The Study of Teleworking in Thailand

Wiratchai Tongprasong

A Project Submitted to the Faculty of Engineering
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Telecommunications Management
Assumption University
Bangkok, Thailand
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Abstract

The rise of the Internet, advancements in mobile technologies, and an expanding global market are forcing companies to compete harder for business and employees. However, technologies like wireless telecommunications and the Web are also creating an environment where companies can finally create a highly flexible work environment that seamlessly puts workers and their offices anywhere at any time. Telecommuting has given rise to teleworking, with the aim of providing employees with robust and increasingly mobile access to a company's entire working infrastructure through a simple phone call or Internet connection.

This project report examines the business issues and explains some of the benefits, design issues, and decisions relating to adopting, promoting, and benefiting from a strong teleworking initiative.

Acknowledgement

I have completed the project report, "The Study of Teleworking in Thailand." I express my gratitude to Dr. Sudhiporn Pratumtaewapibal, who served as my advisor and provided invaluable advice, recommendations, and assistance in resolving any process or procedure issues. For the majority of this project, textbook and article authors were instrumental in conducting the reports, provided valuable information, published articles, and utilized various websites as references.

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Chapter 1
Introduction

"Flexible workplace policies will allow you to find and keep the best talent. And one of the most promising of these new business frontiers is telecommuting"[1]
(George Bush, 1990)

When George Bush made that statement in 1990, he used the word "**Telecommuting**", rather than "**Teleworking**", but the principle remains the same.

For several years, pundits have proclaimed that we are in the age of the "Information Revolution," which will change the way we work just as surely as the Industrial Revolution transformed people's working lives. Not only will the way we work change, but where we work will also undergo a fundamental change. Indeed, the Information Revolution will reverse the work-location trends of the Industrial Revolution.

Driven by business needs and shifting social trends, more and more workers are roaming further from their corporate LAN. Teleworking is a method of using telecommunications technology to extend a company's resources to workers in the field. The "field" can be anywhere across town, across the country, or on the other side of the world. The teleworkers can be your company's branch office employees, teleworkers, traveling professionals, customers, suppliers, or business partners.

Today, sophisticated digital technologies and advanced communications services meet these needs faster, easier, and cheaper than ever before. Branch office employees access corporate data transparently at lightning speeds. Traveling professionals conduct business globally, without time constraints. Teleworkers get more work done with less stress.

[1] Mike Gray, Noel Hodson, and Gil Gordon, Teleworking Explained. (1993), Page 1.

1.1 Teleworking trends.

Recent trends and developments in three major areas have fueled the growing acceptance of teleworking as an alternative form of work.

Business trends.

Over the last decade, changes in the economy, the shifting makeup of the workforce, and increasing global competition have created a business environment ripe for teleworking networking. In response to competitive pressures and workers' demands for more flexibility and empowerment, companies are experimenting with alternative work styles, such as teleworking, that increase productivity. Information workers can use computers, telephone lines, faxes, and express mail to perform their work from almost any geographic location.

Social trends.

Because of changing attitudes about work, leisure time, and changes in the size, shape, and maturity of our families, people are placing increasing importance on flexibility in their work lives. Teleworking or working from branch offices closer to home lets employees enjoy less-structured lifestyles, live where they want or where housing is affordable, and accommodate child- or elder-care responsibilities.

Technology trends

For years, analog phone lines and modem technology have limited the work employees could perform at remote sites. For workers with demanding file transfer requirements—service representatives, computer programmers, engineers, or graphic artists, for example—sluggish modem speeds have limited productivity or made it impossible for them to work remotely at all.

With the recent advancements in telecommunications technology, remote workers have more and more options. High-speed, high-performance digital network services and

sophisticated access equipment allow remote sites to connect to corporate networks at speeds of 128 kbps and beyond. Teleworkers can use emerging high-bandwidth applications such as collaborative sessions, large file transfers, whiteboards, and desktop video.

Local and long-distance phone companies have lowered tariffs on high-speed digital offerings such as ISDN and extended their service areas into suburbs. New services, such as Frame Relay and xDSL, have emerged.

Network management and security methods have also improved. Equipment is getting easier to set up and manage with standards-based platforms. New security solutions are available that minimize the increased risks associated with opening corporate networks to remote traffic.

1.2 Objectives

The project's objectives are as follows:

- To study the concept of teleworking and its operation process.
- To study teleworking benefits, an overview of the different technologies used in teleworking deployment and its future trends.
- To study the problems, alternatives, issues, and factors that should be taken into consideration before establishing the telecenter or deploying teleworking in the organization.
- To represent a teleworking case study from various situations all over the world and take some useful information to analyze, adopt, and apply to implement in Thailand.
- To give recommendations for teleworking deployments that may be implemented in Thailand.

This project report is divided into the following chapters:

- **Chapter 1: Introduction**

This chapter introduces the concept, trend, and objectives of the teleworking study.

- **Chapter 2: Teleworking Definition and Technologies Overview**

This chapter also describes the definition, importance, and benefits of the various technologies used for teleworking, as well as some strong and weak points about each technology. This chapter aims to provide insight into the reasons behind the revolutionization of new techniques, the evolution of teleworking technologies, and the ideal aspects of practical teleworking.

- **Chapter 3: Best Practical Cases Study**

This chapter is a study of the best practical cases from the various situations. Analyze and draw conclusions. Discover the benefits and potential strategies for implementation in Thailand in the upcoming chapter.

- **Chapter 4: Teleworking Implementing in Thailand**

This chapter will provide the necessary information, introduce the deployment model, and conduct a cost analysis that compares the benefits of different communication styles, whether they are working from home or at a telecenter.

- **Chapter 5: Conclusion and Recommendations**

This chapter provides a conclusion and recommendations for teleworking deployment, as well as ways to improve work performance and make corporate practices more effective in increasing productivity anywhere, anytime.

Chapter 2

Teleworking Definition and Technologies Overview

"Teleworking" is the use of remote access technologies to maintain a helpful office away from the traditional workplace. Typically, an employee's home serves as this office, but it can also be a hotel room, a client's site, or a shared telecommunications center for employees from the same company or different companies. Teleworkers include executives, managers, mobile workers, traveling professionals, and other information workers who access their corporate network remotely, either part-time or full-time, during regular business hours, after work hours, or on the weekends.

With today's technology, teleworking is a viable option for some employees and employers. With internet-based collaboration, teleconferencing, and videoconferencing products, it is not necessary for people to be in the same room. It’s now economical and practical for separated individuals to interact with one another in company meetings, sales presentations, and other group activities.

Each company needs to decide if teleworking is right for it and its needs. If a company is to embrace teleworking as a viable option, it needs to get over certain hurdles. The managerial attitude is the most significant. Those attitudes are most likely inherited from managers who grew up in pre-teleworking days. For example, teleworking may become the norm at dot-com companies like Yahoo, Hotmail, or Amazon much quicker than at General Electric or General Motors.

2.1 Teleworking definition.

Many individuals have encountered the following definitions of teleworking:

“Teleworking is defined by RCEPT-91 as a way of working in which the work is carried out at a distance from the employer or contractor for whom it is intended. Important is

placed on the concepts of location independence and the increasingly important role of telecommunications as an enabling factor."[2]

"Teleworking used in a general sense to describe a variety of different ways in which the nature and location of work may be transformed as a result of the use of advanced telecommunications networks in conjunction with information-processing technologies"[3]

"Teleworking is working at a distance from your employer, either at home, on the road, or at a locally-based center. Teleworkers use computers, telephones and faxes to keep in contact with their employers or customers."[4]

"Teleworking means making use of information and communication technologies to practice some form of remote working."[5]

From the various definitions above, I would like to conclude and use this definition below to understand the meaning in this project proposal.

Tele – far way, far from

Working - involves a complex set of abilities to understand and use the dominant symbol systems of a culture for personal and community development. The need and demand for these abilities vary in different societies.

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2 Andrew Page and David Brain, EC DGXIII publication.Review of Experiences and Prosspects for Teleworking-1991(RCPT-91), page 1.

3 Ursula Huws, EC Publication DGV.Social Europe Follow-up the White Paper-1995, page 2.

4 Imogen Bertin and Alan Denbigh, Telework, Telecottage and Telecentre Association, TCA 1996.The Teleworking Handbook: New ways of Working In The Information Society-1996, page 1.

5 Andrew Bibby,Whitstable Litho.Calouste Gulbenkian Foundation.Teleworking – Thirteen Journeys To The Future of Work – 1995, page 2.

"Teleworking is a flexible way of working which covers a wide range of work activities, all of which entail working remotely from an employer, or from a traditional place of work, for a significant proportion of work time. Teleworking may be either on a full-time or part-time basis. The work often involves electronic processing of information, and always involves electronic processing of information, and always involves using telecommunications to keep the remote employer and employee in contact with each other."[6]

This definition excludes traditional 'outworkers', as well as people who work at home very occasionally, but includes:

- People working *at home* (e.g. programmers, project manager, tester).
- People working *from home* (e.g. sales people, operators).
- People working at *work centers* (such as telecottages, or satellite offices, e.g. Clark, technician or administrative).

The categories of teleworkers.

Informatics-IT Services Teleworkers with a wide range of IT related skills including: Programming, Hardware, Networks, Operating Systems, Database Design, IT Consultants AND Internet / Web Designers and Developers, Creative. No attempt has been made to categorize them further as many are multi-skilled.

Design Teleworkers with a wide range of design skills excluding IT related skills.

Consultants Teleworkers offering consultancy in areas NOT including IT and the Internet, who can be found under their respective categories. Categories here include marketing, engineering, legal assessing, and management.

Administration Teleworkers offering a wide range of secretarial, office and administrative skills.

6 Mike Gray, Noel Hodson and Gil Gordon, Teleworking Explained. (1993), Page 2.

Other Professional Services, other services not included elsewhere such as salesperson, translator, and operator.

There are more realizable works through telework; these are just a few examples of its applications to different fields.

Another identifiable group of teleworkers is all those people who work in a work center. Work centers vary widely, from the rural telecenter (sometimes known as a telecottage) to a company satellite office. A satellite office is a small office located far from the company head office that is not self-sufficient, i.e., relies on excellent communication links with the head office. A work center may permanently assign desks and workstations to one individual or make them available to multiple individuals on a short-term basis.

In teleworking terms, the work center is a halfway house between the central office-working situation and home. Working in a center is preferable to working at home. Traditional employers find it easier to manage small groups of workers than dispersed individuals. However, a work center may not fully comprehend the benefits of homework.

Because teleworking is essentially a flexible way of working, there are also working practices that may encompass two or more of the situations described.

2.2 The importance of teleworking.

In today's mobile business world, the keys to success are speed and autonomy. Teleworking solutions provide workers with ubiquitous access to all communications and computer systems, enabling them to work from any location. This is an essential dimension of today's business model. Teleworking is the initiative and set of supporting technologies that provide a broad range of dynamic and flexible work arrangements, including home offices and telecommuting. It's not about working just at home instead of the office; it's about putting the office anywhere that workers are located. Today's organizations can conduct business more effectively through teleworking, free from the constraints of having everyone work at the same time and place. It empowers the modern enterprise with a practical way to seize new business opportunities as they emerge. As wireless technologies, the Internet, and the global economy grow, so too does teleworking. Teleworking is not

just about letting people stay home instead of making the daily commute; it can be an overall productivity booster for any type of worker. Although teleworking has many forms, these forms all share two common characteristics:

2.2.1 Geographic distribution of an organization's workforce

By enabling freedom from the office, companies can more easily place key workers based on their geographic effectiveness. Whether it's to provide them with a better quality of life or to place them near important clients or markets, breaking down the geographic requirements of work is a key competitive point in today's global economy.

2.2.2 Electronically supported communication and collaboration.

Teleworking is more than reducing the need to commute; it is also about building a more effective working environment through enhanced communications and collaboration through electronic networks with the goal of improving communication among key employees, business partners, and customers.

Teleworking is the sum of many parts and the differentiate in wording:

As a process and a set of technologies, teleworking encompasses many different aspects of mobile work activities and information distribution. These include:

- **Telecommuting** refers to the practice of conducting work from a home office, which eliminates the need for a full-time or part-time commute to the corporate office.
- **Mobile working** refers to the practice of a traveling employee performing tasks at different locations, which involves a wireless connection to the teleworker.
- **Home office.** A worker's home serves as the location of the office. The office may be eligible for an IRS tax exemption.
- **Satellite Office:** A telecenter located far from the central office where a group of individuals often work on a free-lance or consulting basis. This type of telecommuting typically uses office locations operated by and for a single employer, which are situated away from the employer's primary work site. Satellite offices help to reduce commute times for employees and help alleviate

city traffic and parking congestion problems by locating offices closer to employees's homes and communities, especially in metropolitan areas.

- **The Telework Center** allows employees at a satellite or branch office to access the features and functions of the corporate office.
- **Hoteling** refers to the practice of providing employees with drop-in access to shared office space at a company location. It is especially effective to reduce real estate expenses by implementing this concept for highly mobile workers like sales representatives, who are only in the office for a short period of time and can therefore share desk space with others.
- **A telecottage** typically serves as a "community-based" facility, facilitating learning, providing access to technology, and facilitating work for its local community. Sweden initiated the telecottages movement, which has gained widespread adoption, particularly in the UK, where there were approximately 200 telecottages as of the last count.

2.3 Specific benefits to teleworking.

The factors that drive the overall teleworking environment only tell part of the story. At a more direct level, there are many specific examples of why companies should adopt aggressive teleworking strategies. These benefits include:

- The overall employment environment has improved.
- Existing infrastructure reduces overhead costs and increases ROI.
- You can save money on overhead expenses such as office décor, chairs, desks, and other office equipment, as well as utilities like cleaning, water, electricity, and phone bills.
- The ability to adapt to new competitive challenges and the flexibility of staff working patterns are crucial.
- Skill retention: continuing to employ skilled workers who would otherwise leave.
- People who live too far from the 'office' or who are housebound present greater recruitment opportunities.
- Increased productivity: Teleworking programs almost always result in increased productivity among teleworkers.

- We are resilient against extreme weather conditions, terrorist activity, and public transportation system breakdowns.
- There are numerous small aspects of freedom, such as dressing in 'comfortable' attire, avoiding sitting next to someone you don't like, and having the power to manage your own workspace.
- Reduced commuting leads to saving money, saving time, and less stress.
- Improved customer service and satisfaction.
- Out-of-hours cover, ‘round the clock’ service.

There are also benefits for individuals and society as a whole. Adaptation to individual domestic and lifestyle needs, reduced 'travel hassle', and reduced rush hour pollution are among the widely mentioned benefits. The introduction of teleworking often brings attention to previously neglected work flow and management issues.

2.4 The factors driving business teleworking today.

As more and more businesses embrace mobile technology and become less monolithic, the need for every business to become more mobile increases. Mobility is also about flexibility. In today’s fast-paced climate, where new businesses (and competitors) are popping up daily and mergers and major new initiatives among established businesses are becoming more frequent, having a highly adaptive company and workforce is paramount. A key tool for achieving more mobility and flexibility is teleworking, economics, cultural influences, environmental factors, and technology as follow.

Economics

The bottom line is under increasing pressure. The quest to drive costs toward zero is not the Holy Grail it once was, but a real aspect of doing business today. Teleworking technology is a great help in reducing costs, increasing productivity, and subsequently improving profit margins. It can help lower costs during mergers and acquisitions, where employees may need to coordinate jobs from newly remote locations. It can lower costs by widening the ability to work with foreign-based labor and temporary contract workers. People working from home can reduce real estate and office space costs, which have risen during a booming economy, as offices only serve as locations for group meetings or subsets of the corporate workforce.

