects and requires a substantial change in the system. Radical innovation is based upon different sets of scientific principles, applications, and markets. It requires changes in organizations or even sometimes in the whole industry (Daft, 1982; Hage, 1980).

Technological innovations are adopted at a faster rate than administrative ones. On the other hand, administrative innovations may trigger the adoption of technological ones but not the vice versa (Damanpour et al., 1984).

Innovativeness is the degree to which an organization is relatively earlier in adopting an innovation than other organizations (Rogers, 1983).
2.5. Telecommunications Technological Innovations, Organization, and Environment

Technology is defined as the means by which an organization's outputs are created. It is those tools, devices, and knowledge that mediate between inputs and outputs (process technology) and/or that create new products or services (product technology) (Rosenberg, 1972). Organizational technological concern lies in operational technology, or the two combined forces of machines and individuals' activities, that produces a desired good (Thompson, 1957).

Blau et al. (1976) suggested that an organization's technology reflects different degree of mechanization and is usually classified as: (1) craft or unit or custom technology; (2) small and batch production technology; (3) mass-production technology; and (4) continuous-process automated technology. In order to operate any of these types of technology, some organizational requirements are needed and should be reflected in the pattern of work tasks and roles employed. Consequently, the characteristics of organizational technology systems influence organizational personnel, the allocations of functions and responsibilities, design of organizational control system, and managerial activity patterns (Burack, 1967).

Organization is a collectivity with a relatively
identifiable boundary, a normative order, ranks of authority, communications systems, and membership coordinating systems. This collectivity exists on a relatively continuous basis in an environment and engages in activities that are usually related to a set of goals; the activities have outcomes for organizational members, the organization itself, and for society (Hall, 1991:32).

An organization can be viewed as a stable system of individuals who work together to achieve predetermined goals through a hierarchy of ranks and a division of labor (Rogers et al., 1976). Organizations are constantly changing. Dill (1958) viewed organizational environment as all elements not formally defined as belonging to the organization. Hage (1980) defined organizational change as the alteration and transformation of the organizational forms in order to improve its survival in the environment and to accomplish its predetermined goals.

Numerous literature (Hage et al., 1970; Hage, 1980; Moch, 1976; Moch et al., 1977) suggests that an innovative organization is characterized by: (1) high complexity; (2) high decentralization of power; (3) low formalization of members; (4) low stratification in the differential distribution of rewards (those employees who get high rewards are more likely to resist change); (5) more emphasis on quality; (6) low emphasis on efficiency in the cost of
production or service; and (7) high level of job satisfaction. Further, adoption of innovations in organizations is related to organizational size, specialization, differentiation, and decentralization. Also, values, interests, and perspectives of lower level decision-makers must be compatible with the innovation.

Bidwell et al. (1985) used the concept of organizational niche to indicate organizational environment. The niche, according to Bidwell et al. (1985), contains the resources and other organizations competing for the same available resources. The organizations that survive are the ones that are able to make adaptations in order to overcome, or at least coexist, with their competitors in the same niche. Also, an organization can develop agreements with other competitors to lessen competition (Child et al., 1981).

Robey (1991) stated that the environment impinges on the process of organizational innovation in three ways. First, impeding performance problems are usually recognized initially by consumers. Consumers may switch immediately to competitors as a consequence of increasing product cost, decreasing product quality, and delaying product delivery. Successful innovators must actively scan their environment to recognize these potential performance gaps. Second, while most innovative organizations obtain their own slack resources, all depend on ideas and technology drawn from the outside such as
consulting firms, vendors of technology, universities, and government-sponsored reports. Third, the environment can also be a source of financial resources, especially for public organizations. Public organizations depend heavily on tax dollars and special grants to subsidize innovation.

Baldridge et al. (1975) argued that organizational characteristics are more important to the innovation process than the attitudes of the organizational members. First, individual characteristics, such as sex, age, and personal attitudes, do not seem to be important determinants of innovative behavior among people in complex organizations. However, administrative positions and roles do seem to have an impact on the involvement of an individual in the innovative process. Second, structural characteristics of the organization, such as size and complexity, strongly affect the organization's innovative behavior. Third, environmental input from the community and other organizations is a major determinant of an organization's innovative behavior. Hage et al. (1973) argued that the values of the elites in organizations are more important than the structural characteristics.

Corwin (1973), and Hall (1991) argued that economic conditions of the organizations affect the adoption of an innovation. Hall (1991) argued that lack of resources is a systematic obstacle to change. Manns et al. (1978) found that
strong units or departments respond to adversity with fewer innovations than the weaker ones. The stronger organizations have greater access to alternative resources than the weaker ones which make them insulated from adversity. On the other hand, the weaker organizations should innovate more in order to compensate their lack of resources. Sawhney et al. (1991) found that partnership is one of the main strategies used by small rural telephone companies to cope with deficiencies of resources and obtain advanced technological innovations.

Technology and technological changes are consistently seen as sources of organizational uncertainty. Uncertainty implies a lack of predictability, of structure, and of information. It is the degree to which alternatives are perceived with the respect to the occurrence of an event and the relative probabilities of these alternatives. The greater the degree of technical uncertainty, the greater the knowledge pressure facing the organization (Tushman et al., 1990). Pearson (1991) divided organizational uncertainty into two types: uncertainty about ends or focus, and uncertainty about means or approaches.

Tushman et al. (1986) found that technological breakthrough can enhance or destroy organizational competencies. Knowledge and skills can become highly valuable or obsolete on the basis of technological change. Organizations that initiate major technological innovations
will have higher growth than other firms in the product class. Changes in external environment such as competition, innovation, public demand, and governmental policy may require that new strategies, methods of working, and outputs be devised for an organization to survive or continue at its present level of operations.

Internal factors, or internal environment, may also promote change to the extent that managers and other members of an organization may seek not just its maintenance but also its growth, in order to secure improved benefits and satisfactions for themselves (Child et al., 1981). Heterogeneous or changing organizational environments are likely to cause problems for organizations that promote the adoption of innovation (Baldrige, 1971; Evan, 1965).

Pfeffer (1983) argued that organizational demography is affected by both organizational policies in regard to issues such as the rate of growth of the industry in which an organization operates. Organizational demographic characteristics in turn affect the patterns of change since it will have impacts on succession and power differences among future leaders and companies.

On the other hand, organizational personnel can be viewed as a potential source of inertia. When personnel are selected on the basis of reliability and accountability in a formalized organization, organizational structures become reproducible.
Hannan et al. (1984) argued that this refers to the fact that the same organizational forms will continue to remain in place because there is no differentiation among the personnel. This tendency towards inertia, as a consequence of the commonalities in personnel is more likely to occur in larger, older, and more complex organizations. Kaufman (1971) mentioned that change takes place through personnel turnover. Also, change can be forced on an organization from the environment (Meyer et al., 1977; Tolbert et al., 1983). Kaufman (1971) emphasized the influence of internal factors in resisting any organizational change. Also, there are obstacles to change within the overall system in which organizations operate. They include factors such as sunk costs or investments in the status quo; the accumulation of official constraints on behavior, such as laws and regulations; unofficial and unplanned constraints on behavior in the form of informal customs; and inter-organizational agreements, such as labor-management contracts. Katz et al. (1978) argued that there are six factors that contribute to organizational change resistance: (1) organizations are overdetermined or they have multiple mechanism to ensure stability including personnel selection, training, and reward systems; (2) organizations commit the error of assuming local determinism, or believing that a change in one location won't have an organization-wide impact. In addition, a change in
local operations can be nullified by the larger organizations. (3) other factors include individual and group inertia which is very difficult to overcome; (4) organizational change can threaten occupational groups within organization; (5) organizational change can threaten the established power system; and (6) organizational change can threaten those who profit from the present allocation of resources and rewards.

Biggart (1977) emphasized laws and regulations as forces of environmental change. Hage (1980) emphasized the importance of internal groups as a driving force for organizational change.

Organizations vary widely in their ability to recognize performance problems, and some are more successful in obtaining resources and technical information from the environment. They also differ in the degree of success they have in moving through the stages of need recognition, initiation and implementation. These differences indicate that some organizations manage innovation better than the others.

2.6. Small Rural Telephone Company Leadership and Demographics

Leadership is defined as the ability, based on the personal qualities of the leader, to elicit the followers' voluntary compliance in a broad range of matters. Leadership
entails influence, that is, change of preferences, while power implies only that subjects' preferences are held in abeyance (Etzioni, 1965:690).

In this sense, the leader is the one who motivates and influences his followers to think and behave in a rational way (Katz et al., 1978). Leadership uses persuasion and innovative ideas while power imposes them. Leadership is something attributed to leaders by their followers and leaders attributes are crucial for leadership role (Meindl et al., 1985). Hollander et al. (1969) stressed the fact that leadership is a blend of traits and situations.

Hall (1991) argued that organizational leadership involves a combination of factors: (1) position in the organization; (2) specific situation or confrontation; (3) characteristics of individuals involved; and (4) nature of relationships with subordinates.

Amabile (1988) suggested three domains of leader's creativity. First is domain of dominant-relevant skills which includes knowledge about the domain, technical skills required, and special domain-relevant talent. This domain depends on three factors: (1) innate cognitive abilities, (2) innate perceptual and motor skills, and (3) formal and informal education. Domain-relevant skills can be considered as the basis for which any performance must proceed. Second is domain of creativity-relevant skills which includes
appropriate cognitive style, implicit or explicit knowledge of heuristics for generating novel ideas, and conducive work style. This domain depends upon: (1) training, (2) experience in idea generation, and (3) personality characteristics. Third is domain of task motivation which includes attitudes toward the task, and perceptions of own motivation for undertaking the task. It depends upon: (1) initial level of intrinsic motivation toward the task, (2) presence or absence of salient extrinsic constraints in the social environment, and (3) individual ability to cognitively minimize extrinsic constraints. An organization will be more innovative when the highest level of leadership within the organization communicate a genuine motivation for innovation. In this sense, the process of individual creativity and the process of organizational innovation have mutual impact on each other.

Rogers (1983), and Tsui et al. (1989) emphasized certain individual and demographic attributes as vital attributes of leadership that affect innovativeness. They include position, tenure, age, and level of education.

Hannan et al. (1984) identified organizational personnel as a potential sources of inertia. Commonalities in personnel are the most important reason for organizational inertia. In general, inertia mostly happens in larger, older, and complex organizations. Organizational structure, in those old
31

organizations, is not based upon the reliability and accountability of choosing its personnel.

Kaufman (1971) argued that organizational change takes place through personnel turnover. Pfeffer (1983) argued that the general concept of demography may have substantial effects on organizational outcomes including innovation, performance, control, and executive succession. On the other hand, organizational demography is affected by organizational policies and elements of organizational environment such as growth rate of the industry in which the organization is involved. Pfeffer (1983) also stressed the fact that it is not only the simple demographic characteristics such as age, tenure, race, or education that are important to understand, but also their compositional effects.

Katz et al. (1978) identified group and individual inertia as one of the most important elements of organizational resistance to change. Hage et al. (1973) found that the values of organizational elites, or leaders, are the primary reason for organizational innovativeness. Tsui et al. (1989) found, after controlling for an individual's demographic characteristics, that the greater the difference in superior-subordinate dyads in terms of age, education, race, and sex, the lower the supervisor's rating of the subordinate's effectiveness and the higher the subordinate's role ambiguity.
McCain et al. (1983) mentioned that being older in a group dominated by younger members leads to an increased tendency to leave among older workers. It is logical that people tend to be attracted to those who are similar which may support effective group communication and integration (Rosenbaum, 1986).

O'Reilly et al. (1989) found that increased distance in tenure within work groups lowered social integration, which in turn is related to higher turnover rates. They also found that high role ambiguity is related to superior's short job tenure. In the case of subordinates with the same or longer job tenure as their superiors, their role ambiguity was lower than their superiors. These may lead to organizational communication problems. It was also found that superiors viewed older and younger subordinates as performing less well. Subordinates with the same age as their superiors reported less role ambiguity. El-Ghamrini (1988) found that neither age nor education of leaders is related to organizational innovativeness.

Baldridge et al. (1975), taking the opposite side, argued that organizational characteristics are more important to the innovation process than the attitudes of organizational members or even their elites.

Applegate et al. (1988) observed that advanced computer-assisted communication and decision technologies are essential
to support project-oriented work groups and temporary task forces that are becoming pervasive in organizations. In general, these advanced technologies can support forms of group interaction and communications. Also, it was found that physical closeness fosters natural understanding and unifies emotions among group members (Zajonc, 1965; El-Ghamrini, 1988). In this sense, face to face interconnectedness may be of high importance to organizational innovativeness (Rogers, 1983).

Valacich et al. (1993) found that groups using electronic communication for idea generation tasks outperformed groups using verbal communications. In this sense, appropriate training attended by leaders can be viewed as positively related to their companies' innovativeness.

2.6.1. Small Rural Telephone Company Managers Commitment or Attitudes of Leadership

Amabile (1988) argued that perceptions of one's motivation for undertaking the task depend largely on external social and environmental factors such as the presence or absence of salient extrinsic constraints in the work environment. Internal factors, such as a person's ability to cognitively minimize the salience of such extrinsic constraints, might also influence the self-perception motivation.
Baldridge et al. (1975) found that there is no relationship between organizational innovativeness and personal attitudes. On the other hand, administrative positions may have an impact on the involvement of an individual in the innovative process. Weick (1979) stressed the importance of individuals' attitudes and how they view their organization's importance as the major source of organizational innovativeness. This can be identified as the willingness of social actors to give their energy and loyalty to social systems (Kanter, 1968). It is the identification of individuals with or attachment to their organization (Hall et al., 1972; Patchen, 1970). It can also be viewed as an awareness of the impossibility of choosing a different social identity, or of rejecting a particular expectation, under force of penalty (Stebbins, 1970), the binding of an individual to behavioral acts (Kiesler, 1971; Salanick, 1977), or an attachment of an individual to an organization regardless of the worth of this attachment (Buchanan, 1974).