Cultural influence

As productivity increases, workers are looking for a more diverse set of benefits that move beyond common salary demands. Two-income families want to spend more time at home with their children. Lifestyle and geographic changes are increasing requests from valued employees. Most importantly, the ability to schedule the workload over an entire week to meet pressures for personal time and professional time in a way that is most productive for both is becoming perhaps the signature work issue of the day. As they spend less time in the corporate office, employees can expand their search for suitable or desirable areas to live. In these cases, even longer commutes from more remote areas can be a realistic opportunity.

Environmental factors

It's more than just a social or employee issue; the reduction of air pollution and congestion, as well as the environmental impact of reducing commuting, are becoming business issues. Local municipalities and government programs provide tax incentives and regulations that motivate businesses to do what they can to reduce their employees' daily commute.

Technology

Technology is finally providing the global productivity that it has long promised. The rise of the Internet, e-commerce, and corporate LANs/WANs has created one of the most fluid business environments in history. As these technologies improve and spread, traditional notions of location and time in relation to business activities are dramatically changing. Wireless devices are spreading faster than the original PC or the first wave of the Internet. People expect Pagers, PDAs (like the Palm Pilot), and cell phones to become the most dominant ways to receive and send data via the Internet. This is creating a whole new category of mobile workers. At the same time, mainstay communication applications such as email and voicemail are giving rise to web-based meetings, unified messaging platforms (which combine fax, email, voicemail, and instant messaging in one mailbox), and desktop videoconferencing.

As a result, one can directly offer a wide range of services from any desk, regardless of location. It's also possible today to generate messaging and communication links to customers, employees, or business partners that go far beyond a mere telephone call. This is almost as good as sitting in the same room with them.

Whether it's to sell a product, instruct employees, or interact with consumers, today's technologies are reducing geographic limitations. Companies see this as an advantage once they begin a strong teleworking initiative that facilitates not only off-site communication but fosters real collaboration between decentralized workgroups.

2.5 Technologies overview.

Technologies, such as the tools to operate and manage the system, are crucial for the deployment of teleworking. The subsequent content will delve into the specific details of these technologies.

2.5.1 Remote networking applications.

To get the most out of a remote network, make sure that branch offices, travel professionals, and teleworkers have access to critical applications on the corporate LAN and enough bandwidth to use them adequately. Remote users simply cannot do their jobs effectively without access to e-mail, groupware, and the other applications their counterparts use in the home office.

Teleworkers will need access to use some, or all, of the following applications: Most of them require high-bandwidth equipment and connections.

E-mail.

Most remote workers need email to keep in touch. To send intercompany message, they will need dial-in access to the company's e-mail server. To send messages to clients, customers, business partners, or others outside your company, you will need access to online services such as American Online, Microsoft Network, and CompuServe, or an account at an Internet Service Provider (ISP).

FTP.

File Transfer Protocol (FTP) is a simple-to-use program that lets you download files from remote servers on the Internet or other TCP/IP environments. User will need FTP

capabilities, for example, to download free software from bulletin board services, research papers from a university and product information from a vendor's web site.

Groupware.

If your company uses groupware packages such as Lotus Notes, Microsoft Exchange, Claris Works, WordPerfect Office, or Microsoft Office, giving your remote users access to their powerful capabilities is a must. Groupware includes centralized scheduling programs, bulletin boards, interactive conferencing, and "whiteboards" that let groups of users work on a single document or image at the same time. Remote users usually need high-bandwidth to take full advantage of these powerful applications.

Internet access.

Over one-third of the organizations polled by Infonetics Research said their remote sites needed access to the Internet. Yours may also require Internet access—to collaborate with clients or partners, scan professional journals, or make airline reservations. Since most Internet services are inefficient at slow speeds, a growing trend is to give remote callers high-bandwidth connections and digital equipment.

Virtual Private Networks (VPNs).

These new offerings from Internet service providers let you set up a virtual private network (VPN) over the Internet. VPNs, acting as intranets, are a good way to connect your remote sites, teleworkers, customers, or mobile users into a secure, private network without paying long-distance charges or installing costly dedicated lines. They use tunneling techniques to protect your private data from hackers or other individuals you want to keep out of your network.

2.5.2 The building blocks of remote networking

The task involves establishing a remote networking program that aligns with the company's requirements. This task is easier to accomplish as it involves a step-by-step process that can be broken down into five individual building blocks. Use these building blocks to construct your remote access network as shown in figure 2.1

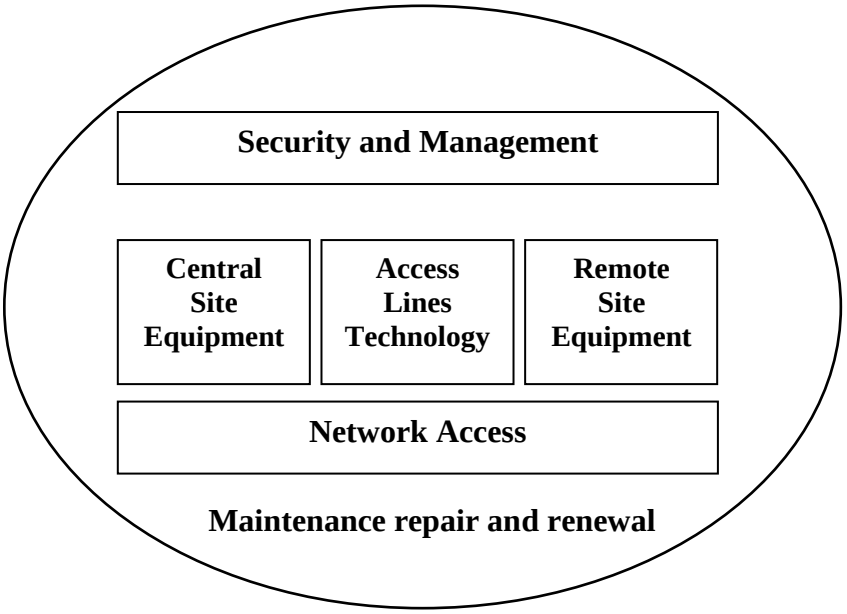

Figure 2.1-Building blocks to construct remote access network.

Access lines technology: carrier services.

There are services that carry data traffic between remote locations and the central site, such as analog, ISDN, frame relay, and XDSL. Telephone companies, Internet service providers, competitive access providers, and local exchange carriers can all provide these services.

Remote access equipment.

Remote site access equipment, also known as customer premises equipment, is the equipment that branch offices, teleworkers, and mobile workers use to connect their LANs or workstations to the phone company's access lines.

Central site access equipment.

Central site access equipment—the linchpin of your remote access network—is the hardware on your corporate LAN that answers incoming calls from remote workers.

Security and Management.

Remote access computing exposes your network resources to thieves and hackers. Protect yourself against both internal and external security threats with next-generation security products that are on the market.

Through network management tools, you can control your remote site equipment and access lines without sending IS staffers into the field.

Network access.

Access to the network will be limited to the private network and the public network. However, focusing on the public network, also known as the "Internet," has become an essential component of any remote networking solution. As companies develop virtual private networks (VPNs), which allow users at one location to “tunnel” through the Internet to access resources at a different location, the Internet itself helps extend the traditional functionality of the corporate LAN.

Maintenance repair and renewal.

The system equipment needs to be checked and maintained by the usage hours from the period checking schedule. The technicians often have the support of technicians to deal with problems and enjoy easy access to replacement equipment and parts, which is a consideration for the technicians' availability. It is therefore important to plan the maintenance, repair, and renewal of teleworker equipment, networks, and systems to ensure adequate availability.

2.5.2.1 Access line and technology: carrier services.

Access lines are the pipes that send data into a carrier's network from an end-point location, such as a branch office, a customer's site, a telecommuter's home, or a corporate central site. These pipes connect your remote users with the important computing resources on their company’s enterprise network and the Internet.

Setting up a remote access network requires two types of access lines: remote site access lines and central site access lines. Remote site access lines carry traffic from remote users’ sites onto the telephone company’s network. Central site access lines extend from the carrier’s network to your corporate office, aggregating traffic from multiple remote sites onto the corporate LAN.

Remote site access lines and technology factors consideration.

Each remote location needs an access line to link their LAN or workstation to a corporate LAN, the Internet, or commercial online services. This access line must give them the speed and reliability to perform their jobs just as easily from remote sites as from the office, but it has the following factors to consider:

- **Using Patterns**

Consider remote-access traffic patterns. How often does a particular site need network access? What kind of tasks do users perform remotely? What type and size of files do they exchange over the network? What sort of response times do they need?

Table 2.1- File transfer times will vary considerably.

		File Transfer Times				
File Type	**File Size**	**9.6 Kbps**	**28.8 Kbps**	**64 Kbps**	**128 Kbps**	**512 Kbps**
Word processing (20 pages)	**40 K**	33 sec.	11 sec	5 sec.	2.5 sec.	.625 sec.
Spreadsheet	**100 K**	83 sec.	27 sec.	12.5 sec.	6.25 sec.	1.6 sec.
Black & White	**1 MB**	14 min.	4.5 min.	2 min.	1 min.	15 sec.
Presentation						
CAD/CAM	**2 MB**	29 min.	9 min.	4 min.	2 min.	30 sec.
Digitized Photograph	**4 MB**	56 min.	19 min.	8 min.	4 min.	1 min.
Color Presentation	**10 MB**	139 min.	46 min.	21 min.	10 min.	2.5 min.
X-ray Files	**100 MB**	23 hrs.	8 hrs.	3.5 hrs.	1.7 hrs.	26min.

Note: depending on the speed of your remote workers' access lines and the size of the files they transmit.

Source: http://www.ascend.com

An analog line, for example, may be adequate for sales staff at a small remote office who access their corporate LAN twice daily to read e-mail and submit orders electronically. On the other hand, a bank customer service representative who works full-time from home and queries his company's database all day long might require a dedicated Frame Relay connection.

- **Cost**

To select the most cost-effective access lines, estimate how many hours per month each remote site will use its network link. Then determine how far away each site is from the phone company's nearest serving office. With this information, you can determine the relative cost of different types of access lines.

The Break-even point: ISDN or Frame

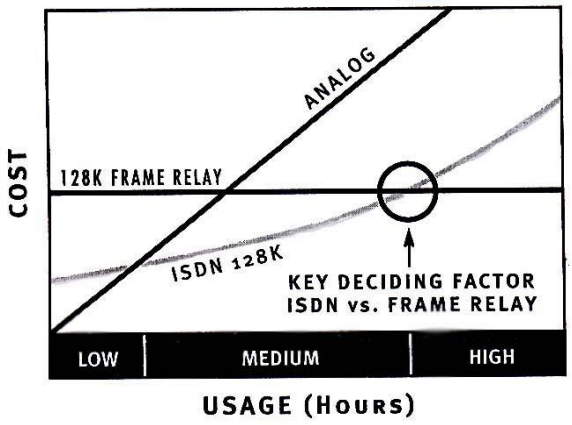

Figure 2.2- The Breakeven point: ISDN and Frame Relay.

Source: http:/ www.ascend.com

- **Availability**

Certain remote site access lines, such as ISDN or Frame Relay, may not be available in all of the geographic locations where your company does business. In advance, inquire with your telephone company about any restrictions on specific types of access lines in specific areas.

Types of remote site access lines and technology.

Choose access lines with capabilities that align with remote user's traffic patterns. Three main types of remote access lines are available:

- Analog, which utilizes circuit switching technology.
- ISDN Basic Rate Interface (ISDN BRI), which utilizes circuit switching technology.
- Frame Relay, which utilizes fast-packet switching technology.
- XDSL, which a family of technologies aimed at provided high-bandwidth applications over twisted-pair phone lines.

Analog.

We use this same service at home for voice conversations. Analog lines use modems and pulse code modulation (PCM), a digital representation of the analog wave form, to exchange data traffic over wide links at speeds up to 36.6 kbps. Support for up to

56K is possible when the technology becomes more widely implemented at the central and end user sites.

Advantage: Ubiquitous; inexpensive.

Other Considerations: Too slow for heavy usage or high-bandwidth applications; lengthy call set-up time (up to 40 seconds); only 93 percent connect rate; often connect at slower speeds to accommodate noisy line conditions.

Analog lines: The drawbacks

When transmitting data, analog phone lines, designed for voice communications, present significant limitations. Line noise, nearly imperceptible to the human ear during a phone conversation, frequently wreaks havoc on data transmission, causing distortion, data errors, and lost connections. The switching equipment at the Phone Company's service office also creates line noise and data corruption.

Digital services, on the other hand, provide end-to-end digital connectivity from the local loop all the way across the phone company's backbone network. They also eliminate line noise and the time-consuming conversion from analog to digital, and back. As a result, digital connections such as ISDN and Frame Relay provide greater reliability, improved performance and increased throughput.

Transmitting Data over Analog Lines

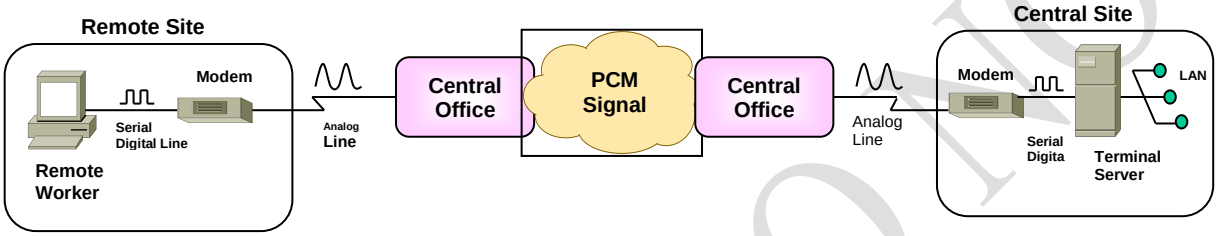

Figure 2.3- Compared to digital technologies.

Note: the process of transmitting data over analog phone lines is slow and unreliable.

To transmit data from a PC over an analog phone line, a modem must first convert the PC's digital signal to analog. The telephone company's central office receives the resulting analog signal via a local access line. Switching equipment converts the analog signal into a 64 Kbps data stream using a technique known as PCM. Next, a long-distance carrier transmits the digital stream containing the digitized analog waveform onto its digital backbone network.

The process is reversed at the other end of the transmission. Switching equipment restores the digitized PCM stream to its original analog waveform and then transmits it over a local access line to its destination. Finally, another modem restores the analog waveform to a digital signal so that the PC can process it.

ISDN BRI.

ISDN BRI access lines consist of two 64 Kbps B-channels that carry either voice or data, and a third D-channel used primarily for signaling. Countries that have access to ISDN BRI offer it as a switched service.

It called a dial-up service. (A connection between two predetermined locations, like a headquarters and regional office, is known as a leased line; you can make switched connections to any location from anywhere.) In Australia, Germany, and Japan, ISDN is also available as a semi-permanent service, which is essentially a leased line connection.

Inverse multiplexing, a feature of some ISDN BRI access equipment, enables users to combine the two B-channels of an ISDN BRI line to achieve a total throughput of 128 kbps. Used in conjunction with compassion, this feature makes it possible to achieve very high data rates.

Advantages: Relatively high speed; cost effective; set-up of less than a second; handles multiple devices, multiple phone numbers and Both data and voice call on a single pair of wires.

Other Considerations: Can be expensive in some areas; not available in all countries.

Frame Relay.

Frame relay is a fast-packet switching technology that is popular in many corporate networks. IT works by breaking data streams into variable-length packets and routing them across a carrier's network over predetermined logical connections called Permanent Virtual Circuits (PVCs). Frame relay requires a dedicated connection to the network.

Frame Relay pricing is usually based on some combination of the following:

- Fixed monthly access charges.

- Committed Information Rate (CIR) is the minimum amount of bandwidth available to the network. Negotiated between the user and carrier.
- Number of PVCs.
- Number of frames transmitted per billing cycle.
- The amount and number of times your transmission rate exceeds your CIR.

Frame Relay pricing is distance-insensitive, making it a good choice for remote offices or telewokers who would otherwise pay long-distance rates to connect to the corporate LAN. It is also a good choice for locations that average more than three hours per day online.

Advantages: Economical in frequent-usage, high-bandwidth situations.

Disadvantages: Expensive if users must set up PVC to a number of different location; requires greater technical expertise to set up and manage.

xDSL.

Digital subscriber line (DSL), sometimes referred to as xDSL, is a family of technologies aimed at providing high-bandwidth applications over twisted-pair phone lines. DSL is not actually a line, but rather a pair of modems at either end of a phone line that can provide high-speed data and video transmissions over a single copper phone line without affecting voice traffic. Carrying data on frequencies not used by voice transmissions, DSL can maintain an always-on, non-switched connection between the user and the telephone company's central office.

Although DSL transforms a twisted-pair phone line into a fast data pipe, there is a distance limit (usually up to 18,000 feet) to how far existing DSL systems can provide high-speed data transmission. Even within DSL's distance limit, data speed varies depending on the distance between the user and the telephone company's central office. Industry experts estimate that only about 50% to 70% of US households are within DSL's distance limit.

DSL has many versions, including ADSL (asymmetric DSL), SDSL (symmetric DSL), HDSL (high-bit-rate DSL), VDSL (very high-bit-rate DSL), RADSL (rate-adaptive DSL), and IDSL (Integrated Services Digital Network DSL), all with different data rates

and distance limits. Currently, DSL uses three modulation schemes: ISDN-like 2BIQ (2 binary/one quaternary), CAP (carrier less amplitude phase), and DMT (discrete multitone). These standards are not interoperable.

Although DSL service does not require an extensive network upgrade as a two-way cable modem service does, deploying DSL service is still expensive. In addition, telephone companies need to perform some network re-engineering before they can provide DSL service. For example, they must remove load coils and bridge taps to support DSL service.

Advantages: Always-on connection, Supporting data and voice simultaneously on a single line, High-speed data rate.

Other Considerations: Utilization of existing phone lines, No need for major network upgrade, Potential of supporting video applications.

The advantages of ISDN BRI over analog.

Once you know how ISDN BRI works, it's easy to understand why it's better for remote access applications than analog lines.

Based on speed alone, ISDN BRI wins over analog hands down. Its top data rate, 128 KPBS, is twice as fast as 56 K modems, three times faster than 33.6 Kbps modems, four times faster than 28.8 Kbps modems, and nearly nine times faster than 14.4 Kbps modems, the most commonly used modems in the marketplace today.

ISDN beats analog in terms of call setup time, too. With an analog line and a modem, it usually takes between eight and fifteen seconds to setup a call, and sometimes as much as 40 seconds. ISDN sets up calls at lightning speeds of just 300 milliseconds. The difference is only a matter of seconds. However, for remote users who must dial up network connections repeatedly throughout the day, seconds mean considerable savings in terms of connection time and aggravation.

ISDN's analog advantage is reliability. ISDN lines are virtually error-free because they improve a single transmission along its length while maintaining full speed all the way. Analog calls are subject to interference, which may corrupt your data and cause

modems to automatically degrade to slower speeds. Worse yet, line problems can cause modems to suddenly terminate your network connection.

Table 2.2- The comparison of ISDN BRI and Analog.

ISDN BRI Versus Analog

	ISDN BRI	Analog
Speed	64 Kbps on each B-channel 5 times faster than analog Call setup time: 300 milliseconds.	Up to 56 Kbps on dial-up modem Call setup time: 8-26 seconds average
Flexibility	Two simultaneous calls can be made over a single BRI Bandwidth expansion is possible through combining B-channel Up to eight telephones, computers, or fax Machines can be linked to a single BRI B-channels can be used for voice and data	Only one call can be made at a time A telephone, computer, and fax machine can share an analog line. Only one telephone number can be Assigned to an analog line.
Cost	Faster speeds result in less usage and higher Productivity.	Slower speeds result in higher usage and lower computer productivity.

Frame Relay versus Dedicated Lines.

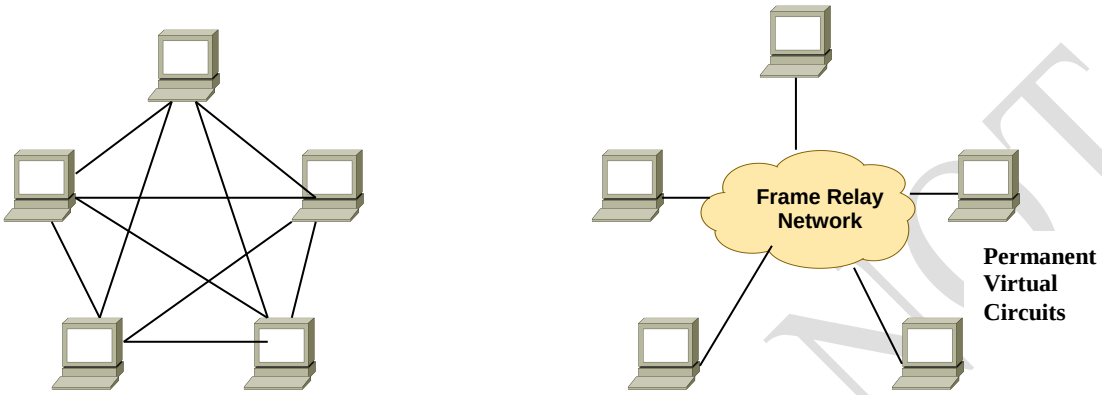

Figure 2.4- The private network and Frame Relay.

Each site on the network necessitates expensive dedicated lines, adding up to a total of 10 lines. A frame relay network requires only one connection to the network at each site, for a total of five lines.

Table 2.3–The kind of access lines depends usage patterns and bandwidth requirements.

Remote Site Access Lines: A Comparison

	Analog	**ISDN BRI**	**Frame Relay (64K)**	**XDSL**
Speed				
Low	✓			
Medium		✓	✓	✓
High		✓	✓	✓
Frequency				
Occasional	✓	✓		✓
Frequent	✓	✓	✓	✓
Amount of transfer				
Low	✓			
Medium		✓	✓	✓
High		✓	✓	✓
Installation Cost				
Low	✓	✓		
Medium		✓		
High			✓	✓
PROS	Low Cost Ubiquitous	High-speed Relatively Low Cost	Economical for Heavy Usage	High-speed
CONS	Slow Error-prone	Not available in Some Areas	Expensive if Connecting To Multiple Locations	Not available in Some Areas

Because of carriers' aggressive pricing and marketing, as well as their increasingly widespread availability over the last few years, ISDN and ADSL are becoming the access lines of choice for the majority of today's telecommuters.

The others consideration technology for remote site.

ATM (Asynchronous Transfer Mode).

The system can support high-speed services such as data reception and transmission, animation, and multimedia. ATM technology responded to the need to send more data in a shorter period of time. ATM Technology provided a range of services that ensured quality of service (QoS) during data transmission, utilizing a modern network management system that was adaptable enough to optimize network performance. At each level of communication, the customer has the ability to select the level of bandwidth or speed.

Network Model.

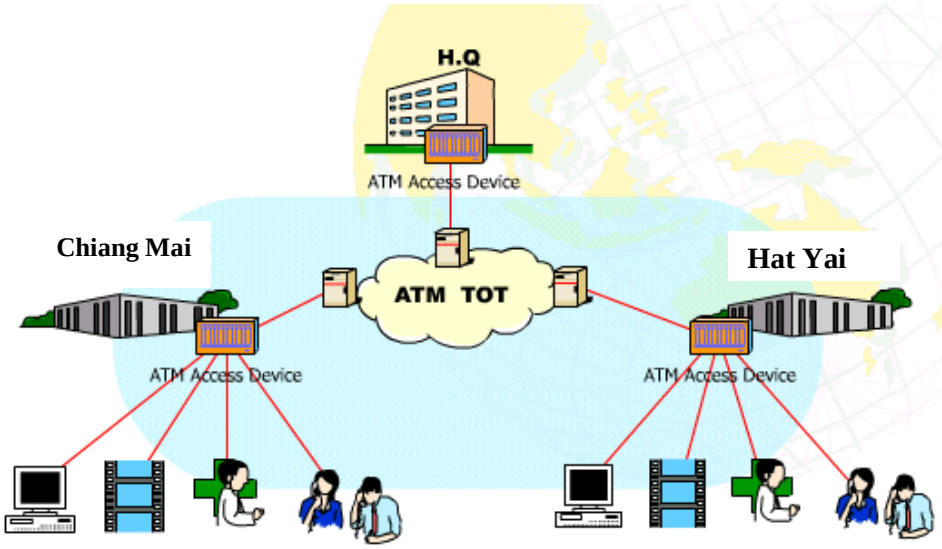

Figure 2.5- ATM network

Source: http://www.tot.co.th/broadband/isdn/atm.html

Applications.

ATM services have 3 types, CBR, VBR, UBR that separate from the requirement of working pattern.

Constant Bit Rate (CBR).

The user can transmit and receive data at a constant speed. This technology is ideal for emulating circuits or facilitating voice communication. CBR transmission reserves bandwidth to ensure no loss or a lower transmission rate. CBR services, such as video conferences and interactive voice responders, have the best performance for implementation.

Variable Bit Rate (VBR).

Users can transmit and receive data at varying speeds. It is appropriate for non-instantaneous transmission or transmission that doesn't occur continuously during usage, like data transmission or file transfer.

Unspecified Bit Rate (UBR).

Using open loop service in cases of heavy network usage will not notify the user, but the service charge is cheaper than VBR 20%.

Advantages.

1) The same network allows for faster transmission of video, voice, and data.
2) Lower overhead cost for operation cost and investment in network.
3) It is easy to link with other networks, such as LAN, Frame Relay, X.25, and IP.
4) We can choose more alternatives to the bandwidth pattern to suit the purpose.
5) Guarantee the quality of services (QoS).
6) The device has the ability to connect to another network.

CES (Circuit Emulation Service).

Leased line communication connects to the destination device through a high-speed network (ATM). You can use it for voice communication or real-time transmission with a slight delay. The speed went from 64 kbps to 2 Mbps.

Network Model.

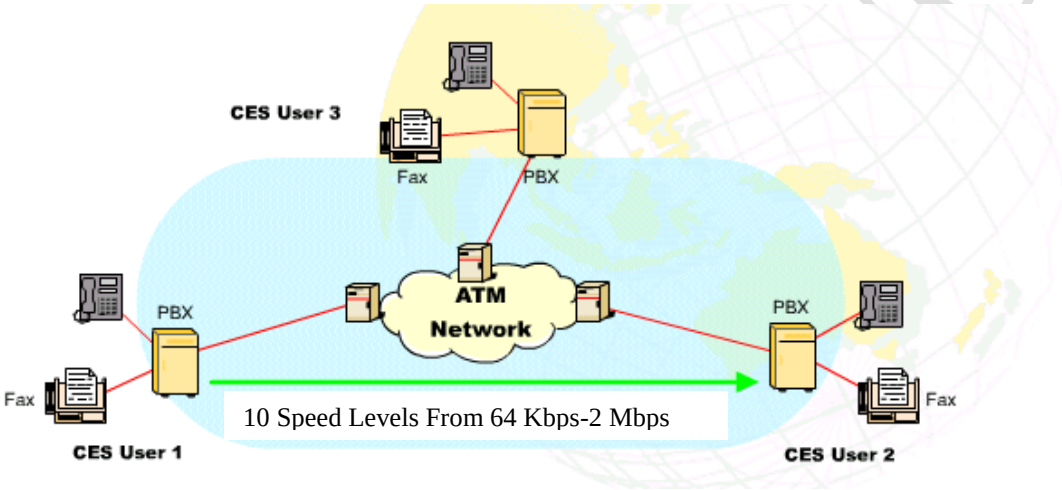

Figure 2.6- Network connections with CES service.

Source: http://www.tot.co.th/broadband/isdn/ces.html

Applications.

There is no service charge for linkage between the PBX and ATM networks, especially for remote access. These processes are like communicating in the same organization's network.

Advantages.

In the event of communication between the branches, there is no service charge for long-distance calls, which is suitable for voice communication and real-time processing.

RAN (Remote Access Network).

Communicate from the computer through the basic telephone network or ISDN telephone network via an ISP (Internet Service Provider) or VPN (Virtual Private Network) connected to a high-speed network (ATM). The transmission rate ranged from 64 kbps to 128 kbps, allowing for simultaneous transmission of two channels. The services charge only 3 baht per time, and they are available throughout the country.

Network Model.

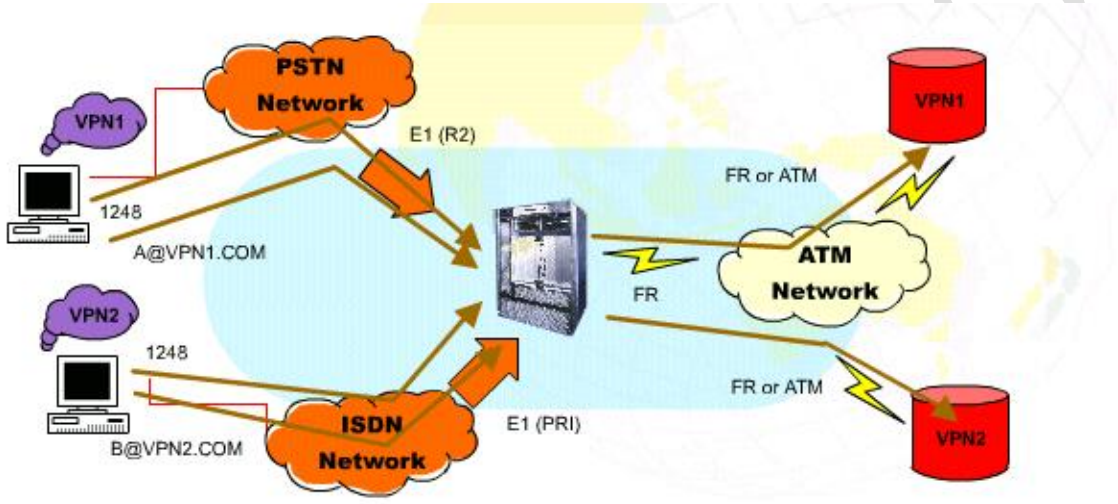

Figure 2.7- Remote Access Network Layout.

Source: http://www.tot.co.th/broadband/isdn/ran.html

Applications.

The customer can be applied RAN for the connection into two patterns by the following

1. The ATM network connects the RAN to the ISP or the corporate network.
2. The Internet connects home base users and the ISP, offering 64/128 Kbps speed for the same service charge.

Advantages.

1. An ISP can connect ISDN users to the Internet for the same service charge nationwide.
2. The service provider can reduce investment costs by strengthening the connection.

Wireless Network.

People frequently mention wireless access as a significant alternative to wired technologies like DSL, cable, and fiber. Wireless has always played an important role in telecommunications networks because of its inherent advantages of modest infrastructure investment (no wires!), rapid service deployment, and end-user mobility support. The strategic significance of wireless communication services has increased over the past decade as cellular-telephony subscriber growth continues to outpace all earlier projections. It is now clear that wireless will continue to play an important role in emerging telecommunications services, including narrowband data and broadband services, because of the same intrinsic advantages. For both Internet and broadband services, wireless services have experienced a longer than expected gestation period owing to a combination of factors such as technology cost and performance problems, spectrum regulation barriers, and weak standards. However, wireless data and broadband Internet services appear to be poised for technical and market breakthroughs over the next 3 to 5 years, and should therefore provide an important alternative for the facilitation of broadband services in the United States and other parts of the world.