Lord (1977) found a positive relationship between availability of information and leader's commitment to his organization. Wagner et al. (1984) found that managers' perspectives on the organization are affected by their time of entry and the stage of organization and the problems it confronted at that time.

Mobley (1977) emphasized the consequences of
organizational commitment on organization's stability and innovativeness. Amabile (1988) stated that an organization will be more innovative when the highest level of leadership within the organization has genuine motivation for innovation.

Sawhney et al. (1991) found that small rural telephone companies have been colored by the personal visions of their individual leaders.

**Hypothesis 2.6.1.** In a small rural telephone company, manager's perception of telecommunications importance, as an infrastructure, is positively related to its technological innovativeness.

2.6.2. **Age**

Lehman (1953), and Simonton (1984) found that leaders demonstrate their creativity at younger ages. Older people are handicapped in fields that require new learning, but they have an advantage when the accumulation of experience is required. In general, curves of creativity rises rapidly in early maturity and then decline slowly.

Baldrige et al. (1975) found that there is no relationship between individual characteristics, such as sex, age, and personal attitudes and organizational innovativeness. El-Ghamrini (1988) found that age is not related to organizational innovativeness. Tsui et al. (1989) observed, after controlling for an individual's demographic
characteristics, that the greater the difference in superior-subordinate dyad in terms of age the lower the superior's rating of the subordinate's effectiveness and the higher the subordinate's role ambiguity. McCain et al. (1983) mentioned that being older in a group dominated by younger members leads to an increased propensity to leave among older workers. Rosenbaum (1986) interpreted this phenomenon that people tend to be attached to those who are similar. Sawhney et al. (1991) noted that most employees of rural telephone companies are young and very few old. The very few elderly employees who are working in small rural telephone companies are retirees from larger companies and they are not expected to have great impact. Therefore, it is assumed in this study that employees in small rural telephone companies are young. Consequently, it is expected that there will be no role ambiguity among subordinates or managers. In this sense, it is expected that age is not related to small rural telephone company technological innovativeness.

Hypothesis 2.6.2. In small rural telephone company, manager's age is not related to its technological innovativeness.

2.6.3. Highest Level of Formal Education Completed

Rogers (1983), and Amabile (1988) found that formal education attained by the manager is positively related to organizational innovativeness. Waldman et al. (1986)
suggested that demographic characteristics such as age, tenure, education, race, and sex is related to performance. Sawhney et al. (1991) found that many responsible positions in telephone companies working in rural areas are staffed by "mustang engineers", those who have worked through the company without the benefit of a formal technical degree. Consequently, it is expected that highest level of formal education completed by small telephone company leaders is not related to its technological innovativeness.

Hypothesis 2.6.3. In a small rural telephone company, manager's highest level of formal education is not related to its technological innovativeness.

2.6.4. Tenure

Rogers (1983) argued that tenure is positively related to innovativeness. Tenure leads to better organizational communication, better accumulative experiences, and organizational stability. Tenure can be measured in terms of the period of time manager spent in telecommunications field and in his present company. On the other hand, tenure of the same position for a long period of time may be perceived as an indicator of elites control and stagnation of promotions and incentives. In this case, it implies a strong resistance to innovativeness (Katz et al., 1978). This may lead to organizational inertia (Hannan et al. (1984)).
Sawhney et al. (1991) found that most of small rural telephone companies' elites have spent a relatively short period of time in the field and also in their companies. These small rural telephone companies are privately, and mostly family owned. They are relatively newly established and have been monopoly utilities since their establishment. Consequently, it is assumed that tenure is not related to organizational innovativeness.

**Hypothesis 2.6.4.** In a small rural telephone company, tenure is not related to its technological innovativeness.

2.6.5. **Formal Training**

The main objective of rural telephone company-formal training is to provide workers with additional necessary skills and to refine their past acquired skills. Most rural telephone companies conduct formal training for their employees within or outside their boundaries. This leads those trainees to acquire innovative ideas, or practices, or objects to solve problems or improve the situations in their companies.

In addition, most of small rural telephone companies are dependent completely upon training of their employees in order to compensate the deficiencies in technical expertise needed. They can afford to invest in their human capital because rural communities tend to have much lower turnover rates than urban
areas, and it is difficult for them to attract professionals from outside the community (Sawhney et al., 1991). In this sense, formal training leads to rural telephone company survival and prosperity. Amabile (1988), and Rogers (1983) emphasized the role of training in organizational innovativeness.

House (1968) found that social influences in the work environment explain why training produces both functional and dysfunctional consequences. The consequences of leadership training depends on the degree to which the social influences in the trainee's work environment are perceived by the trainee as motivations to learn.

**Hypothesis 2.6.5.** In a small rural telephone company, manager's formal training is positively related to its technological innovativeness.

2.7. Small Rural Telephone Company Structure

James et al. (1976) emphasized that four of the most frequently studied properties of organizational structure are size, configuration (number of hierarchical levels), formalization, and centralization. Hage et al. (1967), and Baldridge et al. (1975) argued that adoption of innovations by an organization is more related to organizational structure such as size and complexity than individual attributes such as age, attitudes, and education. Hall (1991) noted that
organizational structures are a consequence of the simultaneous impact of multiple factors. Organizational structure is defined as the distribution, along various lines, of people among social positions that influence the role relations among these people (Blau, 1974:11).

Organizational structure is influenced by two groups of variables: (1) contextual variables that include size, technology, the environment, and cultural conditions; and (2) design variables that are divided into: (a) strategic choice; and (b) institutional models of structure. In this sense, organizational design is a political decision (Hall, 1991).

Complexity is a basic organizational structural characteristic. It encourages organizational members to perceive and suggest innovations, but it may make it difficult to achieve consensus about the way of implementing them. Both vertical and horizontal differentiations are related to higher rates of program change or adoption of innovations. In this sense, when such differentiations are present, much information will flow smoothly in the system.

Rogers (1983:360) defined Complexity as the degree to which an organization's members possess a relatively high level of knowledge and expertise, usually measured by the members' range of occupational specialties and their degree of professionalism expressed by formal training.

Aiken et al. (1968) found that organizations with many
41

joint programs are complex ones. These organizations usually have highly professional and more diverse occupational structure. Also, flow of information in those organizations is very high. This can be interpreted as a consequence of importing different professionals in different areas in order to compensate the deficiency of skills in the available organizational personnel. Rogers (1983), and Hage et al. (1970) argued that complexity is positively related to innovativeness.

Centralization is the degree to which power and control, in a system, are connected in the hands of relatively few individuals. It is the locus of decision making authority within an organization (Van De Ven et al., 1980). It is essentially related to the distribution of power within an organization. Organizational centralization occurs when most decisions are made hierarchically.

Rogers (1983), Moch (1976), and Moch et al. (1977) argued that centralization is negatively related to innovativeness. In a centralized organization, top leaders are poorly and technically positioned. Therefore, it is very difficult for them to identify potential problems and suggest solutions or innovations to solve them.

Centralization, according to Rogers (1983), may actually encourage the implementation of innovation after the decision of adopting it is taken. Hage (1980) mentioned that more
radical innovations occur when there is a high centralization of cosmopolitans or specialists. The innovation is more likely if the values of the dominant coalition, or elites, are supporting change (Hage, 1980).

Hall (1991:83) observed that high levels of centralization means greater coordination, but less flexibility; consistent organizational wide policies, but possibly inappropriate policies for local conditions; and the potential for rapid decision making during emergencies, but overloaded communications channels during normal operations as communications flow up and down the hierarchy.

Interconnectedness is the degree to which organizational units are linked together by interpersonal networks. Rogers (1983) found that organizational interconnectedness is positively related to innovativeness. Hall (1991) argued that horizontal, or lateral communication, is a vital and an important aspect of organizational existence.

Katz et al. (1978) mentioned that within an organizational unit, communication is highly critical for efficient system functioning. McGrath (1984) found that the group, task situation, and environment, which includes techniques and the technologies employed by the group, are all vital elements in shaping group interconnectedness and outcome. In addition, telecommunications has increased interconnectedness. Better interpersonal communication saves
time, money, and leads to better mutual understanding and coordination.

Formalization is the extent to which written rules and procedures are designed to handle the problems faced by organizations as a form of Weberian bureaucratic rationality (Hall, 1991; Hinnings et al., 1976). In this sense, the higher an organization's scores on formalization, the more its reliance on written communications. It is the degree to which an organization emphasizes rules and procedures in the role of performance of its members. In general, the extent of formalization varies from an organization to another.

Rogers (1983) argued that formalization inhibits consideration of innovations by organization members, but encourages their implementation. Hage et al. (1970), and Hage et al. (1967) found that formalization is negatively related to organizational innovativeness.

Hall (1991) mentioned that the degree to which an organization is formalized is an indication of the perspectives and perceptions of its decision makers in regard to organizational members. This reflects the opinion of an organization as being a mirror of its elites' perspectives (Hage et al., 1973). Hage et al. (1967) argued that the presence of a well-trained staff, in an organization, is related to a reduced need for extensive rules and policies. Blau (1970) pointed out that highly formalized organizations
are highly centralized ones. This can be interpreted as a direct consequence of the availability of highly qualified personnel. This comes as a direct consequence of the formalized and standard rules and procedures in selecting applicants for jobs and promoting the old ones. In general, one of the solid bases of formalization is its willingness and ability to make decisions based upon professional training and experience.

Scott (1987) identified formalization as the extent that the rules governing personnel behaviors are precisely and explicitly formulated and that rules and role relations are prescribed independently of the personnel attributes of individuals occupying positions in organizational structures. In this sense, formalization may be viewed as an attempt to make personnel behaviors predictable by standardizing and regulating them. Such stable expectations are an essential precondition to a rational considerations of the consequence of action in a social group.

Blau et al. (1971) found that organizations select highly qualified individuals to ensure that they will act according to their organizational demands and rules. Hage et al. (1967) argued that organizations that establish high levels of formalized rules, or rigid routines, for their members to follow, leave no time or rewards for their involvement.

Burack (1967) argued that the characteristics of the
organizational technology system influence the organizational personnel, the allocation of functions and responsibilities, design of organizational control system, and managerial activity patterns.

Kohn (1971) argued that there is significant relationship between bureaucratization, operationalized as the number of formal hierarchical levels in an organization, and employee intellectual flexibility, openness to change, and choice of leisure time. When the employee's educational level is statistically controlled, the impact of the bureaucratic structure on the outcomes of interests is reduced. On the other hand, Child (1976) found that Larger organizations are more specialized, have more rules, more documents, more extended hierarchies, and a greater decentralization of decision making further down such hierarchies.

Morris (1972) emphasized that organizational growth is a measure of organizational success. It is a major way in which organizational decision makers or elites demonstrate their contribution to the organization. In general, from all the previously mentioned studies, looking at rural telephone company structure from only one perspective cannot provide sufficient information about its technological innovativeness.
2.7.1. **Small Rural Telephone Company Size**

Kimberly (1976) observed that organizational size has four related aspects: (1) physical capacity of the organization or boundaries; (2) personnel available to the organization including both full time and part time ones; (3) organizational inputs or outputs including number of clients served; and (4) the discretionary resources available to the organization. These components of organizational size, according to Kimberely, should be treated separately.

Inkson et al. (1970) found that increased organizational size is related to increased organizational structure and decreased centralization. Gooding et al. (1985) argued that increasing organizational subunit size is negatively related to their performance. Mahoney et al. (1972) emphasized that delegation, flexibility, and emphasis on results rather than procedures are related to larger size organizational units.

Child (1976) observed that larger organizations are more specialized, have more rules, more documentation, more extended hierarchies, and greater decentralization of decision making further down such hierarchies. Mohr (1969) found that size is positively related to innovativeness. Marsh et al. (1981) found that structural differentiation, or complexity, was linked causally to size more than technology.

Growth in administrative departments is related to large size, while growth in academic or research departments has
more of technological base (Dewar et al., 1978). Pressures from the community contribute to the differentiation and expansion of academic departments (Daft et al., 1980).

Mohr (1969) and Rogers (1983) found that larger rural telephone companies are more innovative. Larger size rural telephone companies mostly dominate the smaller ones and exploit their available resources and capabilities for their profits.

**Hypothesis 2.7.1.** Size of a small rural telephone company is positively related to its technological innovativeness.

2.7.2. **Small Rural Telephone Company Resources**

Resources are the most viable elements necessary for organizational survival. Therefore, competition, dominance, and cooperation are the most common relationships existed in organizational niche shared by different organizations (Mcklevey, 1982). Organizational slack is the degree to which uncommitted resources are available to an organization (Rogers, 1983).

Manns et al. (1978) found that weaker organizations, with insufficient access to resources, have to innovate more in order to compensate for resources. On the other side, strong organizations, with sufficient access to resources, respond to adversity with fewer innovations than weaker ones.

Mostly, larger organizations, with a surplus of
resources, adopt unplanned or non-programmed innovations as soon as they have those slack resources. As a consequence, small rural telephone companies use partnerships and joint programs as a strategy to overcome their lack of resources. This strategy avoids fierce competition of bigger companies. Loans, grants, and financial aid are other strategies to create resources. Sawhney et al. (1991) found that small rural telephone companies have some strategies to deal with deficiency of resources including employee training and self sufficiency, partnership joint programs, and regional alliances.