Service Concept.

The concept of a wireless broadband access network. The basic idea is to provide a high-speed wireless link between subscriber devices such as PCs, Internet appliances, PDAs, and new personal multimedia devices (both fixed and mobile). It is expected that initial applications of wireless access will start with fixed devices such as home PCs connecting to an ISP, with a gradual migration toward mobile applications as end-user devices become more and more portable. Thus, the initial impetus for wireless access comes from the need to rapidly deploy networks capable of supporting high-speed Internet access. As investments in next-generation wired networks increase, we can anticipate a shift in focus towards semi mobile or mobile services in developed countries, as a growing number of computing platforms become inherently portable. It is noted that the wireless access network may be expected to interface with both the future public telephone network and the Internet, which are themselves experiencing some degree of convergence as they migrate toward broadband services. This implies that future broadband systems' wireless access networks will likely align architecturally with fixed network protocols, instead of designing custom overlay solutions like today's cellular networks. Over time, we can anticipate a further convergence between fixed and wireless networks, ensuring seamless service delivery to both wired and wireless devices.

Technology Overview.

As previously mentioned, a relatively slow improvement in wireless technology cost and performance over the past decade or so has inhibited the adoption of wireless data services. The previous generation of wireless data technologies (including cellular modems, wide-area data, satellite data, and wireless LANs) fell far behind Moore's law improvements experienced by most computing and telecommunications technologies. Although wireless presents significant technical challenges, the discrepancy seems to have no fundamental cause, likely due to insufficient R&D and/or venture funding to propel this field. Over the last 2 or 3 years, various new broadband wireless technologies have emerged as competitive alternatives to wired solutions, largely correcting the situation. Newer commercial or precommercial wireless technologies have reached the Mbps+ bit-rate levels necessary for viable services, either fixed or mobile.

Wireless LAN (WLAN).

Uses radio frequency (RF) technology to transmit and receive data over the air.

Most wireless LAN products operate in *radio bands.*

- 2.4 GHz. is most popular.
- Available in most parts of the world.
- No user fee or recurring charges.

A LAN implemented without a wired connection between the wall and the client.

- Typically, an extension or alternative to a wired LAN.
- All LAN services and capabilities are preserved.

Wireless LANs combine data connectivity with user mobility.

Usually confined to a single building or campus.

WLANs use electromagnetic airwaves (radio or infrared) to transmit data from one point to another without relying on any physical connection.

Spread Spectrum Technology is used by most LANs; two types:

- Frequency Hopping Spread Spectrum Technology.
- Direct Sequence Spread Spectrum Technology.

Infrared Technology.

- Use very high frequencies, just below visible light in the electromagnetic spectrum, to carry data.

The mobile phone generation.

Understanding the capabilities of each current mobile generation is crucial for determining the potential scope of mobile phones in e-business implementations. Based on the stages involved in developing mobile devices,

- First-generation 1G devices are all analog, which means that they transmit voice-only, as radios do.
- 2G systems, also known as second-generation phones, are the current standard for most countries, replacing analog transmissions. They are all digital, in comparison with 1G and 2G systems.
- 5G: The next major development in wireless technology will be 3G phones, which are not widely available yet. However, tech-savvy consumers, unable to wait for 3G, have sought a temporary solution: 2.5G. 2.5G. Generally, the

increased capacities for rapid data transfer (GSM and GPRS) distinguish 2.5G phones from their predecessors. These phones not only achieve faster data exchange rates but also enable Web browsing and adhere to Wireless Application Protocol (WAP) standards.

I am confident that the release of the third generation (3G) will occur shortly. The speed of data transmission between a mobile phone and a mobile network will increase. Consequently, it would enhance the efficiency of doing business on m-commerce; for example, users could receive real-time video and audio clips or songs. Therefore, it is crucial for business managers to thoroughly understand and integrate m-commerce into their business processes and strategies to gain a competitive edge.

Central site line options.

Now that you've chosen access lines for your remote sites, you're ready to select your central site access lines. These are the circuits that carry data traffic from your branch offices, customers, and telecommuters/teleworkers onto your corporate network.

The process of choosing central site access lines consists of three basic steps:

Step 1:

Estimate the amount of traffic your remote sites will generate. This estimate should be based on the total number of remote users in your program, the combined bandwidth of their access lines, and predicted usage patterns. Make allowances for peak traffic periods on certain days of the week, month, or at certain times of the day. Next, plot your results to determine how much total bandwidth you will need.

Step 2:

Consider your new remote access need in the context of any remote access program you have in place now. If you're already using a combination of separate analog, frame relay, ISDN, and xDSL, think about combining traffic from existing remote users and traffic from new remote sites onto one access line. A single access line will save you money on your phone bill, equipment, management, and support.

Step 3:

Choose the central site access line best suited to your particular needs from the following options:

- Replace individuals' low-speed lines with a new T1 or ISDN PRI circuit. You will save money, and your new high-speed pipe can handle traffic from both new and existing remote users.
- If you have extra bandwidth on an existing T1 or PRI access line, piggyback your remote access traffic onto the corporate LAN over this line.
- If your PBX already transmits voice traffic over an T1 or PRI line, reallocate a portion of its bandwidth to carry data traffic from your remote sites.

Table 2.4– A feature comparison between ISDN PRI, E1 and T1.

ISDN PRI, E1 and T1: A Features Comparison.

	PRI T1	**E1**	**T1**
Speed	64 Kbps on each of 24 channels	64 Kbps on each of 32 channels Channel 0 and 16 used for Framing and signaling Call setup time: 3 to 5 seconds	56 Kbps on each of 24 channels 8 Kbps of each channel is used framing and signaling Call setup time: 3 to 5 seconds
Flexibility	Any channel can be used for Inbound calls, outbound calls, or 800 calls, on a call-by-call basis. Look-ahead routing feature does not allocate channel if destination number is busy. Allocate channels by time of day, e.g. more voice calls during day and high-speed data transfer at night.	Channels are pre-assigned for type of calls, so some channels can site idle while other channels ring busy. Channel is allocated for the call while it checks to see if destination line is busy. Voice and data channel assignments are fixed and can't borrow from each other.	Channels are pre-assigned for type of calls, so some channels sit idle while other channels ring busy. Channel is allocated for the call while it checks to see if destination line is busy. Voice and data channel assignments are fixed and can't borrow from each other.
Cost	25 % more efficient use of channels (avg.)	Need more channels to ensure no busy.	Need more channels to ensure no busy.

2.5.2.2 Remote site access equipment.

Once you've decided which access lines fit your remote users' needs, your next step is to choose equipment that physically connects their LAN, laptop, or desktop computer to these lines. Consider your choices carefully. The remote site access equipment you select will have a long-lasting effect on your recurring remote access costs, your network's security, and the overall success of your remote access network.

Table 2.5- The choice of access lines and remote site equipment options.

Remote Site Equipment Options and Access Lines

Access Line	Access Equipment Options
Analog	Modem
ISDN BRI	ISDN Terminal Adapter Bridge Router Integrated Access Device
Frame Relay	Bridge Router
xDSL	XDSL Modem Bridge Router ISDN Terminal Adapter (IDSL only)

Remote site access equipment options.

Remote site access equipment has an interface on one side that connects it to the telephone company's access line. On the other side, it plugs directly into an interface on your remote LAN file server, PC workstation, or laptop computer.

The type of access line you select determines the options for remote site access equipment. For example, if you install an analog line, a modem is your only choice of access equipment. If you opt for an ISDN BRI circuit instead, you have three options for access equipment: ISDN terminal adapters, ISDN bridges or routers, or integrated access devices.

Currently, there are seven types of equipment available for remote access:

- Modems
- Cable Modem
- Routers
- ISDN Terminal Adapters
- Bridges
- ISDN Integrated Access Devices
- ADSL Modem

Modems.

Modems, the workhorses of the remote access world, are stand-alone units or cards that fit inside a PC and connect to an analog phone line. The maximum throughput for most modems today is 56 Kbps—an adequate speed for many remote applications. Modems are still a must in hotel rooms, customer sites, and other locations where only analog lines are available.

Advantages:	Inexpensive; familiar; easy to use.
Other Considerations:	Low speed; prone to errors; unsuitable for multimedia and Large graphic files; line noise often causes lost connections.
Access Line:	Analog.

Cable modem.

A cable modem is a device that provides high-speed Internet access and other types of data services via a cable TV network. There are two types of cable modems: hybrid fiber/coax (HFC), known as two-way modems that operate over HFC networks currently serving about 15 million US homes, and one-way modems that operate over traditional coax cables and use phone lines for the return path.

Typically, a 10Base-T Ethernet adapter and twisted-pair cabling connect a cable modem to a computer, necessitating professional installation. A cable modem head-end system communicates with cable modems via dedicated upstream and downstream data channels, allowing for a constant connection to the Internet.

There are several modulation techniques for data delivered to cable modems, the most popular being quaternary phase shift keying (QPSK), which transmits data at up to 10 Mbps, and 64 quadrature amplitude modulation (64-QAM), which delivers up to 27 Mbps. The actual speed experienced by users is lower, primarily due to shared bandwidth in a cable network. To address the multiple-standards issue.

Overall, cable modem service is demonstrating itself as a very attractive high-speed Internet access platform. Of course, cable modems also have their share of shortcomings,

the most important of which is the need for expensive network upgrades and professional installation at subscribers' premises.

Advantages: Fast speed and constant connection, flexibility for scaling bandwidth.

Other Considerations: Partnership with content providers, good progress in industry standards.

Access Line: Hybrid fiber/coax (HFC).

ISDN Terminal Adapters (ISDN TAs).

These simple devices plug into the serial port of a PC or laptop. Using a method known as rate adaptation, they translate data into ISDN-compatible data and perform signaling and call setup. Most ISDN TAs cannot automatically bond the B-channels of an ISDN line into a single channel. Furthermore, a PC's serial port restricted external TAs to a total of 112 Kbps throughputs. Some internal TA cards can get as much as 122 Kbps, still shy of the 128 Kbps maximum throughputs available from an ISDN line. With the ISDN DSL (IDSL).

Advantages: Less expensive than ISDN bridges or routers; faster than modems.

Other Considerations: Contain no intelligence; limited throughput capability.

Access Line: ISDN; IDSL.

Bridges.

Bridges transmit data across wide-area networks to other devices on the same LAN segment. Unlike routers, which send packets to specific network addresses over the best route, bridges simply broadcast packets over the entire network. Bridges can connect LANs running different protocols because they are protocol-independent.

Advantages: Easier to set up and manage than routers or ISDN integrated access devices.

Other Considerations: More expensive than ISDN TAs or Modems; their Inefficient use of bandwidth can result in "broad-cast

	Storms". And network congestion.
Access Line	ISDN; Frame Relay; xDSL; dedicated.

Routers.

These intelligent devices connect remote users to corporate networks over ISDN, dedicated or Frame Relay access lines. Routers select the optimal path for sending data through a network based on routing tables that contain information on all the addresses in the network and the best pathways to each one,

Because routers are protocol dependent, they can only route traffic between LANs running the same protocol but can bridge other protocols. Routers are particularly efficient for linking multiple segments and sub networks of large corporate LANs.

Advantages:	Operate over multiple networks; make efficient use of network bandwidth.
Other Considerations:	More expensive than other access equipment; more complex to setup and manage than bridges.
Access Line:	ISDN; Frame Relay; xDSL; dedicated.

ISDN Integrated Access Devices.

This is a type of access equipment designed specifically for small offices or home offices. ISDN integrated access devices come with an ISDN port and either one or two analog ports, so you can transmit both analog and digital calls over the same ISDN BRI line. They can be configured to function as either bridges or routers.

Advantages:	Handle ISDN and analog devices at the same time; can multiplex both B-channels to achieve 128 Kbps throughput
Other Considerations:	More complex to set up and provision than other access equipment.
Access Line:	ISDN.

ADSL Modem.

ADSL modems require power and typically interface with a computer via an Ethernet connection or some other means to an MPEG-2 Set Top Unit (STU). Alternatively, you can combine the STU with the ADSL modem. Since ADSL does not use frequencies below 20 kHz, it can co-exist with an analog telephone on the same twisted pair.

At the other end of the twisted pair, in the exchange building, a filter combines the analogue telephony signals from the exchange or Remote Access Unit with the high-frequency signals (20 kHz to 1.2 MHz) from the 'exchange end' ADSL modem, better known as the 'DSLAM' or DSL Access Multiplexer. This is a rack-mount piece of equipment that drives multiple pairs individually, likely connecting to the Internet (and video servers for VOD) via SDH fiber using TCP/IP and ATM protocols.

These asymmetric modems send data faster in one direction than the other. ADSL technology is based on the premise that any normal home or building has a dedicated copper wire running between it and the telephone company's nearest central office (CO, or MUX). This dedicated copper wire can handle a lot more data than the 3,000 hertz signal needed for your phone's voice channel. Therefore, if your home or building and the telephone company's central office both have an ADSL modem, the copper wire link between your building and the phone company can function as a purely digital high-speed transmission channel.

ADSL technology divides the phone line's bandwidth into 4,000 hertz bands, assigning a virtual modem to each band between 24,000 hertz and 1,200,000 hertz. Each of these 249 virtual modems transmits as best as it can with the assigned slice of bandwidth. The combined capacity of these 249 virtual modems makes up the overall speed of the "pipe." The upper capacity of ADSL is in the range of one million bps between your home or building and the phone company (upstream) and eight million bps between the phone company and your home or building. The same line can also transmit both a phone conversation and digital data simultaneously.

Advantages: Used exiting phone line, ISDN, High-speed communication, reliability.

Other Considerations: Distance limitation.

Access Line: twisted pair phone line, fiber optic, ISDN.

Table 2.6- Remote Site Access Equipment: A feature Comparison.

Remote Site Access Equipment.

	Modems	Cable Modem	ADSL Modem	ISDN TA	Bridge/Router	Integrated Access Device
Access Line	Analog	HFC	Twisted pair phone line	2 B-channels	2B-channels	ISDN and analog
Advantage	• Low cost • Easy	High Flexible Connection speed	• High speed Reliability	• Low-cost ISDN	• High performance • Secure Remotely manageable	• Solves SOHO wiring limitations • Lower cost line charges • Multiplex voice & data traffic • Secure • Remotely Manageable
Disadvantage	• Slow	• Fixed connection	• Distance limited	• Not the full 128 Kbps	• Cost	• Slightly longer installation for analog & ISDN connections
Cost	700-2000 Baht	3000-10000 Baht	5000-25000 Baht	5000-7000 Baht	50000 Baht up to 200000 Baht	30000-200000 Baht

2.5.2.3 Central site networking equipment.

To manage the increased traffic flow from the remote sites, the central site requires new access equipment. The equipment acts as a gate between the LAN resources and callers in the field, performing critical functions that include answering incoming calls, checking user passwords, rejecting unauthorized users, and routing traffic onto the LAN. On the wide area network side, it connects to the FT1/T1, T1/E1, ISDN PRI/T1, or Frame Relay access line that you are using to carry remote site traffic. On the other side, it connects to your local area network file server. By the way, the main server should be located in the center.

- System server, that is, a server machine to serve and authenticate authorized users from remote and local logins, balancing the work load for remote and local workers.
- Application Server: This one is used to install all of the applications that should be used in the business in the same or different organizations, including freeware, shareware, and custom software.

- Database server is used to install and backup the database of the business by using the standard technique and best effort of the database management system of the business.
- Internet server: this service server is used to serve the internet portal that links to and provides content for the network service, which is the biggest channel for communication both in and offsite of the business.

Even though there are multiple servers to implement, in practice, a single machine can represent one or more working functions. All of the servers have to have the best maintenance system and security management to represent reliability and accuracy, as Figure 2.8.

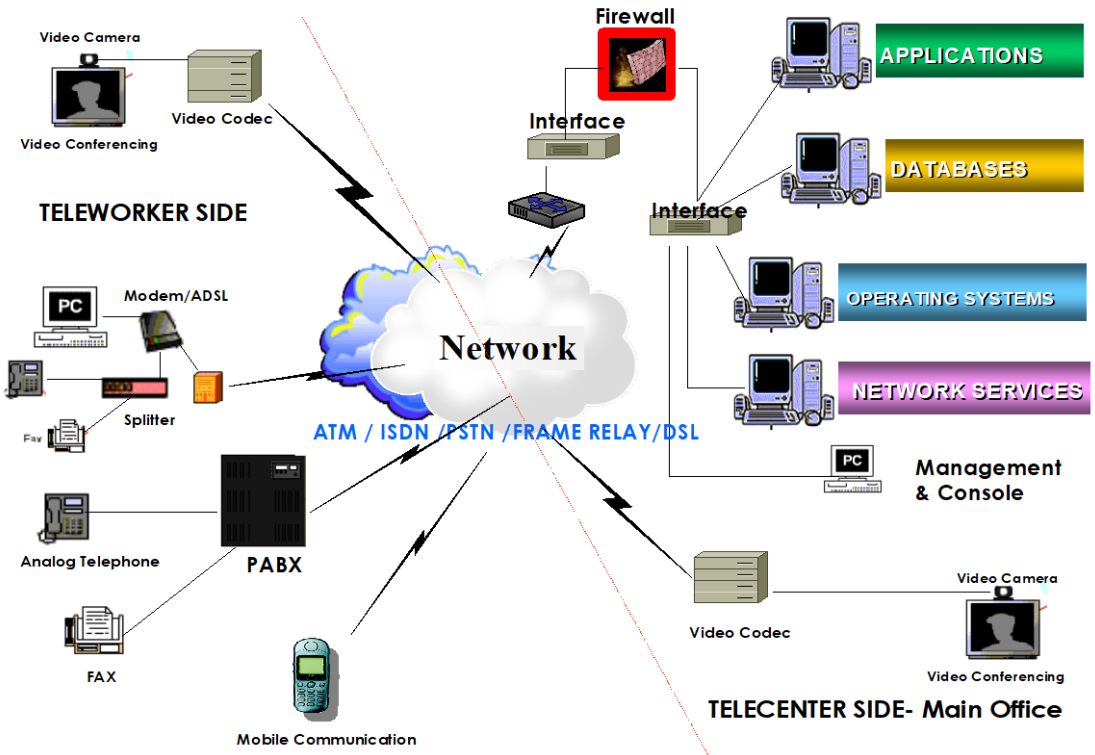

Figure 2.8- The central site or telecenter network configuration.

Remote access servers.

A remote access server is the optimal choice for central site access equipment. Any number of users at remote locations can dial in over a wide-area network link, establish a connection to the corporate LAN as if locally attached, and terminate the connection once they complete their work, thanks to remote access servers. Many remote access servers

combine a number of diverse technologies into a single cohesive product, under a single advanced management package.

Organizations, faced with exploding remote access requirements, are rapidly using remote access servers. Organizations are rapidly replacing older methods of connecting remote users, such as terminal emulation and remote control, which have been in use for the last decade, with remote access servers. Both of these older methods have serious drawbacks in today's demanding remote access environment. The choice of remote access server depends on the number of remote users that the company supports, the type of access lines installed, network protocols, and your network management and security needs.

2.5.2.4 Security and management.

1) Remote access security.

The statistics about computer crimes are alarming. Each year, reported incidents of confidential business information theft are rising exponentially, and dollar losses from hacking total in the billions. Crimes run the gamut, from direct theft of a company's bank assets or trade secrets to acts of vandalism that plant fraudulent records on corporate systems or destroy valuable database files.

Define a security policy.

To getting start the security policy, should take the following steps:

Decide what resources need protecting. The network is a combination of equipment—file servers, LAN segments, and workstations—and critical business data—confidential records, customer databases, strategic plans, and other types of files. Determine precisely which equipment and data are vulnerable to attack when you open the network to remote users. Equipment housing highly sensitive data will undoubtedly require more security.

Perform a risk assessment. An organization can be especially vulnerable to risks if it is growing rapidly, operates in a highly competitive industry, owns proprietary information or intellectual property that other companies want, and works with a large number of contractors, consultants, or vendors.

Determine how critical the network resources are to the business operations. The company's value of its computing resources and the likelihood of their compromise will ultimately determine the level of security required. Could a competitor break into the network and steal the marketing plans, customer database, or other confidential information? It is surprising how frequently this occurs.

Decide how much you are willing to spend on security. Implementing iron-clad security can be expensive. There's the initial cost of purchasing and installing security equipment, in addition to ongoing costs of support and maintenance. Make sure the costs of your security measures are commensurate with the value of the resources that trying to protect and the risk that they will be stolen or compromised.

Basic security requirements.

There are several basic requirements that every successful security solution should meet, whether your company is local or multinational, public or private, large or small. The solutions chosen are:

Integrated.

Integrating a firewall into the remote access device simplifies management and deters hackers from targeting the device directly.

Very secure.

Your solution should use the latest, state-of-the-art technologies and provide the highest possible level of security.

Transparent to users.

It's human nature—users will go to great lengths to undermine security methods that are difficult to use. Make sure that doesn't happen in the organization by choosing security that makes logging on from a remote site or home office as easy as logging on from a workstation connected directly to the corporate LAN.

Easy to admin.

The chosen systems should simplify the process of adding and changing users' security profiles, deleting users, and administering from a central location. Users should be able to access multiple servers or subnets without having to add them to the system multiple times, and they should be able to use the same password to access resources across the network.

Flexible.

As the company's business requirements grow, so will its remote access program. Choose a security system that is flexible enough to grow with it. Security systems should be able to accommodate changes in platforms, protocols, and operating systems without compromising security or impacting network performance.

Deployable enterprise-wide. End-to-end security requires protection of both the corporate LAN and remote sites. The solution should be cost-effective enough to be implemented end-to-end.

The elements of security.

You need security solutions designed to handle the increased risk of setting up a remote access network in order to eliminate it. Today, security vendors are developing more and more sophisticated security products that address the specific risks associated with remote access and Internet access.

The selected security solution should incorporate these four key components:

- Authentication.
- Authorization.
- Encryption.
- Perimeter Firewalls.

The individual's security needs will determine how you combine these elements into a total security solution.

Table 2.7– The elements of a security solution.

The Elements of a Security Solution

Security Elements	Method
Authentication	Smart Card
	CHAP/PAP
	One-time Passwords
	Simple Passwords
	Token-based Security Cards (RADIUS)
Authorization	RADIUS
	TACACS
	TACACS+
	Access Control
Encryption	Network Level
	Application Level
Perimeter Firewall	Static Packet Filtering
	Dynamic Firewall

2) System management.

Organizational management should designate a manager for the telecenter who oversees all service patterns, excluding those related to technology or networks, such as customer service. The general manager should have the skill and ability to administer personal systems, as well as IT literacy.

- System management is truly concerned with information and communication technology. The system manager monitors, controls, designs, and analyzes all the systems in the telecenter. The system manager caters to the teleworker's requirements by offering comprehensive information.
  - Resources Planning by consider these factors.
  - Consider system resources in the user level.
  - Consider system Network.
  - Consider system device and equipment.
- Open the system for work, then shut it down for maintenance.
- Make sure to include backup and recovery in your working process and future work plan.

- Correct the problem of computer resource limitations (such as disk space and CPU memory).
- When the link is down, terminate communication and alert the users.
- Update the operating system and maintenance.
- Training and answering the working trouble.
- Manage the system and database security.
- Group management and authorization.
- Hardware Configuration: Adding, upgrading, and deleting application software.

System managers are responsible for overseeing and focusing on various operational processes to facilitate easy administration. Divide the work function by the frequency and period of time, such as operating daily or monthly. However, the frequency will depend on the system's size and complexity. The recommendation system schedule plan is:

Tasks list.

As needed tasks.

- Create/modify user accounts.
- Record all system modifications and events in log.
- Be on call to restart the system after panics, crashes, power failures.
- Maintain security of hardware, software, data file access.

Daily tasks.

- Perform scheduled backups (if configured).
- Check usage levels.
- Check for runaway processes.
- Check disk space.
- Check mail functionality, connections.
- Check printer status
- Check auditing output, if activated.
- Check communications links, if active.
- Check for unattended login sessions.

Weekly tasks.

- Check printer spooler status report.
- Check log files clear, trim, or truncate.
- Generate a report of activity.
- Generate detailed report of user disk utilization.
- Remove temporary files including *lost and found* files.

Monthly tasks

- If you are not doing scheduled backups, perform an unscheduled backup.
- Re-tune system and re-allocate resources, if necessary.
- Perform tape drive maintenance: clean heads and retention drive.
- Change dial-in passwords, if necessary.
- Change *root* password, if necessary.

Occasional tasks

- Upgrade system and application software, as needed.
- Re-distribute space in filesystems.
- Find SUID or SGID files, check owner, size. Locate huge (over 64 Mbyte) files and verify their purpose.
- Find “orphan”" files (files belonging to deleted users).

3) Management the networks.

A network management system keeps track of network activities and ensures that network components are in proper working order. It can also reduce downtime, improve user services, and facilitate cost control.

Network management system components.

There are five main components of a network management system: the system administrator, network managers, managed devices, agents, and a management information base (MIB).

System administrator.

A system, either host-based or UNIX-based, gathers and organizes management data from various network managers, then displays it on a unified platform. The most commonly used system administrator packages are Open View Management System from Hewlett-Packard, System View from IBM, and SunNet Manager from Sun Microsystems, Inc.

Network managers.

The software interacts with agents on managed devices to collect operational data. A management information base stores the information. Network managers can be vendor-specific, gathering detailed information about particular devices, or generic software that gathers information about multiple vendors' devices.

Management Information Base (MIB).

The MIB contains a database that contains information about all the manageable devices on the network. Information on each device is contained in what is called a "managed object" within the MIB. Information about managed objects includes network protocol information, routes, and other factors that relate to how a particular kind of device functions.

Managed devices.

Manageable devices on the network include routers, remote access servers, computers, hubs, and switches.

Agents.

Network devices require the implementation of software modules for management. Agents collect data about events that occur within the device, such as the number of packets transmitted, and communicate that information to network managers. The MIB stores the information.

2.5.2.5 Networks access.

The network for teleworking communication in this project, separate by the following:

- **Private networks** refer to the internal communication links within an organization. High-speed data transmission and reception typically utilizes a corporate LAN for the internal network link and a leased line for the external connection. A Leased Line is a private network that uses fiber optics to receive and transmit picture, voice, and data signals between two sites. convenience, speed, accuracy, and security. The speed can have more options to meet the needs, ranging from 9.6 kbps to 140 kbps in the ITU standard, controlled by the NMS (Network Management System).

  Leased line use for more reasonable in each type of business by this:

  - Small businesses can control their costs because they can use a fixed cost and the same cost pattern.
  - The bank links the leased line from the main data center to the branches, either through a LAN (local area network) or a WAN (wide area network).
  - With a leased line channel for TV broadcasting, both video and audio signals can be transmitted and received. The quality of signal transmission is better with optical fiber than via satellite. It is most commonly used for broadcasting regional news and live TV programs. The transmission speed is 34 Mbps. No delay.
  - An internet service provider, also known as e-commerce, is capable of receiving or transmitting pictures, voice, and data at a high speed. It can support up to 30 incoming calls simultaneously.

  Leased line performance:

- Fiber optics provide high speed, accuracy, and safety in receiving and transmitting picture voice and data, ensuring greater confidentiality.
- The Network Management Service simplifies administration by monitoring the network configuration, allowing for checks, changes, and adjustments across the entire coverage area.
- Urgent damage can be changed or substituted with the backup line immediately for continuous and best performance.
- The cost is controllable due to its fixed monthly cost.

- **Public network** is a large network that provides support for an enormous number of users and a wide range of users, requires high speed, and appears anywhere you want to access the information for the public link. The well-known public network is the "Internet.".

The Internet accesses.

The Internet may be the only network that an organization will ever need. While this might appear at first to be somewhat of an exaggeration, industry analysts are touting the Internet as a solution for all wide-area communications. And many companies are indeed beginning to use the Internet for an expanding array of applications. Because of its strategic importance, the Internet is considered one of the fundamental building blocks of corporate remote networking.

Most organizations recognize the unprecedented marketing potential of the Internet's World Wide Web. It seems that every company, government agency, library, university, TV and radio station, and magazine now has a web site on the Internet. But the Internet is much more than a backbone for the web, and few organizations have yet to fully utilize the value-added capabilities of network service providers (NSPs).

Virtual Private Networks: The ultimate corporate Internet application.

A VPN is a private network that uses a public network (in this case, the Internet) as the infrastructure for all communications. It is “virtual” because the VPN appears to the user's organization as a genuine private network with exclusive use of resources, even though all traffic is traversing public facilities. Why uses the Internet? It's the world's most widely available and least expensive "public data network.".

VPNs requirements.

Virtual private networks based on the Internet have several fundamental requirements, including:

- Support for the Internet Protocol (IP) and IPX gateways.
- Dynamic firewall protection.
- Tunneling capabilities.
- Support for encryption.
- A user and security management system.

VPNs are suitable for many applications.

Applications that make good VPN candidates meet at least one of the following three criteria; the best meet all three:

- High number of users and /or sites.
- Widespread locations involving long distance, nationally or internationally.
- Relatively modest bandwidth and latency requirements.

Internet access for the entire corporation.

Many corporate remote networking applications use the same equipment for Internet access. The reason is that most NSPs use the very same public wide area network and similar systems to support their subscribers. Sometimes the application software is the only difference between a private corporate remote access network and an NSP network.

Individual users.

Individual users consist of mobile workers and telecommuters. Mobile workers generally use analog or cellular modems to have access anywhere in the world via the public switched telephone network (PSTN).

To access the Internet, individual users need a TCP/IP protocol stack and certain applications, such as an e-mail package and a web browser. Windows and other workstation operating systems come with suites of such software, while various vendors offer alternatives. Most NSPs use a password to prevent 'free' or otherwise unauthorized access to the Internet.

Remote offices.

Remote offices typically involve relatively small workgroups, and there are a number of equipment alternatives for Internet access. Individual analog modems at each user's desk or a shared modem bank, often integrated with the local server, are the two traditional approaches. The analog modem is the problem with both of these approaches: modems provide marginal performance, require separate phone lines, pose security risks, and are difficult.

Analog modem problems and limitations are causing many organizations to turn to the Integrated Services Digital Network (ISDN). Because ISDN is digital, it offers higher throughput and is instantaneous, both of which are major advantages for a remote office Internet access router.

2.5.2.6 Maintenance, repair and renewal.

Central office-based workers, particularly in larger organizations, often have the support of technicians to deal with problems and enjoy easy access to replacement equipment and spare parts. These are luxuries that few teleworkers enjoy, with the possible exception of those working from telecenters. For teleworkers, equipment availability is crucial. In many cases, the teleworker will be unable to work if key pieces of equipment fail. It is therefore important to plan the maintenance, repair, and renewal of telewokers' equipment to ensure adequate availability.

We can define "reliability" as the likelihood of the equipment fulfilling its required function, and "maintainability" as the ease and speed of repairing faults. Enhancing reliability, maintainability, or both can lead to improved availability. To achieve this goal, it is important to consider these issues when procuring or renewing equipment. Figure 2.9 outlines the key factors that influence procurement decisions.

There is no algorithm for successful procurement, as the relative weight associated with each of the influencing factors will vary from one application to another. For example, a teleworker who works part of the day at home and the rest at the office, with standby equipment available, will be less concerned about repair times than a full-time teleworker. It is possible to highlight the issues that require careful consideration and make some practical suggestions.