Small rural telephone companies have been monopoly utilities. Although they are not in competition for customers. They do have to compete for loans, grants, and financial aid with other companies.

Hypothesis 2.7.2. In a small rural telephone company, availability of financial resources is related to its technological innovativeness.

2.8. Small Rural Telephone Companies' Activities For Community Development

A community is defined as the combination of social units and systems that perform the major social functions having locality relevance. It is the organization of social activities to afford people daily local access to those broad
areas of activities that are necessary in day-to-day living (Warren, 1978). This definition emphasizes the importance of horizontal communication for human community (Wilson, 1992). Similarly, this definition is consistent with the definition of community development put by the United Nations as a process designed to create conditions of economic and social progress for the whole community with its active participation and the fullest possible reliance on the community initiatives (Rothman et al., 1987).

In general, telecommunications is an important infrastructure for community development. It is considered as a facilitating component. It reduces the costs of distance and has the potential for increasing economic productivity (Wilson et al., 1990). Baldridge et al. (1975) found that environmental input from the community and other organizations is a major determinant of an organization's innovativeness.

Sawhney et al. (1991) found that Small rural telephone companies are locally owned and their owners are aware of their local area needs. They are highly responsive to these community needs. Therefore, there is a special symbiotic relationship between these companies and rural communities where they are located. They are providing job opportunities for rural residents and investing in enriching human resources through their in-house-training. Baldridge et al. (1975) found that environmental input from the community and other
organizations is a major determinant of an organization's innovation behavior. Daft et al. (1980) observed that pressures from the community contribute to the differentiation and expansion of the technological units in an organization.

In addition, these rural telephone companies are encouraging the potential to maximize businesses in their locations in order to make higher profits by adding more subscribers. At the same time, rural communities are supporting those companies as they realize their mutual interests with them. Hage (1980) emphasized the importance of interest groups, such as local communities, as a driving environmental force of organizational change.

**Hypothesis 2.8.** Small rural telephone company activities for local community development are positively related to its technological innovativeness.

2.9. Some Important Factors in Choosing New Technology for Small Rural Telephone Company

Zaltman et al. (1973) found that the total innovation process consists of five stages: (1) knowledge-awareness, (2) formation of attitudes, (3) decision, (4) initial implementation, and (5) continued-sustained implementation. Clipson (1991) argued that all aspects of innovation should be examined prior to major expenditures on development. They include market need, technical, production and marketing
requirements, and a basis for protecting the product from competition. Rosner (1968) argued that organizations can cope with environmental changes and uncertainties not only by applying technological innovations, but also by successfully integrating technical or administrative changes into their organizational structure. Corwin (1973), and Hall (1991) found that economic conditions of the organizations may affect, positively or negatively, the adoption of innovation.

In general, some factors are important in determining the appropriate technological innovations adopted by small rural telephone companies. Among those factors: (1) technical aspects such as skills of personnel and training of technicians; and (2) economic aspects such as availability of low interest loans and the Rural Electrification Administration's regulations, rate of return as an objective, and cost of the new technology.

**Hypothesis 2.9.** In a small rural telephone company, skill of personnel and training of technicians, availability of low interest loans and REA specifications, and cost of technology and Rate of return as an objective are positively related to its technological innovativeness.
2.10. Linkage with Other Companies Outside Service Area

Bidwell et al. (1985) used the concept of organizational niche as synonymous to organizational environment. Corwin (1973), Manns et al. (1978), and Hannan et al. (1984) emphasized the role of both external and internal environmental factors on organization. Domination, competition, dependency, and symbiosis are the main types of relationships in organizational environment. Robey (1991) argued that competition for scarce budget resources often stimulates conflict between innovative groups and more practical groups within an organization. Similarly, conflict occurs among organizations competing for available scarce resources.

Organizational linkages, arrangements, and relationships with other organizations in the same environment may be perceived as resources. Sawhney et al. (1991) defined those relationships as partnership or joint projects. They are of mutual benefits for partners.

The linkages with other organizations may be both within and outside the service area. The arrangements provide for facilities, sharing of expertise and information, sharing of personnel, sharing maintenance, sharing costs and saving money, and other similar activities of mutual importance for small rural telephone companies involved in the arrangements.
Hypothesis 2.10. In a small rural telephone company, linkages with other companies outside its service area are related to its technological innovativeness.

2.11. Inhibiting Federal and State Laws and Regulations

Briesemeister et al. (1989) found that there are three factors that have driven state policy-makers to take a more critical look at telecommunications policy: (1) the economic problems that most states experienced in the late 1970s and the early 1980s (these problems drove policy-makers to take more active role in promoting the economic welfare of their states), and (2) the growing awareness that a sophisticated telecommunications infrastructure is necessary to support a convergence of computer and telecommunications technology, which was, to a large extent, responsible for the breakup of AT&T and the reevaluation of telecommunications regulations.

Federal laws and regulations can play a major role as a stimulus or barrier to rural telephone company technological innovativeness. Daft et al. (1978) found that innovation increases as incentives for innovative alternatives increase. Supporting federal policies can increase organizational innovation. Some departments in American universities do not have any need to innovate because of the huge federal funds they have. On the other hand, the weaker departments have to
innovate in order to compensate for their lack of resources (Manns et al., 1978). McNeil et al. (1977) found that federal regulations in health service can impose innovations on hospitals. Adoption of some health care technologies may be forced on hospitals by federal standards. It was found that the Japanese Governmental regulations and laws are more conducive to japanese companies to expand and innovate, locally and internationally, than those of the U. S. government (Holden, 1980). Holden (1980) argued that policies and regulations made by the Japanese government are better coordinated and more conducive to innovation than those of the United States.

Hall (1981) argued that governmental policies can encourage or discourage organization innovativeness based on the nature of the regulation itself. Sawhney et al. (1991) argued that in the post-divestiture era federal governments are less involved in state telephone policies than state governments. Therefore, state policies and regulations can affect rural small telephone companies positively or negatively. Divestiture created competition and moved a significant part of telecommunications policy debate from the federal to state level. As a consequence, state governments began to be actively involved in telecommunications as important users and some of them began to develop different policies in this regard.
McNamara (1991) expected that state regulations will continue to play a key role in telecommunications future, often taking new forms. Irwin (1984) argued that state regulations possess one virtue that supersedes that of federal power. State utility commissions, according to Irwin (1984), bear the consequences and burden of their regulatory actions.

Local governmental policies not only determine the pricing of telecommunications, but also influence the long-term development of telecommunications infrastructure. They include both economic efficiency and social equity (Twenbafe et al., 1989). The main concern of policy-makers is to ensure affordable services for consumers while allowing telephone companies a fair return on their investment. Biggart (1977) emphasized laws and regulations as a driving environmental force of organizational change.

The innovative actions of successful small rural telephone companies can be viewed as experiments from which policymakers can gain insight to develop appropriate policies for rural telephone companies. In addition, policymakers can have the benefits of knowing the problems and barriers those companies face in implementing their innovations.

**Hypothesis 2.11.** In a small rural telephone company, inhibiting regulations (state/federal) are negatively related to its technological innovativeness.

Figure 2.1 shows the theoretical model used in this study.
Figure 2.1. Theoretical model used in the study.
CHAPTER III. METHODS AND PROCEDURES

This chapter deals with the methods and procedures of the study. The main objectives of this chapter are: (1) to describe the research setting, (2) present the primary procedures and their theoretical background, (3) describe the operationalization of the variables, and (4) discuss the statistical techniques used in analyzing the data.

3.1. The Research Setting

This study primarily concerns the adoption of innovative telecommunications technologies and services by rural telephone companies in the State of Iowa. The study examines the demographics and perceptions of company leaders, company characteristics, and different environmental factors related to the adoption of innovative technologies and services.

Data were collected in summer 1994 as a part of a project supported by Iowa State University College of Agriculture. Prior to collecting the data, a pretest was conducted on six managers of rural telephone companies in Wisconsin. Although there are 152 rural telephone companies in the State of Iowa, telephone interviews were conducted only with managers of 134 rural telephone companies. Managers affiliated with more than one company were interviewed for only one company. The three large and primarily urban telephone companies were excluded.
from the survey (GTE, U.S. West, and Vista) as a consequence of their inconsistency with other Iowa rural telephone companies. The Sample Survey Section of Iowa State University Statistical Laboratory conducted the telephone interviews. Each interview took approximately 25 minutes to be completed and the response rate was 93 percent. In the study, rural telephone companies were taken as the units of analysis.

3.2. Variable Operationalization

3.2.1. Dependent Variables

Innovation is defined as an idea, or practice, or object that is perceived as new by a rural telephone company. Similarly, innovativeness, the dependent variable, is defined as the degree to which a rural telephone company is relatively earlier in adopting an innovation than others (Rogers, 1983).

Telecommunications technological innovativeness is measured with a scale that sums the level of use over nine separate telecommunications technological innovations.

In the study, telecommunications technological innovativeness was measured by the question "Does your company offer (service)? teleconferencing; three-way calling; voice mail; dedicated lines; call waiting; call forwarding; cellular telephones; enhanced 911 (E911); telephone device for the deaf (TDD); video conferencing; caller identification; digital data services; public packet switching; and Signaling
System 7 service (SS7)." Each respondent was asked to choose one of the responses: Yes; No. If the response is No, then the respondent is asked the question: "will you be adding (service) within the next five years? The respondents are asked to choose one of the responses: No; No, unsure; and No, but will add it (service) in the next five years. The responses from the two questions were then combined and coded as: 4=Yes the service is offered; 3=No, but it will be added in the next five years; 2=No, and uncertain as to whether it will be offered in the next five years; and 1=No, it will not be offered.

Three way calling, dedicated lines, call waiting, and call forwarding were deleted because there was no variation in their distributions. Enhanced 911 (E911) was deleted because its adoption involved not a telephone company decision rather a community decision.

Factor analysis was conducted. Although three factors were extracted, only the first had an eigenvalue greater than one (2.4). Furthermore, there was much overlap of items loading across the three factor. Therefore, teleconferencing, voice mail, cellular telephone, telephone device for the deaf, video conferencing, caller identification, digital data services, public packet switching, and Signaling System 7 service were used together to represent telecommunications technological innovativeness.
To assess internal consistency, reliability analysis was conducted on the scale. While a typical reliability coefficient is approximately .7 or higher (Sproull, 1988:75), in exploratory research alpha of .5 or .6 are acceptable. Cronbach's alpha coefficient for telecommunications technological innovativeness is .71. Telecommunication technological innovativeness ranged from 1.3-3.9, with a mean of approximately 3. The standard deviation of telecommunications technological innovativeness is .51.

3.2.2. Independent Variables

The independent variables used in this study are:

3.2.2.1. Small Rural Telephone Company Leadership and Demographics

Leaders' attitudes and characteristics, as independent variables, were viewed by Rogers (1983); Tsui et al. (1989); and Marsh et al.(1981) as one of the most important independent variables affecting innovativeness. In this study, the following leader demographics and perception variables were used:

3.2.2.1.1. Small Rural Telephone Company Managers

Commitment or Attitudes of Leadership

This variable was measured by the questions: (1) "Think about local economic development and the importance of institution/infrastructure
on continuing development. On a scale from 1 to 10, where one means not important at all and ten means very important, how important is telecommunications to continuing development in your areas?"

Seventy two managers (approximately 55%) mentioned that telecommunications is very important, as an infrastructure, for local community economic development. All of the respondents (100%) perceived telecommunications as an important infrastructure for community economic development.

The respondent ranged in perception of telecommunications importance from 2-10, with a mean of approximately 9, and a standard deviation of 1.5.

3.2.2.1.2. **Age**

Manager's age was measured by the question  "How old were you on your last birthday?"

___ Years old.

The respondents ranged in age from 27-83 years, with a mean age of approximately 49 years. Standard deviation of age is 10.49. Table 3.1 shows the distribution of age.

3.2.2.1.3. **Highest Level of Formal Education Completed**

Highest level of formal education obtained by small rural telephone company managers was measured by the question  "What is the highest level of education you have completed,
Table 3.1. Age of Iowa small rural telephone company managers

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>27-47</td>
<td>61</td>
<td>46.56</td>
</tr>
<tr>
<td>48-68</td>
<td>67</td>
<td>51.15</td>
</tr>
<tr>
<td>69-89</td>
<td>3</td>
<td>2.29</td>
</tr>
</tbody>
</table>

Number of Respondents=131

including college, vocational, or technical training?" The respondent's answer in number of years was coded as:
0-11=Less than high school; 12=High school diploma; 13-15=Some college or post-secondary; 16=College degree; 17=Post-graduate work but not a degree; and 18=M.S. or above.

The respondents ranged in highest level of formal education completed from 9 (ninth grade) to 18 (Master degree or above), with a mean education level completed of approximately 13 (some college or post-secondary).

The majority of the managers of Iowa small rural telephone companies had high school diploma (42%) followed by some college or post-secondary (41%). Table 3.2 shows the distribution of the highest formal educational level completed by Iowa small rural telephone company managers.

3.2.2.1.4. Tenure In this study, tenure is measured in terms of the period of time the manager spent in the telecommunications field and in his present company. This was measured by the questions "How many years have you worked in
Table 3.2. Highest level of formal education completed by Iowa small rural telephone company managers

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ninth Grade</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>High School Diploma</td>
<td>55</td>
<td>41.98</td>
</tr>
<tr>
<td>Some College or Post-Secondary</td>
<td>53</td>
<td>40.46</td>
</tr>
<tr>
<td>College Degree</td>
<td>18</td>
<td>13.74</td>
</tr>
<tr>
<td>Post-Graduate Work but not a Degree</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Master Degree or Above</td>
<td>3</td>
<td>2.29</td>
</tr>
</tbody>
</table>

Number of Respondents=131.

the telecommunications field?____years"; and "How many years have you been with this company?____years"

Tenure also was measured by the question "How many years have you been in your present position?____years"

The respondents ranged in number of working years in telecommunication field from 3-64 years, with a mean of approximately 25 years. The standard deviation for number of years working in telecommunication field is 11.27. Table 3.3 shows the distribution of number of working years spent by managers in telecommunications field. A large percentage of Iowa small rural telephone company managers (approximately 48%) spent 18-34 years working in the field.

The respondents ranged in number of working years in the same company from 0-45 years, with a mean of approximately 20 years. The standard deviation for number of years spent in the same company is 11.31. Table 3.4 shows the distribution
of number of years spent by small rural telephone company managers in their present companies. A large percentage of the managers (approximately 43%) spent 16-31 years working for the same company.

The respondents ranged in number of working years in the present position from 0-42 years, with a mean of approximately 14 years. The standard deviation for number of years in the same position is 10.03. Table 3.5 shows the distribution of number of years spent by small rural telephone companies' leaders in the same positions. A large percentage of the respondents (approximately 50%) spent 0-10 years in the same position.

Table 3.3. Number of working years spent by Iowa small rural telephone company managers in telecommunications field

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-17</td>
<td>36</td>
<td>27.48</td>
</tr>
<tr>
<td>18-34</td>
<td>63</td>
<td>48.10</td>
</tr>
<tr>
<td>35-51</td>
<td>31</td>
<td>23.66</td>
</tr>
<tr>
<td>51-67</td>
<td>1</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Number of Respondents=131

3.2.2.1.5. Formal Training: This variable was measured by the question "Have you had any formal training in telecommunications, such as vocational or technical training as well as college courses?". Respondents were asked to choose one of the responses: 1=Yes; 2=No.
Table 3.4. Number of years spent by Iowa small rural telephone company managers in the same companies

<table>
<thead>
<tr>
<th>Years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>52</td>
<td>39.69</td>
</tr>
<tr>
<td>16-31</td>
<td>56</td>
<td>42.75</td>
</tr>
<tr>
<td>31-46</td>
<td>23</td>
<td>17.56</td>
</tr>
</tbody>
</table>

Number of Respondents=131

Table 3.5. Number of years spent by Iowa small rural telephone company managers in the same position

<table>
<thead>
<tr>
<th>Period of Time</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>65</td>
<td>49.62</td>
</tr>
<tr>
<td>11-21</td>
<td>38</td>
<td>29.01</td>
</tr>
<tr>
<td>22-32</td>
<td>23</td>
<td>17.56</td>
</tr>
<tr>
<td>33-43</td>
<td>5</td>
<td>3.82</td>
</tr>
</tbody>
</table>

Number of Respondents=131

In addition, respondents who had formal training were asked: "what was that?__________________". Table 3.6 shows the distribution of formal training the managers attended. The majority of the managers (approximately 77%) attended formal training. Technical training, and GTE or U.S. West sponsored courses, and various short courses were on top of the training programs attended by the managers (each is approximately 24%). Table 3.7 shows the types of formal training programs attended Iowa small rural telephone company managers.
Table 3.6. Formal training attended by Iowa small rural telephone company managers

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>101</td>
<td>77.10</td>
</tr>
<tr>
<td>No</td>
<td>29</td>
<td>22.14</td>
</tr>
<tr>
<td>No Response</td>
<td>1</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Number of Respondents=131.

Table 3.7. Types of formal training attended by Iowa small rural telephone company managers

<table>
<thead>
<tr>
<th>Types of Training</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Training</td>
<td>32</td>
<td>24.43</td>
</tr>
<tr>
<td>Digital Switching Training,</td>
<td>29</td>
<td>22.14</td>
</tr>
<tr>
<td>Telephony Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GTE or U.S. West Sponsored Course,</td>
<td>31</td>
<td>23.66</td>
</tr>
<tr>
<td>Various Short Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBX School</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Electrical Engineering 2 Year Degree</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Special in-House Courses</td>
<td>4</td>
<td>3.05</td>
</tr>
<tr>
<td>Military Training in Communications</td>
<td>6</td>
<td>4.58</td>
</tr>
<tr>
<td>Equipment Manufacturers' Training</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>Automatic Switching Schooling</td>
<td>5</td>
<td>3.82</td>
</tr>
<tr>
<td>Telecommunications Degree from Technical School</td>
<td>11</td>
<td>8.40</td>
</tr>
<tr>
<td>Electronic Training</td>
<td>2</td>
<td>1.53</td>
</tr>
</tbody>
</table>

Respondents (N=131) could provide more than one answer.

3.2.2.2. Small Rural Telephone Company Structure

Rural telephone Company structure includes company formalization, complexity, interconnectedness, resources, and size. In this study, size and resources are used.
3.2.2.2.1. Small Rural Telephone Company Size

Small rural telephone company size is a surrogate measure of several dimensions that lead to technological innovativeness including total resources, slack resources, organizational structure, and so on (Rogers, 1983). Size can be measured by different criteria and with a high degree of precision. In some cases, small rural telephone company size may be used as an indicator of company resources and capabilities. The most common measure of size is number of employees. This includes both part and full-time employees. In this study, number of employees, and number of access lines are used to measure small rural telephone company size.

The questions used in this study to measure size were "How many full time employees do you currently have?"; "How many part time employees do you currently have?". Size was measured as the summated value of number of full time employees and number of part time employees. Also, the managers were asked to provide the number of access lines available in their companies.

Size of organizations (number of employees) ranged from 1-96 employees, with a mean of approximately seven employees. The standard deviation of organizational size is 9.10.

Number of access lines ranged from 39-6057, with a mean of approximately 1239 access lines. The standard deviation for access lines is 1236.44.
3.2.2.2.2. Small Rural Telephone Company Resources

Loans, grants, or financing from different sources are considered resources. Taking those resources during the past five years can give an indicator about the present condition of small telephone rural company technological innovativeness. Respondents whose responses were that their companies received financial assistance over the past five years were asked the question about the sources: (1) The Rural Electrification Administration (REA); (2) Any other place? In order to identify other sources in addition to REA, each respondent was asked to specify the financial assistance sources of his company over the past five years. Those sources of organizational financial assistance over the past five years (REA and other sources of financial assistance) are the summated value of Gamid21.

The main financial assistance for Iowa small telephone companies are Rural Telephone Bank (approximately 56%), and Rural Telephone Financial Corporation (approximately 37%). During the past five years, Local Bank was ranked as the first source of financial assistance for Iowa small rural telephone companies. It is obvious that the State government is not a financial assistance source for Iowa small rural telephone companies.

Iowa small rural telephone company financial assistance sources ranged from 2-4 (Local bank to Rural Telephone Bank,
RTB). The standard deviation of this variable is .60.

Table 3.8 shows sources of Iowa rural telephone company financial assistance sources. Table 3.9 shows other types of finance during the past five years other than Rural Electrification Administration (REA).

3.2.2.3. Small Rural Telephone Company Activities for Local Community Economic Development

This variable was measured by the question: "Has (company) been involved in any of the following activities? (a) Providing support to local entrepreneurs starting new businesses; (b) Assisting with the recruitment of businesses or industries to locate in the local area; (c) Working on the development of local infrastructure other than telecommunications (such as roads, water and sewer lines, rail access, etc.); (d) Helping with the development of public services such as education, health and welfare services; (e) Job training programs; (f) Consulting on innovative

Table 3.8. Different financial assistance sources of Iowa small rural telephone companies (Gamid21)

<table>
<thead>
<tr>
<th>Source</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Bank</td>
<td>7</td>
<td>5.34</td>
</tr>
<tr>
<td>Rural Telephone Fin. Cor. (RTFC)</td>
<td>49</td>
<td>37.40</td>
</tr>
<tr>
<td>Rural Telephone Bank (RTB)</td>
<td>73</td>
<td>55.73</td>
</tr>
<tr>
<td>State of Iowa (INRB)</td>
<td>2</td>
<td>1.53</td>
</tr>
</tbody>
</table>

Respondents (N=131) could provide more than one answer.
Table 3.9. Types of other finance other than REA during the past five years

<table>
<thead>
<tr>
<th>Source</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Individuals</td>
<td>3</td>
<td>2.29</td>
</tr>
<tr>
<td>Local Bank</td>
<td>14</td>
<td>10.69</td>
</tr>
<tr>
<td>RTFC (Rural Telephone Finance Corporation)</td>
<td>7</td>
<td>5.34</td>
</tr>
<tr>
<td>RTB (Rural Telephone Bank)</td>
<td>6</td>
<td>4.58</td>
</tr>
<tr>
<td>Co-Bank</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>Stockholders, Main Branch Office,</td>
<td>3</td>
<td>2.29</td>
</tr>
<tr>
<td>Sell Stock on Capital Market, Internally</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State of Iowa (Iowa Industrial Revenue Bonds)</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>NA, no 2nd. Source of Financing</td>
<td>93</td>
<td>70.99</td>
</tr>
<tr>
<td>Don't Know</td>
<td>2</td>
<td>1.53</td>
</tr>
</tbody>
</table>

Respondents (N=131) could provide more than one answer.

applications of telecommunications to new or existing businesses; (g) Working on the retention and expansion program for existing businesses or industries; (h) Working with local or county economic development organizations; (i) Any other area of local economic development? ______(specify)." The Respondents were asked to choose one of the two answers for each activity: 1=Yes, and 2=No.

Rural telephone company activities in local area economic development was computed in one variable, Compact, as a summated score given for each of the nine small organizational activities in which the company participated.

Cronbach's alpha reliability coefficient for this variable (Compact) is .76. Compact ranged from 0-9, with a
mean of approximately 5. The standard deviation for Compact is 2.48.

3.2.2.4. Some Important Factors in Choosing New Technology for Small Rural Telephone Company

Several factors are believed to be important for choosing appropriate technological innovations. These factors can facilitate or hinder technological innovativeness.

In order to measure some of these important factors in choosing new technology for small telephone companies, the managers were asked to rate the importance of each variable in a four point scale as: 1=Not at all unimportant; 2=Not too important; 3=Somewhat important; 4=Very important.

Four factors were extracted of important factors in choosing new technology for small rural telephone companies. Three of those factors have eigenvalues of almost one or more (1.92, 1.45, and .94). The first factor accounted for 17.5% of the variance of the variable and has four variables: skill of personnel, training of technicians, and government laws, and regulations). It had two variables with the highest factor loading values (skill of personnel, and training of technicians), and only these were used in the scale.

The second factor has four variables (rate of return as an objective, cost of technology, being competitive, maintaining low local rate) and accounted for 10.4% of the
variance of the independent variable. It has two variables with the highest factor loading (rate of return as an objective, and cost of technology), and only these were used in the scale.

The third factor has two variables with the highest factor loading (Rural Electrification Association (REA) specifications, and availability of low interest loans), and only these were used in the scale. It accounted for 8.6 of the variance of the independent variable.

Cronbach's alpha reliability coefficient for Skltrain was .71. Goreaco and Rest16 have relatively lower reliability coefficients (.59, .58).

Skltrain ranged from 2-4, with a mean of approximately 3.70, and standard deviation of .51. Goreaco ranged from 1.7-4, with a mean of approximately 3.5. The standard deviation of Goreaco is .46. Rest16 ranged from 2.5-4, with a mean of approximately 3.5, and standard deviation of .35.

3.2.2.5. **Linkage with other Companies Outside Service Area**

Linkage with other companies outside service area was measured by the question: "Some telecommunications providers develop various kinds of linkages, arrangements or agreements with other providers outside their service area, such as joint plowing of cable, pole attachment agreements, and consortiums
of maintenance personnel. Does your company have any linkages, arrangements, or agreements with other companies? Respondents were asked to choose one of the answers: 1=Yes; and 2=No.

The majority of Iowa small rural telephone companies (70%) have linkages outside their service areas, while 39 companies (30%) have no linkages outside their service areas. Respondents were asked to specify types of linkages with other companies and benefits accrued from these relationships. Most of these linkages (approximately 50%) are with other independent telephone companies, followed by Iowa Network Services (approximately 15%). The respondents viewed that the most important benefits accrued from these linkages with other companies outside service areas are sharing facilities, equipment, and pole attachment (29%), followed by saving costs and saving money (24%). Table 3.10 shows types of linkages with other companies outside service areas. Table 3.11 shows different benefits accrued from linkages with other companies outside service area.

3.2.2.6. Inhibiting Federal and State Laws and Regulations

Inhibiting state regulation is measured by the question "Are there any state regulations which make it difficult for your company to upgrade its system?" Respondents are asked to
Table 3.10. Types of linkages with other companies outside service areas

<table>
<thead>
<tr>
<th>Linkages</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Companies-Electric</td>
<td>18</td>
<td>13.74</td>
</tr>
<tr>
<td>Other Independent Telephone Companies</td>
<td>65</td>
<td>49.62</td>
</tr>
<tr>
<td>Cellular Company</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>Iowa Network Services (INS)</td>
<td>20</td>
<td>15.27</td>
</tr>
<tr>
<td>AT&amp;T Stock Corp., Equal Access Provider</td>
<td>4</td>
<td>3.05</td>
</tr>
<tr>
<td>U. S. West</td>
<td>11</td>
<td>8.40</td>
</tr>
<tr>
<td>Commercial Billing Service</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>GTE</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Fibernet Communications</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Construction and Installing Contractors</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>City</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>No Linkages</td>
<td>6</td>
<td>4.58</td>
</tr>
</tbody>
</table>

Respondents (N=131) could provide more than one answer.

choose one of the responses: 1=Yes; and 2=No.