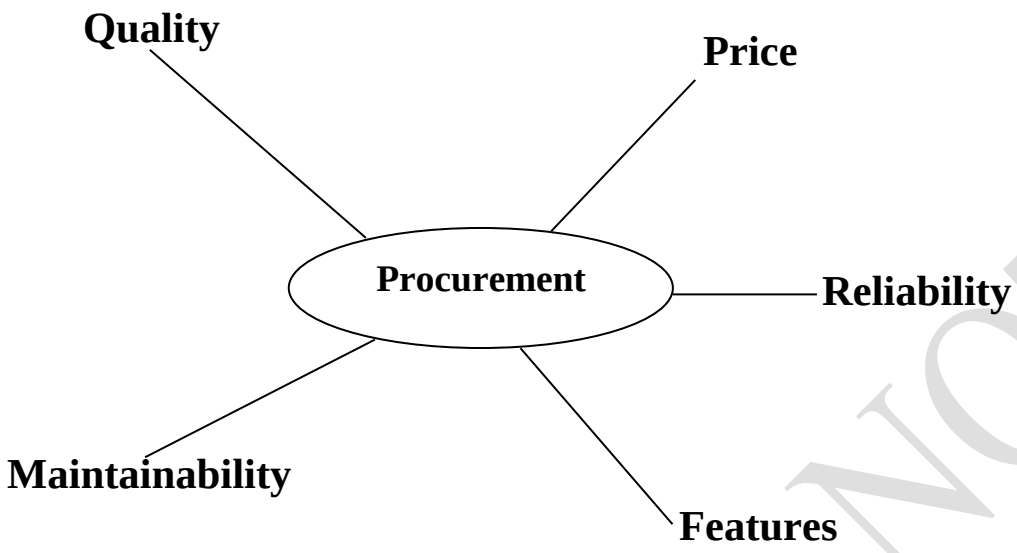

Figure 2.9- Procurement considerations.

Identify key components and assess the impact of their failure.

This will allow you to assign a value to that item, enabling cost-benefit analysis of various maintenance solutions.

Consider the life cycle costs, not the purchase price.

Equipment that is expensive to buy may be cheaper in the long run because it requires less maintenance. Similarly, items that are less reliable but cheaper to repair may have low life-cycle costs.

First-line support.

Teleworkers should anticipate performing initial troubleshooting themselves. Beyond this, a vendor, a third party, or the teleworker's employer may provide a "helpline" for first-line support. Alternatively, the teleworker's employer may provide field service personnel. Many companies now outsource equipment maintenance, so it may be possible to extend the contract to cover teleworkers.

Second-line support.

The teleworker's employer provides workshop maintenance, or self-employed teleworkers may opt for a personal maintenance contract. Workshop repairs are likely to take several days, so it may be worth arranging replacement equipment during this period. This is likely to be an option with maintenance contracts

Adequate head office equipment support.

Teleworkers who rely on communications to a central office are as vulnerable to equipment failure at that end as they are in their own homes. Whether the central office provides support in-house or through a contract, it's crucial that the teleworker doesn't suffer any disadvantage. Maintenance personnel may give office colleagues' problems priority because those colleagues are available to 'chase' the engineers, whereas teleworkers are out of sight and perhaps out of mind.

Maintenance philosophy.

Essentially, maintenance falls into two camps: planned or event-driven. Planned maintenance involves the periodic replacement of components, even when they remain functional. This may at first seem wasteful, but in some instances, the loss of availability, labor, and parts costs associated with replacement on unexpected failures exceed the costs of scheduled replacement. Event-driven maintenance, as the name suggests, involves repairing failures.

Training.

Adequate training and comprehensive, easy-to-understand documentation are crucial for maintenance personnel. Sufficient training will enable the teleworker to promptly identify and resolve simple faults, such as loose cables or blown fuses. Basic awareness will also assist in remote diagnostics. The teleworker may have a range of equipment (PC,

fax, modem, etc.). Therefore, it may be necessary to train field engineers in this broad range of technologies, or, in the case of contract labor, specify the skills required in the contract agreement.

2.6 The teleworking environments.

The setup caters to two distinct categories of teleworkers: Home-based workers are those who work from home or at home, while the others are telecenters. The details are as follows:

2.6.1 Designing a home working environment.

Most homes are not designed for teleworking, and current innovations in building design are accentuating the trend towards smaller housing. Some types of housing are more suited to telework, for example, detached and semi-detached houses that may not be over occupied and have the possibility of extension or the conversion of a garage into an office. Town houses, particularly those with non-convertible roof space and remote garage locations, impose more limitations on expansion. Due to their limited design flexibility and high occupancy rates, small "starter homes" and flats/apartments are the least suitable for teleworking.

Many people believe that a separate room is ideal for teleworking. However, most teleworkers don’t have a separate room and have to use multipurpose rooms. Despite the numerous benefits of having a dedicated workspace, some teleworkers find they can function effectively in a room that serves other functions. However, a separate room does enable one to create the image and trapping of an office, which can be more conducive to working and provides a beneficial physical separation between home and work.

In choosing a suitable room for teleworking you should consider the following:

- Use by other family members during work time.
- Space for furniture and equipment.
- Space for visitors.
- Access.

- Daylight.
- Artificial lighting.
- Temperature.
- Humidity.
- Ventilation.
- Sources of intermittent noise.
- Provision of power and telephone sockets.
- Security.
- Safety.

Separation of work space from home is important psychologically because it reduces the teleworker's tendency to become a "workaholic." Having a workplace in the home can make it more difficult to stop thinking about work during family time, and similarly, during work time, it can be difficult to stop thinking about the housework or the children. There are several ways to establish psychological boundaries between work and family life.

- Working in a spare room.
- There are screens separating the work area from the rest of the room.
- Creating an office atmosphere.
- After finishing, turn off all work equipment.
- Tidying away all work papers and materials.
- Keep all work equipment out of sight.
- Going for a walk before and after work.

One must carefully select and purchase appropriate home office furniture, as most office furniture is not suitable for the home environment. Teleworkers should use ergonomically designed furniture that meets appropriate standards. Employers should bear some, or all, of the cost to ensure that good-quality furniture is bought. Consider the following main characteristics of teleworking furniture:

- Sufficient desk top space.
- Sufficient storage space for equipment and materials.
- Compact.
- Robust.
- Hides and protects equipment.
- Lockable.

- Includes cable management.
- Attractive appearance to fit with room décor.
- No sharp edges or corners.

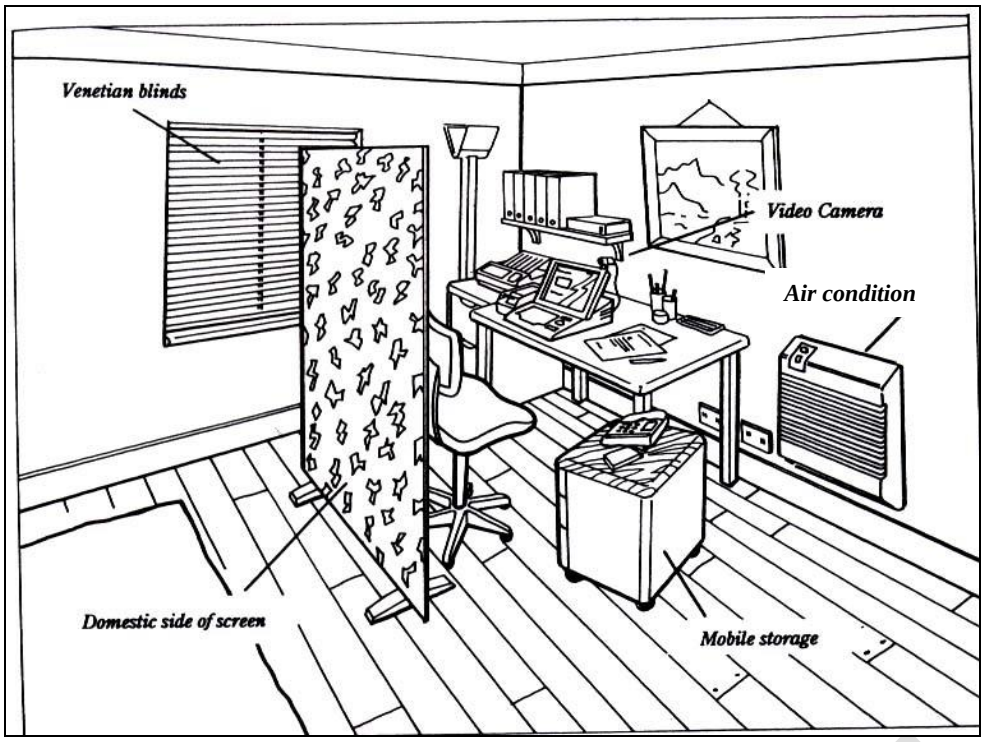

Figure 2.10- A piece of teleworking furniture designed.
(The unit includes most of the features outlined above.)

Since teleworkers may spend around 90% of their working time in the sitting position, ergonomically designed seating is crucial. Seating may also be required for visitors (e.g., managers or clients). It is important that seating provide an upright work-line posture that will encourage work rather than a reclined posture that may discourage productivity and be very uncomfortable or even harmful for the teleworker.

Turning a domestic space into a teleworking environment is not always straightforward due to the variations in domestic interiors and potential teleworkers' lifestyles. Based on my experience setting up teleworking spaces, I outline a suggested approach below.

Imagine you need to design a teleworking environment for a manager who teleworks part-time and needs to meet clients occasionally. You could create a

questionnaire based on the checklists outlined above that explores their home environment, lifestyle, and aspirations for what the teleworking space could be like. Additionally, you must ascertain the approximate layouts and dimensions of the rooms under consideration, the equipment intended for use, and the dimensions of appropriate furniture items. On graph paper, you can create simple room layouts and paper cutouts of furniture pieces at the same scale. You can try various layouts by arranging the furniture cutouts on the room plans.

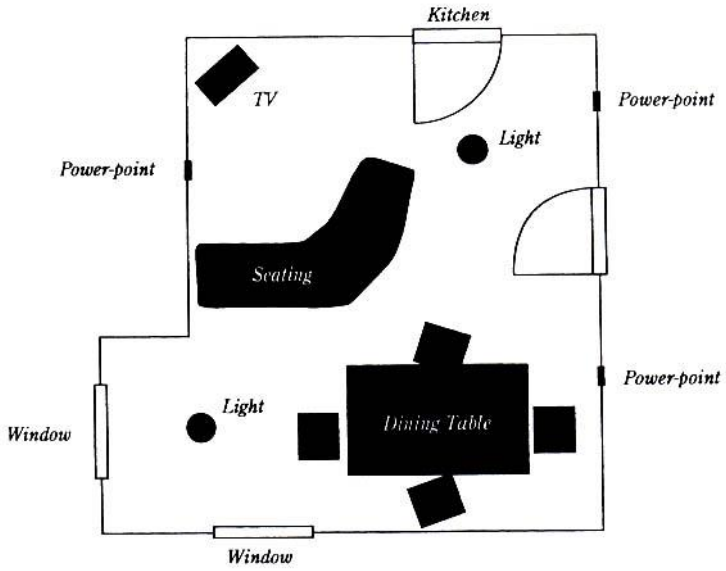

Figure 2.11- A living or dining room to create a teleworking area for a manager.

The room has two lights, seating, and a dining table. One door leads to the kitchen, the other to the hallway. There are two windows, one overlooking a busy road. By rearranging the paper cut-outs of existing and new (teleworking) furniture, the layout shown in figure 2.11 might be chosen. This is a very simple but effective way of generating room layouts.

The work area has been located away from the doors and positioned such that neither window should cause reflections on the PC's screen. By positioning the desk near power and telephone sockets and changing seating, the manager can meet clients near the workspace. Vertical blin Pull vertical blinds around the area to separate them. Figure 2.13 depicts the room. In this scenario, it is necessary to relocate and store all the work equipment. As a result, moving the screen and storage unit is effortless. A professional-looking side of the screen serves as the background for the videophone image. The other side's design makes it appear attractive in a home setting.

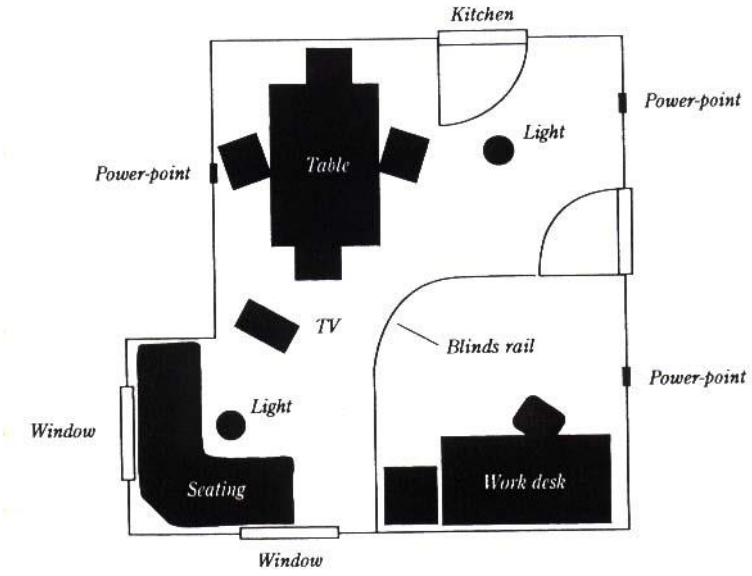

Figure 2.12– The room layout was rearranged.

With such a wide variety of home environments, teleworking jobs, and personal tastes in design, it is not appropriate to specify the exact details of what is best for a teleworker. Instead, the teleworker should choose the designs that are most appropriate for them.

2.6.2 Designing the telecenter environment.

The manager must understand the key factors that influence the decision to select the telecenter's location, including information that is easily accessible and not too far away. The facility should offer amenities like a service bus, a parking lot, and a food center, among others.

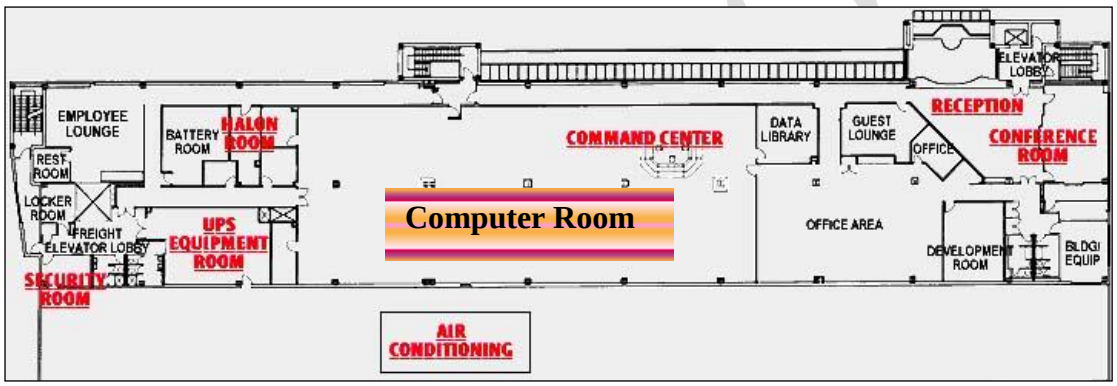

Figure 2.13– The telecenter's floor plan is shown.

Figure 2.13 divides the plan floor into its essential components as follows:

- **Reception** serves as a point of contact for customers and anyone else seeking useful information.
- **Conference room** is used for meetings with the group of clients or workers in the telecenter.
- **Command center** orders and controls the work flow process in the telecenter's working area.
- **Computer room** provided connections with LAN/WAN for computers, peripheral equipment, and electronic data equipment.
- **Air conditions** regulate the air environment system throughout the entire telecenter area.
- **UPS equipment room** collects the electricity and provides it when the electricity shuts down.
- **Security Room** uses the security system to control strangers.