The majority of Iowa small rural telephone company managers (87%) perceived that there are no state regulations which make it difficult for their companies to upgrade their systems. On the other hand, 16 companies' managers (13%) viewed that there are inhibiting state regulations.

Inhibiting federal regulations variable was measured by the question "Are there any federal regulations which make it difficult for your company to upgrade its system?" Respondents were asked to choose one of the two responses: 1=Yes; and 2=No. The respondents were asked to specify those inhibiting federal regulations.

The majority of Iowa small rural telephone company managers (85%) perceived that there are no inhibiting federal
Table 3.11. Benefits of linkages with other companies outside service areas

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share Facilities/Equipment/Pole Attachments- No Duplicate Needed</td>
<td>38</td>
<td>29.01</td>
</tr>
<tr>
<td>Share Personnel (technicians)-Have People Available to Help When Needed</td>
<td>25</td>
<td>19.08</td>
</tr>
<tr>
<td>Save Construction Cost, Cost of Burying cable</td>
<td>15</td>
<td>11.45</td>
</tr>
<tr>
<td>Provides Services to our Customers So We Don't Have to Do It</td>
<td>21</td>
<td>16.03</td>
</tr>
<tr>
<td>They do our Services and Switch work</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>Sharing Costs, Save Money</td>
<td>32</td>
<td>24.43</td>
</tr>
<tr>
<td>Provides Equal Access, to Hook-Up, Expanding Access</td>
<td>13</td>
<td>9.92</td>
</tr>
<tr>
<td>Fiber Maintenance agreement, If Fiber Optic Cable Needs Repair They Do It</td>
<td>7</td>
<td>5.34</td>
</tr>
<tr>
<td>Gives Broader Customer Base</td>
<td>4</td>
<td>3.05</td>
</tr>
<tr>
<td>Share Maintenance (Cable Splicing), Electronic Switch Repair</td>
<td>4</td>
<td>3.05</td>
</tr>
<tr>
<td>Jointly Own Fiber Optic Network, Provides Toll Redundancy to Toll Customers</td>
<td>10</td>
<td>7.63</td>
</tr>
<tr>
<td>Does Their Billing</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>Technical Support/Expertise</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>They Pay Us to Haul Their Traffic</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Provides Data Test Gear to Test Digital Circuits</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Save Expenses of Hiring Personnel-Cheaper to Conduct for Services Than Put on Staff</td>
<td>1</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Respondents (N=131) could provide more than one answer.

regulations. On the other hand, 19 Iowa small rural telephone company managers (15%) stated that there are inhibiting federal regulations. Table 3.12, 3.13 specify those inhibiting state and federal regulations as perceived by Iowa small rural telephone company managers.
Table 3.12. Inhibiting state regulations as perceived by Iowa small rural telephone company managers

<table>
<thead>
<tr>
<th>Inhibiting State Regulation</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iowa State Utilities Board</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governs Service Routing and Line Connections, We are Regulated by Utilities Board and Cable TV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>is not</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>State Mandated Appreciation Rates</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Audio-Visual Specifications for ICN</td>
<td>5</td>
<td>3.82</td>
</tr>
<tr>
<td>Open Competition on Local Service</td>
<td>3</td>
<td>2.29</td>
</tr>
<tr>
<td>Property Tax Rules and Regulations, Tariff Regulations for Upgrading, PCS Technology Regulations</td>
<td>3</td>
<td>2.29</td>
</tr>
<tr>
<td>Policies on Extended Calling Area Service</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>Environmental Regulations, Safety Regulations (Cable on Interstate)</td>
<td>2</td>
<td>1.53</td>
</tr>
<tr>
<td>NA, no others</td>
<td>111</td>
<td>84.73</td>
</tr>
<tr>
<td>Don't Know, Nothing Specific</td>
<td>3</td>
<td>2.29</td>
</tr>
</tbody>
</table>

Respondents (N=131) could provide more than one answer.

Table 3.13. Inhibiting federal regulations as perceived by Iowa small rural telephone company managers

<table>
<thead>
<tr>
<th>Hindering Regulation</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost Tax Exempt Status as a Utility Coop</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>1992 Cable Act, Cable TV Cross-Owner Regulation, Can't Install Cable TV</td>
<td>4</td>
<td>3.05</td>
</tr>
<tr>
<td>REA Loan Specifications, New Rules of REA, Borrowing Money for Upgrade</td>
<td>3</td>
<td>2.29</td>
</tr>
<tr>
<td>FCC Regulations (Allow Cable Companies to Bypass Phone Companies to Get Video Dial Tone</td>
<td>4</td>
<td>3.05</td>
</tr>
<tr>
<td>Caller ID Rules and Regulations</td>
<td>2</td>
<td>1.52</td>
</tr>
<tr>
<td>Competition</td>
<td>2</td>
<td>1.52</td>
</tr>
<tr>
<td>Inter-Lata Restrictions</td>
<td>1</td>
<td>0.76</td>
</tr>
<tr>
<td>NA, no others</td>
<td>111</td>
<td>84.73</td>
</tr>
<tr>
<td>Don't Know, Nothing Specific</td>
<td>3</td>
<td>2.29</td>
</tr>
</tbody>
</table>

Respondents (N=131) could provide more than one answer.
3.3. Statistical Techniques

Data collected from phone interviews were analyzed. The computer Subprogram Statistical Package for the Social Sciences (SPSS) was used for data analysis. Frequencies of all variables were obtained. Factor analysis, reliability, and correlations among independent variables were computed.

3.3.3. Zero-Order Correlation

Correlation analysis provides a summary coefficient of the extent of relationship between two variables (Kachigan, 1982).

3.3.4. Multiple Regression

Multiple regression is the statistical term for predicting performance of dependent variable from two or more weighted independent variables. To maximize predictive accuracy, it is desirable to have predictors that correlate highly with the criterion but do not correlate highly with —

Step-wise or forward multiple regression was used in analyzing the data. It begins with the predictor variable most highly correlated with the criterion variable. The error of prediction resulting from that regression equation are then correlated with the values of each of the remaining predictor variables to identify the one which accounts for the most of this unexplained residual variance. Then, the error of
prediction resulting from the regression equation incorporating both predictor variables are correlated with the values of the remaining predictor variables to identify the one that can account for the most of the residual variance.

This step-wise procedure is stopped at the point where the introduction of another variable would account for only a trivial or satisfactory insignificance portion of the unexplained variance (Kachigan, 1982).

In this study, the data were explored by step-wise forward regression analysis. The single criterion used to enter a variable into the regression analysis was that its correlation with the dependent variable had to be significant at the .05 level. In general, step-wise regression in this study was used to determine how all independent variables used in this study explain variance in the dependent variables of telecommunications technological innovativeness.

This chapter described the basic assumptions, the procedures, the measures of this study, and the statistical techniques used. The results will be presented in the next chapter.
4.1. Zero-Order Correlation Coefficients

Table 4.1 shows the correlation matrix of the independent variables used in the study, and the dependent variable, telecommunications technological innovativeness. Table 4.2 shows a summary of zero-order correlation coefficients between the independent variables and telecommunications technological innovativeness. Following are the findings from the zero-order correlations coefficients.

4.1.1. Small Rural Telephone Company Leadership and Demographics

4.1.1.1. Small Rural Telephone Company Managers Commitment or Perception of Leadership

Hypothesis 2.6.1. In a small rural telephone company, manager's perception of telecommunications importance, as an infrastructure, is positively related to its technological innovativeness.

This hypothesis was supported \( r=.23; p=.008 \). This finding was consistent with those of Rogers (1983), Amabile (1988), Lord (1977), and Weick (1979). Kaufman (1971) mentioned that organizational change takes place through leaders' turnover. Sawhney et al. (1991) found that small rural telephone companies have been colored by the personal visions of their individual managers.
Table 4.1. Correlation matrix of all variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>X1</th>
<th>X2</th>
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</thead>
<tbody>
<tr>
<td>(X1) Perception of Telecommunications Importance</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>(X2) Age of Leaders</td>
<td>.03</td>
<td>1.00</td>
</tr>
<tr>
<td>(X3) Highest Level of Formal Education Completed</td>
<td>-.07</td>
<td>-.24**</td>
</tr>
<tr>
<td>(X4) Number of Working Years in Telecomm.</td>
<td>.21*</td>
<td>.74**</td>
</tr>
<tr>
<td>(X5) Number of Working Years in the Same Company</td>
<td>.10</td>
<td>.66**</td>
</tr>
<tr>
<td>(X6) Number of Working Years in the Same Position</td>
<td>.04</td>
<td>.63**</td>
</tr>
<tr>
<td>(X7) Formal Training</td>
<td>-.20**</td>
<td>.02</td>
</tr>
<tr>
<td>(X8) Number of Employees</td>
<td>.05</td>
<td>.12</td>
</tr>
<tr>
<td>(X9) Number of Access Lines</td>
<td>.14</td>
<td>.14</td>
</tr>
<tr>
<td>(X10) Company Resources (Gadid21)</td>
<td>.02</td>
<td>.10</td>
</tr>
<tr>
<td>(X11) Activities for Local Economic Development</td>
<td>.23**</td>
<td>-.07</td>
</tr>
<tr>
<td>(X12) Skltrain</td>
<td>.37**</td>
<td>.11</td>
</tr>
<tr>
<td>(X13) Goreaco</td>
<td>.18*</td>
<td>-.00</td>
</tr>
<tr>
<td>(X14) Rest16</td>
<td>.13</td>
<td>-.05</td>
</tr>
<tr>
<td>(X15) Linkages with other Companies (O.S.A)</td>
<td>.02</td>
<td>.03</td>
</tr>
<tr>
<td>(X16) Inhibiting State Regulations</td>
<td>-.04</td>
<td>-.14</td>
</tr>
<tr>
<td>(X17) Inhibiting Federal Regulations</td>
<td>-.08</td>
<td>-.17</td>
</tr>
<tr>
<td>Telecommunications Technological Innovativeness</td>
<td>.23**</td>
<td>.16</td>
</tr>
</tbody>
</table>

*Significant at .05 level; **Significant at .01 level
Table 4.1. (Continued)

<table>
<thead>
<tr>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
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<tr>
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<td>-0.13**</td>
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</tr>
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<td>0.81**</td>
<td>1.00</td>
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</tr>
<tr>
<td>-0.26**</td>
<td>0.72**</td>
<td>0.74**</td>
<td>1.00</td>
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<td></td>
</tr>
<tr>
<td>0.10</td>
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<td>-0.11</td>
<td>-0.03</td>
<td>1.00</td>
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<tr>
<td>-0.04</td>
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<td>0.25**</td>
<td>0.07</td>
<td>-0.08</td>
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<td>0.26**</td>
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<td>0.59**</td>
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<td>0.02</td>
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</tr>
<tr>
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<td>0.05</td>
<td>-0.02</td>
<td>-0.18*</td>
<td>0.23**</td>
</tr>
<tr>
<td>-0.11</td>
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<td>0.10</td>
<td>0.10</td>
<td>-0.09</td>
<td>0.10</td>
</tr>
<tr>
<td>-0.06</td>
<td>-0.03</td>
<td>-0.06</td>
<td>-0.06</td>
<td>-0.01</td>
<td>-0.08</td>
</tr>
<tr>
<td>-0.00</td>
<td>-0.05</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.18*</td>
<td>-0.09</td>
</tr>
<tr>
<td>-0.04</td>
<td>0.10</td>
<td>0.11</td>
<td>-0.01</td>
<td>-0.07</td>
<td>-0.07</td>
</tr>
<tr>
<td>-0.08</td>
<td>-0.21*</td>
<td>-0.17*</td>
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<td>0.03</td>
<td>-0.31**</td>
</tr>
<tr>
<td>-0.07</td>
<td>-0.13</td>
<td>-0.13</td>
<td>-0.12</td>
<td>0.15</td>
<td>-0.06</td>
</tr>
<tr>
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<td>0.02</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.17</td>
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</table>

<table>
<thead>
<tr>
<th>X9</th>
<th>X10</th>
<th>X11</th>
<th>X12</th>
<th>X13</th>
<th>X14</th>
<th>X15</th>
<th>X16</th>
<th>X17</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>0.00</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>0.26**</td>
<td>-0.12</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>0.09</td>
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<td>1.00</td>
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</tr>
<tr>
<td>-0.03</td>
<td>-0.23**</td>
<td>0.18*</td>
<td>0.15</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.12</td>
<td>0.03</td>
<td>0.05</td>
<td>0.19*</td>
<td>0.17</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.05</td>
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<td>0.22*</td>
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<td>0.00</td>
<td>0.01</td>
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</tr>
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<td>-0.25**</td>
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<td>-0.11</td>
<td>0.01</td>
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<td>0.00</td>
<td>0.09</td>
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<td>-0.01</td>
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<td>-0.04</td>
<td>0.01</td>
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<td>-0.08</td>
<td>0.53**</td>
<td>0.21*</td>
<td>0.08</td>
<td>0.06</td>
<td>-0.17**</td>
<td>0.18*</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Table 4.2. Zero-order correlation coefficients between independent variables and telecommunications technological innovativeness

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Correlation Coefficient</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception of Tele. Importance</td>
<td>.23*</td>
<td>.008</td>
</tr>
<tr>
<td>Age</td>
<td>-.16</td>
<td>.063</td>
</tr>
<tr>
<td>Highest Level of Formal Education</td>
<td>-.01</td>
<td>.950</td>
</tr>
<tr>
<td># years Working in Tele. Field</td>
<td>.02</td>
<td>.829</td>
</tr>
<tr>
<td># Years Working in the Company</td>
<td>-.01</td>
<td>.866</td>
</tr>
<tr>
<td># Years in the Same Position</td>
<td>-.02</td>
<td>.836</td>
</tr>
<tr>
<td>Formal Training Attended</td>
<td>-.17</td>
<td>.061</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>.26**</td>
<td>.003</td>
</tr>
<tr>
<td>No. of Access Lines</td>
<td>.27**</td>
<td>.002</td>
</tr>
<tr>
<td>Organizational Resources</td>
<td>-.08</td>
<td>.379</td>
</tr>
<tr>
<td>Org. Activities (Compact)</td>
<td>.53**</td>
<td>.000</td>
</tr>
<tr>
<td>Skltrain</td>
<td>.21*</td>
<td>.015</td>
</tr>
<tr>
<td>Goreaco</td>
<td>.08</td>
<td>.378</td>
</tr>
<tr>
<td>Rest16</td>
<td>.06</td>
<td>.489</td>
</tr>
<tr>
<td>(Linkages with Other Companies</td>
<td>-.17*</td>
<td>.046</td>
</tr>
<tr>
<td>Inhibiting State Regulations</td>
<td>-.18*</td>
<td>.046</td>
</tr>
<tr>
<td>Inhibiting Federal Regulations</td>
<td>.003</td>
<td>.976</td>
</tr>
</tbody>
</table>

* significant at .05 level; ** significant at .01 level

4.1.1.2. Age

Hypothesis 2.6.2. In a small rural telephone company, manager's age is not related to its technological innovativeness.