All the rooms mentioned above are necessary for the setup process. The other facilities, which include desks and chairs, are located in different areas, such as the working area, data library, guest lounge, employee lounge, locker room, and rest room. Study other environments and try to customize them to meet their needs.

One of the important rooms above is the computer room, which can be used for the two processes allocated to teleworkers or mixed up depending on the telecenter manager as shown in Figure 2.14-2.15.

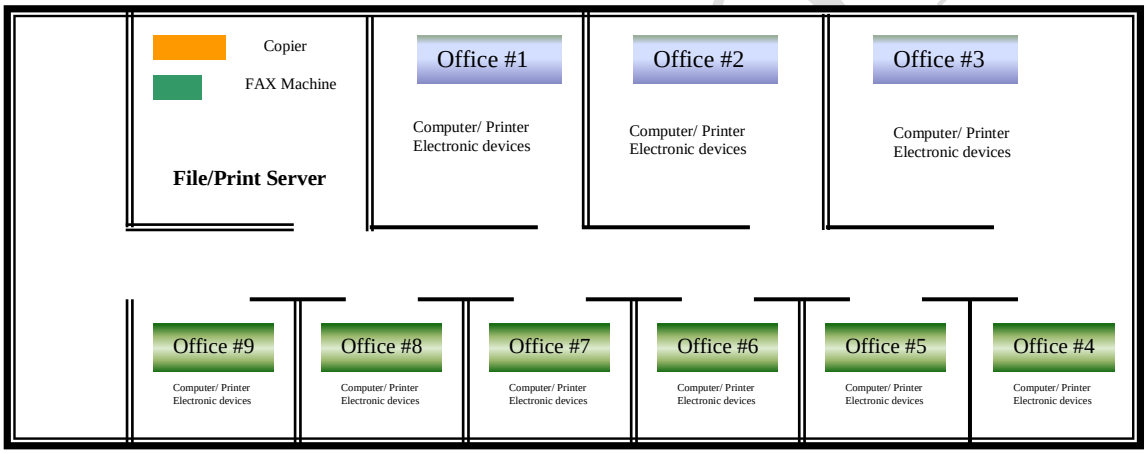

Figure 2.14- The computer room layout for individual offices.

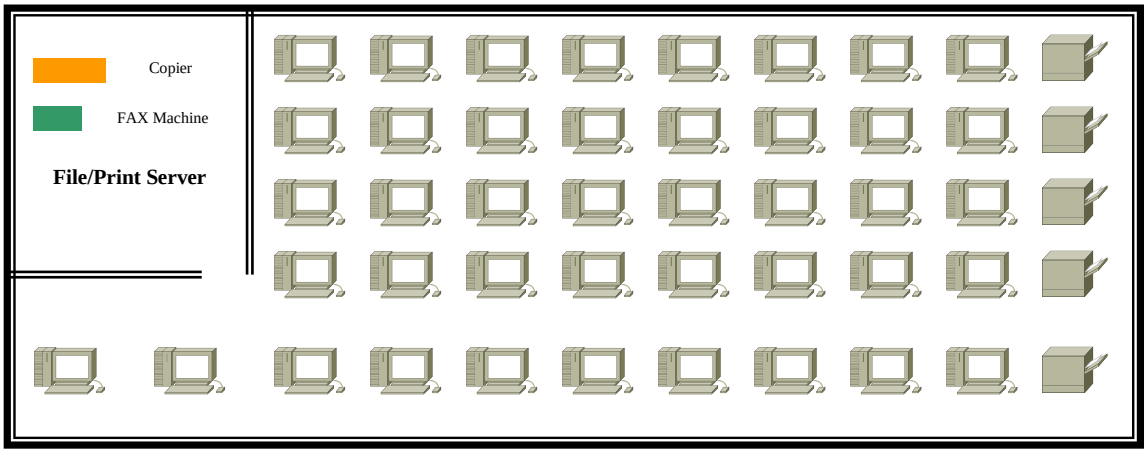

Figure 2.15- The computer room layout for shared offices and resources.

2.7 The way ahead.

The evolution of teleworking is currently at an intriguing juncture. Large organizations face significant challenges, and while teleworking holds immense potential, its widespread adoption remains elusive. On the other hand, there are a growing number of individuals who want to telework. Additionally, teleworking and rural development agencies have potential or actual teleworkers who are actively seeking employment.

Having actively shaped and participated in teleworking within the corporate environment, and now operating a small business within a home-based network, I have come to understand the gaps that require bridging. We need market mechanisms (electronic networks) to bridge the gap between supply and demand. We also need to bridge the culture gap by encouraging more forward-looking and flexible arrangements by organizations, as well as a more commercial and marketing orientation by the telecenter movement. I believe that collaborating can yield numerous benefits, and I trust that this project report has outlined some strategies for achieving these benefits from the consideration as shown in table 2.8

Table 2.8- Flexible Work Alternatives over Time and Space.

	PLACE of WORK		
	Fixed	**Remote**	**Flexible**
Fixed or Synchronous	Conventional Office	Dispersed teams Remote back-office Telecenters Telecottages	Variable location Mobile working
TIME			
Flexible	Flexi-time Job shared Desk sharing	Geographically separated	**Totally flexible working** - location & time independence

Chapter 3

Best Practice Cases Study

This chapter provided examples of teleworking programs in use throughout the country. I divide the section into five cases. I first present examples of regional and statewide teleworking programs. We then highlight case studies from the public sector, move on to examples from the private sector, and conclude with the government section. The section concludes with an overview of satellite or telework centers.

There are numerous examples of teleworking programs and related activities underway throughout the country. I selected the case studies highlighted in this section to showcase a variety of experiences from both the public and private sectors, from the perspective of companies or agencies, and across various geographical locations.

3.1 Government initiated networks western Australia's telecentres.

The Western Australian Telecentre Network comprises 78 community-owned, managed, and incorporated telecentres throughout regional Western Australia. By mid-2001, the network intends to expand to 100 centers. The Telecentre Network has injected opportunities and services into regional Western Australia that are taken for granted in urban Australia but are not always assured for remote communities because of low population and long distances.

Background.

In 1992, the Western Australian Office of Higher Education established the first telecentres in Broome, Derby, and Kununurra, in the north of the state. The Western Australian Office of Higher Education named them Learning Network Centres and included them in a trial run. Their focus was almost entirely on providing education and training for people in remote areas.

The Department of Employment, Vocational Education, and Training (DEVET) took over the Western Australia Learning Centre Network the following year. They

established the Telecentre Support Unit and renamed the network the Western Australian Telecentre Network.

By 1997, there were 38 telecentres in WA. The Department of Commerce and Trade took over responsibility for the network, and telecenters began to take on a greatly expanded role. Computer technology, information access, the labor market, and business enterprise were now major foci, in addition to the continued education and training role.

Today, telecentres provide a wide array of services, helping to bring equity to rural and remote areas. From children to seniors, small businesses to community groups, farmers to tourists, students to the unemployed, everyone uses their state-of-the-art equipment and services.

A typical telecentre provides computers, photocopiers, facsimile machines, modems, printers, TV-video machines, decoders, scanners, and much more. Most telecentres have access to the Internet and can operate individually or as a state-wide network. We will gradually install two-way videoconferencing throughout the telecentre network over the next two years.

All telecentres have satellite receiver dishes, which enable them to participate in one-way video or two-way audio conferences on a state, national, or international basis. One of the network's primary goals is to provide a platform for the delivery of education and training services.

Telecentres serve a variety of purposes, such as business incubators, email post offices, newspaper publishers, computer training centers, desktop publishers, office stationary suppliers, education centers, cyber cafes, tourist bureaus, seniors' and youth clubs, hobby centers, job centers, and other community purposes. They are constantly breaking ground with some of the more recent innovations, including banking services, Work for the Dole projects, and Centrelink service providers.

The State Government's Telecentre Initiatives Fund and the Commonwealth Government's NTN program jointly fund telecentres. New telecentres receive $30 000 for start-up equipment and $20 000 for a part-time telecentre coordinator's salary. The

salary component continues on an annual basis, with funds administered through the Department of Commerce and Trade's Telecenter Support Unit.

Objectives.

The Telecentre Network's mission statement is 'building the future of regional and rural communities through local access to enhanced services and a supportive network of communication technologies across Western Australia'. Telecentres also provide opportunities for enhancing and maintaining essential services for a dynamic community through innovation and cooperation.

Strategic approach.

The Department of Commerce and Trade's Telecentre Support Unit (TSU) oversees the efficient and effective management of all telecentres. The TSU's primary functions are to promote network expansion and provide support for its operations, ensuring that telecenter services are relevant and of the highest possible standard.

TSU staff frequently speak at regional public meetings to outline the process for establishing telecentres and ensure local residents are fully aware of what is involved before they proceed with a funding application. The TSU has also developed a handy compact 'Starter Kit' that contains information on what telecentres do, what opportunities they provide, answers to the most frequently asked questions, and a step-by-step guide to lodging an application.

For communities further along in the process, a 'Telecentre Tool Kit' is available, providing detailed information on everything from preparing a business plan to incorporation procedures. These two resources aim to fully inform the community, especially those who will eventually join the Telecentre Management Committee, about their rights and responsibilities.

The TSU acknowledges the significant responsibility of managing a telecentre, emphasizing the importance of preventing individuals living in remote locations from feeling isolated and relying solely on self-sufficiency. The TSU ensures that strong support is available to guide management decisions and resolve any queries or concerns.

To achieve this, the unit offers a phone-based information and advice service provided by experienced staff in Perth. There is access to three regional coordinators (Northern, Central, and Southern) who travel the state on a regular basis, visiting telecentres in their area. The TSU also organizes regional workshops to bring together management committee members and coordinators from telecenters in different parts of the state. In Perth, there is also an annual Telecentre Network Workshop, bringing together representatives from all telecentres.

Implementation issues.

Prior to establishing a local telecentre, many small communities in regional WA simply did not have access to the technology and services that the rest of us take for granted. Many individuals had never used a computer and knew nothing about the Internet. Many small businesses lacked experience with electronic commerce and had no local access to desktop publishing, photocopying, professional printing, or other business services. Many residents had little opportunity to participate in TAFE, university, and other adult education courses. These are basic services provided by telecentres, and they have had an enormous impact on thousands of people living and working in regional WA.

Any telecenter proposal must undergo a rigorous process before establishment to ensure its responsiveness to community needs and viability. A community guarantor is required to show local commitment to the project, and community members must take responsibility for managing the Telecentre's operations.

The Telecentre Support Unit has developed a memorandum of understanding (MOU) to measure success and ensure strong accountability, outlining the principles a telecentre must uphold to join the network. The resource and performance agreement (R&P) then address each of these objectives separately, mandating that each telecentre outline a practical and measurable plan to achieve them. At the end of the year, the telecentres report back on their actual achievements, according to the R&P. Thus, the same document becomes both a strategic plan and a measure of achievement. The R&P is the base document on which a telecentre receives government funding.

The TSU also plays a valuable role by acting on behalf of groups of telecentres to bid for jobs, programs, and funding. Examples range from working with insurance

companies to arrange generic policy options for telecentres to organizing activities such as a tour of telecentres by Perth's Scitech Discovery Centre, tendering for programs such as Work for the Dole and Centrelink, and seeking network-wide grants from Networking the Nation.

Outcomes and factors for success.

By pushing modern telecommunications boundaries into the remotest parts of WA, the Telecentre Network has ensured individuals, businesses, and community groups in those areas can also reap the economic and social benefits offered by the modern technologies of computers, satellite communications, and online services. Telecenters evaluate their success from seven objectives:

- Promoting opportunities for online information and communications technology.
- Seeking opportunities for successful business and partnership ventures.
- Promoting regional development by enhancing access to government services.
- Providing educational opportunities.
- Actively pursuing grants and funding sources;
- It is a priority to provide all members of the community with access to telecentre services.

The telecenter's administration entails creating employment opportunities. The network has also gained many benefits from the appointment last year of a WA Telecenter Advisory Board appointment last year with a majority of representatives from rural and remote areas. The board ensures a strong regional voice in all major decisions that affect the network. The board must consult and endorse any variations to the MOU and R&P, in addition to setting strategic direction.

To promote quality and excellence, independent surveys have also been conducted on all telecentres. The surveys aimed to determine each community's perception of their telecenter and the services they offered. This was found to be an effective management tool, helping to ensure telecentres deliver the required level of service that truly meets the needs of regional people.

Lessons learned.

From the outset, the program's philosophy was that telecentres could not be set up to fail. The TSU's staff is closely involved in the establishment and ongoing operation of each telecentre. They have a wealth of experience at their fingertips and are able to offer advice and information learned from other telecentres. New telecentres don't have to start from the beginning, figuring out the best way to accomplish something. The TSU can advise on ways to achieve optimum outcomes while avoiding mistakes or difficulties previously encountered by others. It reduces risk.

This central support aspect has helped streamline programs and initiatives at each telecenter. It also ensures they are well-researched and cost-effective. The mobilization of community resources is the most important impact of cost-effective service delivery. Volunteers are a key part of telecentres, helping to bring additional services at low cost to their own communities.

At each site, it is critical to have the community on hand. Without this, volunteers required to back up paid staff will not emerge, and the management committee ultimately responsible for the telecentre's operation cannot function. Financial and in-kind support would also not be present, and ultimately, clients would not come through the doors. This explains the philosophy that telecentres are bottom-up endeavors. The government does not come to a community and say, 'We are going to build you a telecentre'. As mentioned above, the community must request and prove its sustainability.

3.1.1 Case briefing.

- From 1992 to mid-2001, the telecenter expanded from 78 to 100 centers.
- The government supports the fund and enhances community activity to set up the telecenter, which will provide a wide range of services.
- The goal statement is to "build the future of regional and rural communities through local access to enhanced services and a supportive network of communication technologies across Western Australia."
- The department that has responsibility for the teleworking since the start of WA is the Department of Employment, Vocational Education, and Training

(DEVET). After that, the Department of Commerce and Trade took over the responsibility from the managed function of the Telecentre Support Unit (TSU).

- TSU oversaw the telecenter, provided support, and created the innovative "Starter Kit" and "Telecentre ToolKit" concepts as a strategic approach to community teleworking.
- The establishment of the telecenter presents an implementation issue, necessitating a rigorous process to guarantee the proposal's responsiveness to community needs and viability. A community guarantor is required to show local commitment to the project, and community members must take responsibility for managing the telecenter's operations.
- To measure success and ensure strong accountability, the TSU has developed a memorandum of understanding (MOU).
- The outcomes and success factors that telecenters evaluate are based on seven objectives:
    - There are increasing opportunities for online information and communications technology.
    - Actively seeking opportunities for successful business and partnership ventures.
    - Increasing access to government services to promote regional development.
    - Providing educational opportunities.
    - Actively pursuing grants and funding sources.
    - Providing access to all members.
    - Key tasks include administering the telecenter and creating employment opportunities.
- The mobilization of community resources is the most important impact of cost-effective service delivery. Volunteers are a key part of telecenters, helping to provide additional services at a low cost.
- The government does not come to a community and say, 'We are going to build you a telecentre'. As mentioned above, the community must request and prove its sustainability.

3.1.2 Benefits from this case.

- The growing up of telecenter.
- The department responsible for maintaining the telecenter (TSU).
- Sources of funding.
- The process of teleworking and its evaluation based on document and work-based performance are discussed.
- Know the key factors that contribute to successful implementation and what the benefits are.