This hypothesis was supported \( r=-.16, p=.063 \). This finding is consistent with those of Baldridge et al. (1975), McCain et al. (1983), and El-Ghamrini (1988).

Sawhney et al. (1991) noticed that most of employees in small rural telephone companies are relatively young. In this study, the majority of the managers were in a relatively young
age, 27-47 (Table 3.1). Rosenbaum (1986) argued that people tend to be attached to those who are similar. This provides an assumption that there is no role ambiguity in small rural telephone company employees mutual relationships with their managers as a consequence of their age closeness (McCain et al., 1983).

Risk acceptance is a psychological and personal attribute. It is not related to age. Therefore, the age of a small rural telephone company manager is not related to his company technological innovativeness.

4.1.1.3. Highest Level of Formal Education Completed

Hypothesis 2.6.3. In a small rural telephone company, manager's level of formal education is not related to its technological innovativeness.

This hypothesis was supported ($r=-.01; P=.950$). The finding is consistent with those of El-Ghamrini (1988), and Baldridge et al. (1975). Education is not the only personal variable for accepting risk. Some individuals with less or even no education have the ability to take higher risk than individuals with higher levels of education. Sawhney (1991) observed that many responsible positions in small rural telephone companies are staffed by individuals who have worked through the company without the benefit of a formal technical degree. The finding is consistent with this observation.
This was obvious in the distribution of this variable (Table 3.2). A large percentage of the leaders of those Iowan small rural telephone companies had a high school diploma (42%) followed by some college or post-secondary (40%).

4.1.1.4. Tenure
Hypothesis 2.6.4. In a small rural telephone company, tenure is not related to its technological innovativeness.

This hypothesis was supported. This finding is consistent with those of Katz et al. (1978), Hannan et al. (1984), Baldridge et al. (1975), and Sawhney et al. (1991).

In a small telephone company, number of working years spent by managers in telecommunications field is not related to its technological innovativeness (r=.02; P=.829); In a small rural telephone company, number of years spent by a manager in the same company is not related to its technological innovativeness (r=-.01; P=.866); and In a small rural telephone company, number of years the manager occupies the same position is not related to its technological innovativeness (r=-.02; P=.836).

Katz et al. (1978) found that organizational change can threaten the established power system and those who profit from the present allocation of resources and rewards. In an era of uncertainty, those individuals with a long time working in the field may have an incentive to keep the system stagnant
in order to keep their rewards and privileges. Generally, they resist technological innovativeness. Working in an organization for long period of time is a source of organizational inertia (Hannan et al., 1984). It was found that a large percentage of Iowa small rural telephone company managers (48%) spent 18-34 years working in the telecommunications field (Table 3.3). Forty three percent of the respondents spent 16-31 years working for the same company (Table 3.4). Fifty percent of the respondents spent 0-10 years in the same position (Table 3.5).

4.1.1.5. Formal Training

Hypothesis 2.6.5. In a small rural telephone company, manager's formal training is positively related to its technological innovativeness.

This hypothesis was not supported ($r=-.17; P=.061$). This finding is consistent with those of House (1968), and Baldridge et al. (1975). Training may add more knowledge and experiences. Applying those added experiences in real situations requires personalities with high risk acceptance. Personalities, to some extent, cannot be changed solely by training attended. Also, attending training programs does not mean applying it in the real life. House (1968) found that social influence in the work environment explains why training produces both functional and dysfunctional consequences. The
consequences of leadership training depends on the degree to which the social influences in the work environment are perceived as a motivation to learn.

The majority of Iowa small rural telephone company managers (77%) attended formal training (Table 3.6). A relatively large percentage of managers attended technical training (24%), GTE or U. S. West sponsored courses, and various short courses (24%), and digital switching training, telephony program (22%) (Table 3.7). This implies that other small rural telephone company environmental factors, mostly social or economic and not technical ones, may have some bad effect on technological innovativeness. Social influence in the work environment should be studied.

4.1.2. Small Rural Telephone Company Structure

4.1.2.1. Small Rural Telephone Company Size

Hypothesis 2.7.1. Size of a small rural telephone company (number of employees and number of access lines) is positively related to its technological innovativeness.

This hypothesis was confirmed for both number of employees \( r = .26; P = .003 \), and number of access lines \( r = .27; P = .002 \). This finding is consistent with those of Hage et al. (1970), Mohr (1969), Baldridge et al. (1975), and Rogers (1983). Child (1976) found that larger organizations are more specialized, have more rules, more documentation, more
extended hierarchies, and greater decentralization of decision making further down such hierarchies. In general, size of organization reflects more resources and higher risk acceptance.

The finding is also consistent with Sawhney et al. (1991) observation that number of access lines is positively related to small rural telephone company technological innovativeness. Sawhney et al. (1991) found that number of access lines provides rural telephone companies with a chance to capture more access minutes for billing. In this sense, there is the potential for increased toll minutes of use, and thus increased revenues.

4.1.2.2. Small Rural Telephone Company Resources

Hypothesis 2.7.2. In a small rural telephone company, the availability of financial resources (Gamid21) is positively related to its technological innovativeness.

This hypothesis was not supported ($r=-.08; P=.379$). This finding is consistent with that of Manns et al. (1978). Manns et al. (1978) found that there is a negative relationship between organizational resources and innovativeness. Sawhney et al. (1991) argued that some rural telephone companies, in order to survive in the competitive post divestiture era, move toward becoming self-sufficient and thus are less reliant upon increasingly undependable or uncertain sources of assistance.
such as the Rural Electrification Administration (REA).
External financial assistance, to some extent, implies or creates fear of dominance by larger corporations or donors. Companies with low resources have to innovate more in order to compensate for its deficient resources. Stronger companies, with sufficient access to resources, respond to adversity with fewer innovations than weaker ones. They adopt unplanned or non-programmed innovations as they have sufficient slack resources (Manns et al., 1978).

During the past five years, Local Bank was the main source of Iowa small rural telephone company financial assistance (11%), In addition to the Rural Electrification association (Table 3.9).

4.1.3. Small Rural Telephone Company Activities for Local Community Economic Development

Hypothesis 2.8. Small rural telephone company activities for local community development is positively related to its technological innovativeness.

This hypothesis was supported ($r = .53; p = .000$). It is consistent with those findings of Baldridge et al. (1975), Daft et al. (1980), and Wilson et al. (1990). Daft et al. (1980) emphasized that pressures from the community contribute to the differentiation and expansion of the technological units in an organization. Baldridge et al. (1975) found that
environmental input from the community and other organizations is a major determinant of an organization's innovative behavior.

Sawhney et al. (1991) found that small rural telephone companies are locally owned and their owners are aware of their local area needs. They are highly responsive to those community needs. Therefore, there is a special symbiotic relationship between these companies and rural communities where they are located. They provide job opportunities for rural residents and investing in local human resources. On the other hand, rural communities served by these companies often take a special interest in the companies' well-being.

Despite the fact that Iowa small rural telephone companies have been monopoly utilities, technological innovativeness is very important to keep their symbiotic relationships with the communities around them. Encouraging new businesses to invest and expand in these rural communities is an effective strategy for small rural telephone companies to increase their profits and participate effectively in their local community economic development.

In general, it is very important for small rural telephone companies to strengthen their symbiotic horizontal relationships within their communities. This horizontal relationships should include rural citizens, different companies and organizations existed in these communities.
4.1.4. Some Important Factors in Choosing New Technology for Small Rural Telephone Company

Hypothesis 2.9. In a small rural telephone company, skill of personnel and training of technicians (Skltrain), availability of low interest loans and REA specification (Goreaco), and cost of technology and rate of return as an objective (Rest16) are positively related to its technological innovativeness.

This hypothesis was supported for Skltrain (r = .21, p = .015), not supported for Goreaco (r = .08, p = .378) and Rest16 (r = .06, p = .489). This finding of Skltrain is consistent with those of Blau et al. (1971), Hage et al. (1967), and Kohn (1971). Hage et al. (1967) found that the presence of a well-trained staff, in an organization, is related to a reduced need for extensive rules and policies, and it leads to its technological innovativeness. Blau et al. (1971) found that organizations select highly qualified individuals to ensure that they will act according to their organizational demands and rules. Skill of personnel and continuous training of technicians are the bases for innovativeness when all bureaucratic rules are rigid and applied equally. Kohn (1971) found that there is a significant relationship between bureaucratization, operationalized as the members of formal hierarchial levels in an organization, and employee intellectual flexibility, openness to change, and choice of leisure time. Blau (1970) suggested that highly
formalized organizations are highly centralized ones. This came as a direct consequence of the availability of highly qualified personnel. In general, there is a significant relationship between bureaucratization, operationalization, and employee intellectual flexibility and innovativeness. Providing personnel and technicians with the newest techniques and facilities increase innovative ideas. Joint training programs with other technicians from other companies can provide better and new applicable ideas. Skilled personnel can save money and time and increase the speed and quality of communication. In this sense, skill of personnel and training of technicians are two inseparable elements for any innovative company.

In respect to the economic factors (Goreaco and Rest 16) this finding is consistent with that of Sawhney et al. (1991). Sawhney et al. (1991) argued that some rural telephone companies, in order to survive in the competitive post divestiture era, move toward becoming self-sufficient. This explanation was supported by the findings in the study (Finding 4.1.2.2) that loans, grants, and other financial assistance are not related to technological innovativeness. It is clear, that horizontal relationships within the community is more beneficial for small rural telephone companies than vertical relationships with other companies outside their communities. On the other hand, these small
rural telephone companies have been monopoly utilities, at the local level, since their establishment. As a consequence of unstable and uncertain environmental conditions reflected by changing regulations and the Congressional threats of budget cuts, each Iowa small rural telephone company has sought to achieve self-sufficiency.

4.1.5. Linkages with other Companies Outside Service Area

Hypothesis 2.10. In a small rural telephone company, linkages with other companies outside its service area are positively related to its technological innovativeness.

This hypothesis was not supported (r=-.17, p=.046). Linkages with other companies outside service area is negatively related to small rural telephone company technological innovativeness.

Small rural telephone companies have been monopoly utilities, at the local level, since their establishment. Each of these companies has its own territory. Establishing linkages with other companies, to some extent, may lead to loss of territory or at least a part of it. This means that Iowa small rural telephone companies may have the fear tendency of being dominated by other companies involved in the same network. Therefore, there is a relative tendency toward self-reliance and self-sufficiency.

This finding confirms the previously mentioned finding
stated that telecommunications technological innovativeness is not related to financial assistance resources (4.1.2.2). It also confirms the finding stated that Goreaco (availability of low interest loans and the Rural Electrification Association specifications) is not related to telecommunications technological innovativeness (4.1.4).

In general, this finding is closely related to telephone company environmental uncertainty characterized by unstable regulations, threats of the Congressional budget cuts, and fear of dominance by other larger companies.

4.1.6. **Inhibiting Federal and State laws and Regulations**

**Hypothesis 2.6.1.** In a small rural telephone company, inhibiting regulations (state/federal) are negatively related to its technological innovativeness.

This hypothesis was supported only for inhibiting state regulations ($r = -.18; P = .046$), but was not supported for inhibiting federal regulations ($r = .003; P = .976$).

After divestiture, states have become more involved in intrastate telephone policy (Irwin, 1984). Therefore, state regulations in this regard can affect local telephone companies positively or negatively depending on the type of regulation itself (Hall, 1981). Some state regulations may make it difficult for rural telephone companies to upgrade their systems and make profits. Sawhney et al. (1991)
emphasized this fact. State regulations that hinder the company's ability to upgrade its system and make profits reduce incentives for technological innovativeness. On the other hand, state interventions to stabilize service prices are sometimes against the company's interest to make higher profits.

State governmental policies not only determine the pricing of telecommunications, but also influence the long-term development of telecommunications infrastructure (Twenbafel et al., 1989). Iowa telephone company managers perceived the Iowa Communications Network (ICN), the state owned and operated fiber-optic communications system, as a competitor supported by the State government. As a consequence, Iowa small rural telephone company managers perceived audio-visual specifications for Iowa Communications Network (ICN) as one the most inhibiting state regulations (Table 3.12).

On the other hand, federal regulations are not related to telecommunications technological innovativeness. This comes as a direct consequence of the minimum intervention policy conducted by federal government after divestiture (Sawhney et al., 1991). Continuous threats of the Congressional budget cuts may lead small rural telephone companies to consider federal financial support as an unreliable source. In addition, Iowa small rural telephone
companies receive little few federal financial support (loans), and therefore cannot contribute substantially to their technological innovativeness.

Iowa small rural telephone company managers viewed that FCC regulations that allow cable companies to bypass phone companies to get video dial tone and 1992 cable act are the most inhibiting federal regulations encounter their companies' ability to upgrade their systems and services (table 3.13).

In some other fields, federal regulations and financial support may affect technological innovativeness. Daft et al. (1978) found that some departments in the American universities do not innovate because of the huge federal funds they have. Some federal standards impose medical innovations on hospitals and health institutions (McNeil et al., 1977).

4.2. Variables which Predict Small Rural Telephone Company Technological Innovativeness

The foregoing analysis has indicated varying levels of association with innovativeness. However, in view of the fact that telecommunications technological innovativeness occurs as a function of several variables and is not just the independent variables, the data are subjected to multivariate analysis. Independent variables were associated in a stepwise-forward regression with telecommunications technological innovativeness as the sole dependent variable.
Table 4.3 shows this relationship.

The most important predictor was found to be compact (small rural telephone company activities for local community economic development) which explained 23 percent of innovativeness. The combination of size and compact explained 30 percent of innovativeness. This finding is consistent with that of Baldridge et al. (1975).

From the previously mentioned findings, small rural telephone company leader demographic attributes do not contribute to technological innovativeness. Age, highest level of formal education, tenure, and formal training are not related to technological innovativeness. Small rural telephone company leader commitment is the sole demographic variable related to technological innovativeness. On the other hand, size of small rural telephone company (number of employees), an element of company structure, contributes to technological innovativeness. Size explains 7% of technological innovativeness. Small rural telephone company appropriate size for technological innovativeness is a future research question.

Small rural telephone company activities for community economic development contribute effectively to technological innovativeness. It explains 23% of technological innovativeness. This finding is consistent with small rural telephone company tendency to achieve self sufficiency, fewer
linkages with other companies outside service area, and less dependence on external financial resources.

Realizing their symbiotic relationship with rural communities around them, small rural telephone companies encourage others to establish new businesses and provide new job opportunities in rural areas. Distance education is one of the means to achieve mutual prosperity for both small rural telephone companies and the communities around them. In general, horizontal linkages within rural communities around small rural telephone companies are of greater importance to technological innovativeness than vertical linkages. Horizontal linkages include relationships with other companies and businesses, community residents, interest groups, and local governments.

Skltrain (skill of personnel and training of technicians) was an additional factor related to small rural telephone company technological innovativeness. It emphasizes small company tendency to achieve self-sufficiency by intensifying training for employees. Small rural telephone companies invest heavily in human resources through in-house training because they lack sufficient resources to hire skilled employees. Small rural telephone company environmental uncertainty intensified around inhibiting state regulations, future federal funds, and fear of dominance by other companies, or even the State. As a consequence, Goreaco
(governmental regulations and REA specifications, Rest16 (availability of low interest loans and rate of return as an objective), inhibiting federal regulations, inhibiting state regulations, linkages with other companies outside service area, and small rural telephone company resources do not contribute to small rural telephone company technological innovativeness.

The Study findings emphasize the need for more research in this area. Organizational technological innovativeness should be studied in the light of many different variables including social, economic, administrative, and technical factors.

Table 4.3. Independent variables which predict telecommunications technological innovativeness

<table>
<thead>
<tr>
<th>Core Variables</th>
<th>R2</th>
<th>Beta</th>
<th>F</th>
<th>F-Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (number of employees)</td>
<td>.07</td>
<td>.26</td>
<td>8.9**</td>
<td>.003</td>
</tr>
<tr>
<td>Compact</td>
<td>.30</td>
<td>.50</td>
<td>27.6**</td>
<td>.000</td>
</tr>
</tbody>
</table>

**significant at .01 level
CHAPTER V: SUMMARY AND CONCLUSIONS

The main objective of the study was to identify those variables responsible for technological innovativeness in rural telephone companies. Different independent variable groups were used. Those groups of variables used were: perception of leaders and demographic attributes; company structure; company activities for local economic development; determinants of technological innovativeness; linkages with other companies outside service area; and inhibiting state and federal regulations.

Data were collected in summer 1994 as a part of a project supported by Iowa State University College of Agriculture. A pretesting of the survey instrument was conducted on six rural telephone company managers in Wisconsin. Of the 152 telephone companies in Iowa, telephone interviews were completed with 134 telephone company managers. The three large and primarily urban telephone companies were excluded from the survey (GTE, U.S. West, and Vista). Managers affiliated with multiple companies were interviewed for only one company. The response rate was 93 percent. The sample survey section of Iowa State University Statistical Laboratory conducted the interviews. Each interview took approximately 25 minutes.

Telecommunications technological innovativeness, the
dependent variable, is measured with a scale that sums the level of use over nine separate telecommunications technological innovations. Those innovations are teleconferencing; voice mail; cellular telephones; telephone device for the deaf (TDD); video conferencing; caller identification; digital data services; public packet switching; and Signaling System 7 (SS7).

Factor analysis, reliability, frequency, zero-order correlations, and step-wise multiple regressions procedures were used in the analyses. It was found that the following independent variables are significantly related to innovativeness:

1. Perception of telecommunications importance by Iowa rural telephone company managers, as an infrastructure, is positively related to telephone company technological innovativeness ($r=.23, P=.008$).

2. Size of rural telephone company is positively related to its technological innovativeness (number of employees: $r=.26, P=.003$, and number of access lines: $r=.27, P=.002$).

3. Linkages with other companies outside service area is negatively related to rural telephone company technological innovativeness ($r=-.17, P=.046$).

4. Rural telephone company activities for community development is positively related to rural telephone company technological innovativeness ($r=.53, P=.000$).
(5) State regulations that make it difficult for rural telephone company to upgrade its system is negatively related to its technological innovativeness \( r = -.18, P = .046 \).

(7) Skill of personnel and training of technicians is positively related to rural telephone company technological innovativeness \( r = .21, P = .015 \).

The most important predictor was found to be rural telephone company activities for community development which explained 23 percent of technological innovativeness. The combination of size and rural telephone company activities for community development explained 30 percent of telecommunications technological innovativeness.

5.1. Limitations of the Study

Limitations of this study can be identified as the following:

(1) The dependent variable, telecommunications technological innovativeness, was measured as a composite score of the nine technological innovations adopted by Iowa small rural telephone companies. As a consequence, the innovation process for such innovations was submerged through aggregation into an overall innovativeness score for each rural telephone company. Thus, differences in the innovative process among the innovations were lost. This is consistent with Rogers' (1983) criticism of innovation research.
(2) Managers at different hierarchical levels within and among rural telephone companies, may have different opinions concerning telecommunications technological innovativeness. Thus, it is possible if this study was conducted again, with different managers within and among those companies, to have different findings.

(3) This study's findings are related to the State of Iowa and may not be applicable completely to others states, because of the unique political and historical context of the telephone industry in Iowa. Thus, we cannot generalize from only this study. More studies are needed.

(4) To address limitations two and three above, a multiple-respondent data gathering design, and multimeasurement approach, or triangulation, at different periods of time is recommended.

(5) Despite those previously mentioned limitations of this study, it confirms the findings of some other studies such as those of Baldridge et al. (1975), and Sawhney et al. (1991). It also emphasizes the needs for studying different social and economic variables and their combined effects on small rural telephone company technological innovativeness.

5.2. Recommendations

Rural telephone companies play a vital role in rural community development. Because most of them are indigenous to
rural areas, they are responsive to rural community needs. They provide rural areas with employment opportunities, attract new businesses to rural areas, and give rural individuals, to some extent, equivalent services to urban areas. They also provide residents of rural areas, especially the elderly, with better public services.

In addition, rural telephone companies provide rural area residents with an excellent chance to have better participation in their country's political and social arenas. As a consequence, they are deserving more attention than they usually receive. Policy makers should take them into considerations when formulating and conducting any legislative issue. An unstable and uncertain environment for small rural telephone companies in relation to state and federal regulations, financial resources, linkages with other companies outside their service areas, and the Congressional threats of budget cuts for agencies such as Rural Electrification Administration (REA) should be eliminated or alleviated. Congressional authorization of complete deregulation and competition have resulted in dour predictions for small rural telephone companies. In general, policy makers should consider small rural telephone companies as an important asset in their policies for rural areas. These companies can be an important tool in American rural community development.
5.3. Implications

Small rural telephone companies have symbiotic relationships with their local communities. They are locally established and owned. Their owners are aware of their community service needs and it is in their interest to encourage investments and business establishment in rural areas. In general, the future of small rural telephone companies depends, to some extent, upon local area economic development. Small rural telephone companies provide job opportunities for rural residents and attract new businesses to rural areas. On the other hand, prosperity of small rural telephone companies is of their rural communities' utmost interest.

At the local level, small rural telephone companies have been monopoly utilities. It is expected that after complete divestiture, competition and deregulation may represent a threat to rural areas and small rural telephone companies. Telephone service in sparsely populated areas may be seriously harmed. It is predicted by some that telephone services will eventually rest in the hands of very few large companies. Pessimistic expectations predict that consumer may will pay higher prices for additional services they do not need.

Local governmental policies not only determine the pricing of telecommunications, but also influence the long-term development of telecommunications infrastructure. Laws
and regulations are driving forces for small rural telephone company change. Prosperity of small rural telephone companies and the availability of innovative telecommunications services to rural Iowa subscribers may have a positive impact on rural economic development. Therefore, policy makers should ensure affordable services for consumers while allowing small rural telephone companies a fair return on their investment. Unstable regulations and environmental uncertainty may damage both small rural telephone company and rural area economic development.

Small rural telephone companies have the tendency to achieve self-efficiency. This comes as a consequence of their environmental uncertainties regarding state and federal policies and regulations, fear of dominance by larger companies through external linkages or financial assistance, and fear of dominance by states policies and programs such as Iowa Communications Network (ICN). Lack of sufficient resources have forced small rural telephone companies to rely on investing in human resources through in-house training. Realizing their mutual and symbiotic relationship with the communities around them, small rural telephone companies provide job opportunities for rural residents and encourage other businesses to invest in these rural communities. Distance education is a recent trend of mutual interests for both rural communities and small rural telephone companies.
Horizontal linkages within rural communities are more important for small rural telephone companies technological innovativeness than vertical linkages outside their rural communities.

Technologically Innovative small rural telephone companies are characterized by relatively large size (number of employees), active involvement in their community's economic development activities, tendency for horizontal linkages within their rural communities to be more important than vertical linkages outside their rural communities, and tendency towards achieving self-sufficiency in an uncertain environment.
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Daft, R., and S. Becker  
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<td>1965</td>
<td>&quot;Superior-subordinate Conflict in Research Organizations.&quot;</td>
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APPENDIX I: QUESTIONNAIRE
The Role of Iowa Telephone Companies in Local Economic Development
Statistical Laboratory, Iowa State University

Int. ID# ______ 

Date Interviewed: ______/______

Respondent's Name: _______________________________________

Day/Date: ______/_____/______ Start Time: ______:____ a.m. p.m.

Appointment time: ______:____ Final outcome: 1 = Interviewed
2 = Refused
3 = Other ______

<table>
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<tr>
<th>Day</th>
<th>Date</th>
<th>Time</th>
<th>Int.</th>
<th>Outcome</th>
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</table>

Hello, this is (your name) calling for the Sociology Department at Iowa State University in Ames. May I please speak to (name)? Recently, Iowa State University sent you a letter about a research study we are conducting with the Managers of Iowa Telephone Companies.

1. Did you receive this letter?
   1 = Yes
   2 = No → EXPLAIN PROJECT - READ LETTER IF NECESSARY.
   9 = Don't know →
As the letter stated, we would like to talk to you about your perceptions and opinions related to the continuing role of companies like yours on local economic development. Before I do that, I want to assure you that any information you provide will be kept strictly confidential and used only for the purposes of this research. If you feel any question is too personal, you do not have to answer it. First, I need to verify some information.

2a. According to our records, you are the (title) of (company name). Is that correct?
   1 = Yes
   2 = No →
   3 = Don't know →

   VERIFY FULL NAME OF RESPONDENT, ADDRESS, AND PHONE NUMBER. GET NAME OF CURRENT MANAGER

3. Is now a good time to interview you for 15-20 minutes?
   1 = Yes
   2 = No →

   LET'S BEGIN WITH SOME INFORMATION ABOUT YOUR COMPANY.

4a. Is your company... 
   1 = Affiliated with a larger company, or is it
   2 = Independent [GO TO Q.S.]

b. With what company is it affiliated?
   1 = Hickory Tech.
   2 = Century
   3 = GTE
   4 = Postville (PTI)
   5 = U.S. West
   6 = Vista
   7 = Other ________ [Specify]
5. Is it...
   1 = Privately owned,
   2 = Publicly owned,
   3 = A cooperative,
   4 = A mutual, or
   5 = Something else? ____________________________  (Specify)

6. Approximately what percentage of your lines are...
   ___ ___ ___% residential lines
   ___ ___ ___% business lines

7a. Thinking of all your customers, about what percentage of your customers have private lines?
   ___ ___ ___% [IF 100%, GO TO Q.8.]

   b. Do you have a projected date for all customers to be on private lines?
      1 = Yes → c. What is that date? ___ ___/___ ___
      2 = No

8a. What percentage of your company's central offices have digital switching?
   ___ ___ ___%
   [IF NONE, GO TO Q.9b.]

   b. When was digital switching first installed? [PROBE: BEST GUESS]
      19 ___ ___
   [IF 100% DIGITAL IN a., GO TO Q.10.]

9a. What percentage of your company's central offices have analog switching?
   ___ ___ ___%
   [CHECK TO SEE THAT 8a AND 9a = 100%]
9b. Does your company have plans for replacing the analog with digital switching?
   1 = Yes → In what year will the change-over be complete?
   2 = No
   19

10. Are any of your lines fiber optic lines?
    1 = Yes
    2 = No

11. There are a number of services telephone companies can provide their customers. We would like to know about your company.

   a. Do you offer (service)? [IF YES, GO TO NEXT SERVICE.]
   b. Will you be adding (service) within the next five years?

<table>
<thead>
<tr>
<th>Service</th>
<th>a. Provide?</th>
<th>b. [IF NO] Adding?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Teleconferencing</td>
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<td>2</td>
</tr>
</tbody>
</table>
12a. Does your company have access to SS7 (Signaling System 7) service?
   1 = Yes
   2 = No → b. Does your company have plans to obtain SS7 service in the next five years?
   1 = Yes
   2 = No

13. What is your basic monthly rate for a single business line, not including the government access charge?
    $_______ . ______

14. What is your basic monthly rate for a single residential line, not including the government access charge?
    $_______ . ______

15. Does your company have equal access to long distance carriers serving the state of Iowa?
    1 = Yes
    2 = No
Now, let's talk about the future development of your company.

16. There are many factors which are significant when adopting new technology in business today. We would like to know how important certain factors are in choosing new technology, such as digital switching, fiber optic lines, SS7, or anything like that. As I read a factor, tell me if it is very important, somewhat important, not too important, or not at all important in choosing new technology for your company?

   How important is/are (factor(s)) in choosing new technology?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Very Important</th>
<th>Somewhat Important</th>
<th>Not Too Important</th>
<th>Not at All Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>The skills of personnel</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>The training of technicians</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Maintaining low local rates</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Being competitive</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Availability of low interest loans</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Demand by users</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Government laws and regulations</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>REA specifications</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Company standards</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cost of technology</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Rate of return as an objective</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

17. What factors could hinder your company's ability to continue to upgrade your system and services you offer your customers?

18. If your company wanted to upgrade, what would you need in order to do that?
19a. Are there any state regulations which make it difficult for your company to upgrade its system?

1 = Yes
2 = No [GO TO Q.20.]

b. What state regulations are those?

________________________________________________________________________

________________________________________________________________________

20a. Are there any federal regulations which make it difficult for your company to upgrade its system?

1 = Yes
2 = No [GO TO Q.21.]

b. What federal regulations are those?

________________________________________________________________________

________________________________________________________________________

21. Next, we would like to know about the types of loans, grants, or other financing your company has used or may need to use to develop its services.

a. Over the past 5 years, have you received any loans, grants, or financing from...

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>the REA?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>any other place?</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Specify)

b. In the next 5 years, from whom do you hope to receive loans, grants, or financing for your company?

________________________________________________________________________

________________________________________________________________________
Next, please think about recruiting personnel for your company.

22. How many...
   ___ ___ ___ full time employees do you currently have?
   ___ ___ ___ part time employees do you currently have?

23a. In the past 5 years, have you had any difficulty in recruiting technically skilled personnel to work for your company?
   1 = Yes
   2 = No → [GO TO Q.24.]
   3 = Don't know → IGO TO Q.24.

b. What type of positions are difficult for you to fill?
   [FOR EACH, ASK c.]
   c. In your estimation, why are the (type) difficult for you to fill?

<table>
<thead>
<tr>
<th>Type of Position</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

24a. Some telecommunications providers develop various kinds of linkages, arrangements or agreements with other providers outside their service areas, such as joint plowing of cable, pole attachment agreements, and consortiums of maintenance personnel. Does your company have any linkages, arrangements, or agreements with other companies?
   1 = Yes
   2 = No   [GO TO Q.25]
b. With whom do you have linkages? [TYPE OF COMPANY, NOT NAME]
   [FOR EACH, ASK c.]

c. In what way is this linkage beneficial to your company?

<table>
<thead>
<tr>
<th>b. Who?</th>
<th>c. Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this next part of the interview, we would like your opinions and ideas about the relationship of telecommunications and the industry to local and area economic development.

25. In what way is telecommunications important to economic development in your service area?

________________________________________________________________________

26a. There are many innovative uses of telecommunications, such as telemetering, computer network linkages, remote turning on or off of equipment, and the like. Are there any examples of innovative uses of telecommunications by private businesses, agencies, or organizations in your area?

1 = Yes
2 = No →
3 = Don't know →  **GO TO Q.27.**
b. What **companies** in your area are using telecommunications in an innovative way?
   [FOR EACH, ASK c. & d.]
   
   c. In what **community** are they located?
   
   d. What innovations are they using?

<table>
<thead>
<tr>
<th>b. Company</th>
<th>c. Community</th>
<th>d. Innovative Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

27. Are there any **communities** in your service area that have been innovative in their use of telecommunications?

   1 = Yes
   2 = No →
   3 = Don't know → **GO TO Q.28.**

b. What **communities** in your area are using telecommunications in an innovative way?

   c. What innovations are they using?

   d. Why do you think these communities have been innovative?

<table>
<thead>
<tr>
<th>b. Community</th>
<th>c. Innovative Use</th>
<th>d. Why</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
28. I am going to read a list of local economic development activities. As I read each one, please tell me if your company has been involved in the activity.

Has *(company)* been involved in...

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Providing support to local entrepreneurs starting new businesses</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Assisting with the recruitment of businesses or industries to locate in the local area</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>c. Working on the development of local infrastructure other than telecommunications (such a roads, water and sewer lines, rail access, etc.)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. Helping with the development of public services such as education, health and welfare services</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>e. Job training programs</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>f. Consulting on innovative applications of telecommunications to new or existing businesses</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>g. Working on the retention and expansion programs for existing businesses or industries</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>h. Working with local or county economic development organizations</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>i. Any other area of local economic development?</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

(Specify)
Think about local economic development and the importance of institutional/infrastructure on continuing development. I will read you a list of 7 types of infrastructures and I would like you to rate them as to their importance. The infrastructures I will ask about are...

[READ ALL FIRST.]

Think of a scale from 1 to 10. One means not important at all and 10 means very important.

Let's start with Education. Thinking of that scale, how important is (infrastructure) to continuing economic development in your local areas?

<table>
<thead>
<tr>
<th></th>
<th>Not important at all</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Health care</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Telecommunications</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Water/sewer/waste disposal...</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Recreation</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Retail and service sector...</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
</tbody>
</table>

b. Of all of these, which one do you think is the most important to continuing economic development in your area?
Next, we have a few questions about the trends in telecommunications in Iowa.

30. There are varying opinions about the impact of telecommunications on rural communities. We would like to know what you think. I will read you two statements and I would like you to choose the one that most closely represents your opinion. Here is the first one.

1 = Recent advances in telecommunications will help to revitalize rural communities by providing them access to the information highway.  

or

2 = Recent advances in telecommunications will widen the gap between rural and urban communities because the rural areas will be comparatively information poor.

Which one of these statements reflects your opinion?  
[GO BACK AND CIRCLE 1 RESPONSE.]

b. Why do you feel that way?

31a. Iowa presently has about 150 companies providing local telephone services. Over the next 10 years, do you expect...

1 = A major decline in the number of telephone companies,  
2 = No major change in the number of telephone companies, or  
3 = A major increase in the number of telephone companies?

b. Why do you feel that way?
32. What do you see as the most important developments in the telecommunications industry in Iowa during the next 10 years?

____________________________________________________

These next few questions relate to the Iowa Communications Network or ICN.

33a. What do you think of the current financial arrangement between ICN and the private sector? Do you think it is a fair arrangement that ICN owns the backbone of the network but private companies are responsible for local hook-ups?

1 = Yes
2 = No
3 = Don't know [GO TO Q. 34.]

b. Why or why not? ____________________________________

34a. Do you feel the investment of tax payers' dollars in the ICN has been a wise investment for the taxpayers of Iowa?

1 = Yes
2 = No

b. Why or why not? ____________________________________

35a. Do you think that any changes should be made in the ownership and financial arrangement of the ICN so that it best serves the people of Iowa as well as the provider of telecommunications services such as your company?

1 = Yes
2 = No

b. Why or why not? ____________________________________

36a. In your opinion, how involved should state government be in developing the telecommunications infrastructure, such as the ICN? Would you say...

1 = A lot
2 = Some
3 = A little, or
4 = Not at all?

b. Why? ______________________________________________
37. Next, I am going to read a series of statements related to telecommunications and I would like to know what you think. As I read a statement, tell me whether you agree or disagree with it.

[READ STATEMENT.]

Do you agree or disagree? [PAUSE]
Do you (agree/disagree) mildly or strongly?

| Assume the skills to use new telecommunications technology. | 5 | 4 | 3 | 2 | 1 |
| Assume the motivation to use new telecommunications technology. | 5 | 4 | 3 | 2 | 1 |
| Assume the financial resources to use new telecommunications technology. | 5 | 4 | 3 | 2 | 1 |
| Assume business and service managers in your service area recognize innovative applications of new telecommunications technology. | 5 | 4 | 3 | 2 | 1 |
| Assume local telephone companies should bear the costs of improving the telecommunication infrastructure. | 5 | 4 | 3 | 2 | 1 |
| Assume telecommunications users should bear the costs of improving the telecommunication infrastructure. | 5 | 4 | 3 | 2 | 1 |
| Assume state government should provide low interest loans, grants or tax breaks for improving the telecommunications infrastructure. | 5 | 4 | 3 | 2 | 1 |
| Assume the federal government should provide low interest loans, grants or tax breaks for improving the telecommunications infrastructure. | 5 | 4 | 3 | 2 | 1 |
| Assume state government should take leadership in developing the telecommunications infrastructure at the state level. | 5 | 4 | 3 | 2 | 1 |
| Assume state government should take leadership in developing the telecommunication infrastructure at the local level. | 5 | 4 | 3 | 2 | 1 |
| Assume the federal government, state government, and private business should form coalitions to improve the telecommunications infrastructure. | 5 | 4 | 3 | 2 | 1 |
Finally, we would like to know a little bit about you.

38. CODE SEX
   1 = Male
   2 = Female

39. How old were you on your last birthday?
   ____ ____ years old

40. What is your position? Are you the...
   1 = General Manager
   2 =
   3 =

41. How many years have you worked in the telecommunications field?
   ____ ____ years

42. How many years have you been with this company?
   ____ ____ years

43. How many years have you been in your present position?
   ____ ____ years

44. What is the highest level of education you have completed, including college, vocational, or technical training?
   ____ ____ Less than high school →
   12 = High school diploma →
   13 = Some college or post-secondary
   16 = College degree
   17 = Post-graduate work but not a degree
   18 = M.S. or above
   [GO TO Q. 45.]
45a. Have you had any formal training in telecommunications, such as vocational or technical training as well as college courses?
   1 = Yes
   2 = No

b. What was that?

46. Would you like a copy of the results of this study?
   1 = Yes
   2 = No

Do you have any additional comments about telecommunications and economic development in Iowa or about this study?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

Iowa State University appreciates the time you have taken to help us understand developing technology in your field and its impact on rural development. Thanks so much for your time. [TERMINATE]

END TIME: ____ ____

COMMENTS:
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

CODE DATA:
   Number of exchanges: ____ ____
   Number of access lines: ____ ____ ____ ____
APPENDIX II: APPROVAL FROM HUMAN SUBJECT COMMITTEE
Checklist for Attachments and Time Schedule

The following are attached (please check):

12. [ ] Letter or written statement to subjects indicating clearly:
   a) purpose of the research
   b) the use of any identifier codes (names, #’s), how they will be used, and when they will be
      removed (see Item 17)
   c) an estimate of time needed for participation in the research and the place
   d) if applicable, location of the research activity
   e) how you will ensure confidentiality
   f) in a longitudinal study, note when and how you will contact subjects later
   g) participation is voluntary; nonparticipation will not affect evaluations of the subject

13. [ ] Consent form (if applicable)

14. [ ] Letter of approval for research from cooperating organizations or institutions (if applicable)

15. [ ] Data-gathering instruments

16. Anticipated dates for contact with subjects:

<table>
<thead>
<tr>
<th>First Contact</th>
<th>Last Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/2/94</td>
<td>9/15/94</td>
</tr>
</tbody>
</table>

17. If applicable: anticipated date that identifiers will be removed from completed survey instruments and/or audio or visual tapes will be erased:

   9/30/94

18. Signature of Departmental Executive Officer:

   Date: 7/18/94

   Department or Administrative Unit: Sociology

19. Decision of University Human Subjects Review Committee:

   [ ] Project Approved  [ ] Project Not Approved  [ ] No Action Required

   Patricia M. Keith
   Name of Committee Chairperson:  7/1/94
   Date:  Signatures:  