3.2 Adopting of working pattern from European.

Adopting location-independent working practices may bring many advantages but how do companies ensure they don't lose their sense of corporate culture and team spirit? Geoffrey Paterson of Teamphone.com believes the answer lies in choosing the right technology.

We live in an age of flexible, location-independent work. Social, economic, and environmental factors suggest we should do it; governments encourage us to do it; and technology enables us to do it. The march towards teleworking seems almost unstoppable.

By 1999, around 9 million people within EU countries were teleworking, according to the European Electronic Commerce and Telework Trends Consortium (ECaTT), a figure that represents around 6% of the entire EU workforce. By 2005, ECaTT estimates that 11.2% of the total labor force in the UK and a massive 22.8% in Germany will be teleworking.

Given these figures, it's amazing that even teleworking's most ardent supporters still admit to knowing very little about its long-term effects on corporate culture. Managers from various organizations have frequently observed that the principles of good management, previously applicable to office-bound employees, no longer hold true for geographically dispersed employees. Tasks such as motivating and rewarding a remote team of workers or sharing information amongst a team of remote workers also take on new dimensions. So, is teleworking worth it?

The possibility of teleworking.

There is ample evidence to support this. And on many different levels. In a recent MORI poll, for example, 27% of small and 36% of large companies said they believed teleworking delivered benefits in terms of reduced office overhead, improved quality of work, and increased productivity. In the same poll, over 70% of both teleworkers and non-teleworkers concurred that its key benefit was greater job flexibility.

There is also evidence that teleworking is a popular option among those most affected. The Telework Association conducted research and found that 98% of potential teleworkers expressed a preference for working at home, with 55% expressing a preference for doing so full-time.

The main reason why people like teleworking, according to a poll from Gemini Consulting, is that it enables them to better balance their work and personal lives. 10,000 managers from Europe, the US, Russia, and Japan participated in the company's international survey, selecting balance between work and personal life as the most or second most important attribute in a job. In fact, nearly every country valued the need for balance higher than remuneration.

Add to this the environmental benefits of reduced commuter traffic (see box copy), and it's clear that the social, economic, and environmental case for teleworking is very strong.

People work better in teams.

One of the biggest challenges facing companies implementing location-independent working practices is how to ensure individuals still function as part of a team when working remotely.

Logic tells us that departmental or operational functions are more effective when people share information and can communicate with each other instantly; there is also much empirical evidence to support this claim.

For instance, a 1998 Gallup study found that, even in the absence of physical establishment and maintenance, strong relationships between team members and their managers can significantly boost productivity and creativity.

An ongoing IPD study (1997) of 100 small and medium-sized enterprises in the United Kingdom also provides evidence of a clear link between excellent people management practices and business performance. The study found that people management practices explained 19% of the variation between businesses in terms of profitability performance and 18% of the variation between businesses in terms of productivity performance.

Evidence from the 1998 Workplace Employee Relations Survey (WERS), which found a correlation between high-performance people management practices and improved economic performance, workplace well-being, and industrial relations climate, supports this finding. 'Team working' was one of the people management policies highlighted in the report.

The Net is the technology key.

Managers who aim to provide flexible working services to geographically dispersed workers must design these solutions from the ground up to enable anytime, anywhere access and facilitate team working practices. Internet-enabled technologies meet both of these requirements.

In many, many ways, the Web has revolutionized the lives of mobile and home-based workers. People can now, for example, cheaply and efficiently access information and send or receive messages either over the public Internet or via a private intranet, often without the need to install any additional software at individual user locations.

The primary reason for this is that the Internet itself is location-independent. People can roam freely with a Web-enabled device, secure in the knowledge that they can receive instant emails from any location. Information on the Web can be accessed at any time and from any location.

According to Data Monitor figures, over three-quarters of European enterprises now provide remote access to their key users, and this proportion is increasing all the time as more companies adopt Internet-working methods, as shown in Table 3.1.

Table 3.1- EU Teleworkers in 1999*

Numbers % of labor force.

Country	Number (persons)	Percentage(s)
Denmark	280,000	10.5%
Finland	355,000	16.8%
France	635,000	2.9%
Germany	2,132,000	6.0%
Ireland	61,000	4.4%
Italy	720,000	3.6%
Netherlands	1,044,000	14.5%
Spain	357,000	2.8%
Sweden	594,000	15.2%
UK	2,027,000	7.6%
Total	8,205,000	6.0%

Source: European Electronic Commerce and Telework Trends Consortium

* This group includes permanent and alternating teleworkers who work from home for at least one full day per workday, self-employed teleworkers in single-occupancy homes (SOHOs), mobile teleworkers who use on-line connections when traveling, and supplementary teleworkers who work from home for less than one full working day per week.

ECaTT extrapolates these figures for the five EU members not included in the survey, estimating that 9 million EU residents engaged in some form of telework in 1999, with 6 million of them spending at least one full working day per week either at home or in the field while connected to their employer or client via data communications.

The case for flexible working.

In a study of workers participating in BT's 'Options 2000' teleworking scheme, it was found that on average employees saved 95 miles of car travel and 143 miles of rail travel if they worked at home for 1.9 days per week.

Source: University of Bradford and UK Centre for Environment and Economic Development

The UK national average daily commute is 18 miles each day.
Source: University of Bradford and UK Centre for Environment and Economic Development

Road congestion costs employers approximately £20 billion per year.
Source: CBI

In 1999, 187 million working days were lost due to sickness, real or reported - 8 days per employee, in total 3.4% of working time. Teleworking can give employees the flexibility to be productive even on days when, for various reasons, they cannot make it into the office.
Source: IM Research

In 1999, a survey of 2000 managers in the UK found that a third of them would change their jobs if they felt it would improve their work-life balance
Source: Ceridian Performance Partners/Management Today

A survey of MBA final year students indicated that the ability to achieve a balanced lifestyle was the most important factor they would look for in choosing their first employment and 90% singled out work-life balance as a key factor in determining commitment to their employer.
Source: Coopers & Lybrand

These have been seen in other American regions.

Over the last several years, AT&T has developed Alternative Officing, a comprehensive program that currently allows 30,000 employees nationally to telecommute on a regular basis from home. This project is particularly interesting because it includes a rigorous cost-benefit analysis of their North Central New Jersey site. AT&T conducted a five-year study of 600 telecommuters and concluded the following:

The most substantial savings were in reduced real estate costs. By allowing employees to telecommute, AT&T was able to close an entire office complex.

Annual Real Estate Savings: $6,333,124.

In addition to hard cost savings, there were substantial productivity gains. AT&T, based on employee interviews, estimates a conservative gain of two and a half hours per employee per week in time worked.

Annual gain due to increased productivity: $5,112,841.

Also, employees state almost without exception that they were able to be more productive during the hours they worked, due primarily to fewer interruptions. **Annual gain due to increased efficiency: $3,127,617.**

There were, of course, start-up costs associated with setting up employees to work at home. Office alterations averaged $3,000 per employee and computer/phone installations averaged $4,000 per employee. These costs were depreciated over five years and $1,250 per employee per year was added for phone, fax, copy and postage bills.

Annual costs: $3,205,507.

AT&T Cost Savings & Productivity Gains.

Real Estate Savings $6,333,124

Productivity Gains Hour $5,112,841

Productivity Gains Efficiency $3,127,617

Total $14,573,582

Less Costs (3,205,507)

Net Annual Gain $11,368,075

3.2.1 Case briefing.

- Adopting location-independent working practices may bring many advantages, but how do companies ensure they don't lose their sense of corporate culture and team spirit?

- By 1999, approximately 9 million people in EU countries were teleworking, or around 6% of the entire EU workforce, 11.2% in the UK, and 22.8% in Germany.
- Teleworking works because it enables them to better balance their work and personal lives, which enhances the social, economic, and environmental case for teleworking.
- People work better in teams, which is one of the biggest challenges to ensuring individuals remain part of a team when working remotely. The study found that people management practices explained 19% of the variation between businesses in terms of profitability performance and 18% of the variation between businesses in terms of productivity performance.
- The Net is the technology key; the solutions are designed from the bottom up for anytime, anywhere access, and can also support team working practices. Internet-enabled technologies fit the bill.
- Another teleworking figure demonstrates the program's efficacy. For example:
    - If the employee worked from home for 1.9 days per week, they could save 95 miles of car travel and 143 miles of rail travel.
    - The UK national average daily commute is 18 miles per day.
    - Road congestion costs employers around £20 billion per year.
    - Compared to America, AT&T has 30,000 employees, or 600 telecommuters. Annual real estate savings: $6,333,124. Annual gain due to increased productivity: $5,112,841. Annual gain due to increased efficiency: $3,127,617. Total $14,573,582. Less annual costs (3,205,507). Net Annual Gain: $11,368.

3.2.2 Benefits from this case.

- Ways of adopting teleworking.
- The figure shows the growing number of teleworkers, as well as other noteworthy improvements.
- Network technology supports teamwork, which is the key to success.

3.3 Teleworking program in IBM.

Employees reporting to site: 800

Telecommuters: 200

Days/week spent telecommuting: 5

Year program began: 1994

Why IBM began a telecommuting program:

- Meet Arizona's air quality statutes.
- Increase real estate savings.
- Boost employee morale.
- Provide flexible schedules for employees.
- Provide employees with new technologies.

Selection criteria for telecommuters:

- Salaried individuals, not hourly.
- The nature of the job lends itself to telecommuting.
- From the perspective of human resources, there are unique situations.

Telecommuter jobs at IBM:

- Sales.
- Marketing.
- Technical Sales Specialists.
- Systems Integration Consultants.
- Customer service.
- Consulting.
- Management.

Elements of the program:

- Selection criteria.
- Written policies.

Steps taken to develop the program:

- Created telecommuting hardware and software.
- Developed handbook.

- Wrote policies.
- Set up desks at customer sites.
- Initiated different concepts at different company locations.
- The warehouse was renovated to create an off-site telework center.
- Retrofitted existing buildings to accommodate telework staff.
- The Flexi-Move program was developed.

Equipment provided by IBM:

- Phone line.
- Cell phone.
- Pager.
- Laptop.

Key Drivers:

- State statutes.
- Real estate savings.
- Employee morale.
- Cost savings.

Cost/benefit analysis: Cost savings, as well as increases in morale and customer service, have given IBM several competitive advantages. The telework program allows IBM to be at the forefront of the technology industry.

What effects has the telecommuting program had on the . . .

Organization.

It has enabled us to establish a regional organizational structure, rather than a geographic one. We now manage people across geographic boundaries in different cities.

Telecommuters.

Now, our telecommuters are more culturally diverse. There are fewer cliques. It has created much wider diversity in IBM's company culture.

Co-workers.

Since there are so many teleworkers at IBM, it doesn't affect them too much. If employees want to telework, the resources are available.

Management.

Because managers are accustomed to managing through tactile methods, telecommuting has made their job more challenging. Geographical differences in the organizational construct now force them to manage solely based on results and productivity.

Customers.

There has been a positive impact on customer service. Now, our employees are more visible, accessible, and quicker to respond.

How the program has changed since the beginning:

- Technology has produced faster and better electronic tools.
- Telecommunications have changed the way IBM communicates internally.
- Telework policies are more well-defined.

Successful program tips.

"Get involved as early on as possible with other companies that have done similar exercises and learn from their mistakes," says Skip Richards. "Don't put together a telework program all at once. Do multiple iterations of pilot exercises and refine your requirements, solutions, and processes."

3.3.1 Case briefing.

- IBM is a private technology company that employs 200 telecommuters who work five days a week.
- The jobs are sales, marketing, technical sales specialists, system integration consultants, customer services, consulting, and management.
- Written policies and selection criteria make up the program.
- IBM provides equipment such as a phone line, a cell phone, a pager, and a laptop.
- The benefits are:
  - Meet Arizona's air quality statutes.
  - Increase real estate savings.
  - Boost employee morale.

- Provide flexible schedules for employees.
- Provide employees with new technologies.

- Step to telework:
  - Developed telecommuting hardware and software.
  - Developed handbook.
  - Wrote policies.
  - Set up desks at customer sites.
  - Initiated different concepts at different company locations
  - Rented warehouse to create an off-site telework center
  - Existing buildings were retrofitted to accommodate telework personnel.
  - The Flexi-Move program was developed.
- The effect of telecommuting on the organization, telecommuters, co-workers, management and customers.
  - The teleworking changed:
    - Technology has produced faster and better electronic tools.
    - Telecommunications have changed the way IBM communicates internally.
    - Telework policies are more well defined.
- The successful program tips are: learn from the mistakes of others; don't put together a telework program all at once; do multiple iterations of pilot exercises; and refine your requirements, solutions, and process.

3.3.2 Benefits from this case.

- There has been a surge in the number of teleworkers and telecenters.
- Which job would the teleworker have?
- The program encompasses the equipment's features, components, and advantages.
- Steps to telework
- Who will bear the consequences of this change?
- The successful tips.

3.4 Teleworking at Abbott Northwestern Hospital.

Case summary.

Abbott Northwestern Hospital began its telecommuting pilot in 1994 with 3 full-time telecommuters, and expects to employ over 20 full-time telecommuters by the year 2001. Abbott has found that telecommuting is not only a way to cut costs; it is it is also an extremely effective recruitment tool.

Summary of Abbott.

Abbott Northwestern Hospital is part of the Allina Health System and is located in the Twin Cities and other areas of Minnesota. Abbott employs 51 medical transcriptionists, of whom 13 telecommute full-time. They set a goal of having 20 transcriptionists telecommute full-time by 2001. Abbott not only uses telecommuting as a practical business tool that saves space, time, and money, but also as a recruitment tool to hire and retain valuable employees in a market with a shortage of experienced medical transcriptionists.

Telework pilot rationale.

An important aspect of the success of a telework program, and in measuring that success, is the productivity of the employee who telecommutes. In this sense, medical transcription is a suitable fit for telecommuting because it requires specific deliverables. We measure the productivity of medical transcription in minutes of dictation per hour. The telecommuting medical transcriptionists at Abbott's were able to use their commute time for work, leading to an increase in productivity. These telecommuting employees were also free from the many distractions that occur in the office, thus increasing their productivity. We measured this increase in productivity simply by comparing the number of lines completed per hour when telecommuting to the number of lines completed per hour when working in the office. In 1998, 38% of Abbott's transcriptionists telecommuted full-time and produced 46% of the total work volume.

Abbott readily attributed this increase in productivity to more time spent actually working and less time commuting, doing other small projects in and around the office, and socializing with others in the office. However, not until a few years into the program did Abbott notice the long-term personal benefits telecommuting offered to

employees. Abbott found that those medical transcriptionists who telecommuted had high job satisfaction, increased loyalty to the company, and no intention of changing jobs. Therefore, not only did Abbott experience better bottom-line productivity results and cost efficiency, but they also saw increased employee satisfaction, which eventually translated to improved bottom-line results as well.

Management issues.

The potential difficulty of communication is one of the most frequent concerns for managers who supervise or are thinking about supervising telecommuters. Managers are curious if telecommuters will be available outside of work. Abbott quickly found that medical transcriptionists who telecommuted full-time were actually easier to get in contact with than those employees who were in the office. Since telecommuters worked at their desks, they always had their phones. They could also receive and respond to e-mails immediately. If a manager calls, e-mails, or stops by during an employee's absence from their desk, it delays communication.

Taking the aspect of communication one step further, Abbott also found that communications between managers and teleworkers were much more productive because of the distance separating them. Both the manager and the teleworker realized that it would be extremely inefficient to make several phone calls during a day, so they learned to address questions, delegate assignments, and discuss any other concerns in one conversation. In short, telecommuting allowed both the manager and the teleworker to become better managers of time, content, and responsibility.

Telecommuters would also come into the office on a quarterly basis for meetings to check their personal mailboxes and reinforce both personal and professional relationships with on-site employees. Abbott recognized that telecommuting medical transcriptionists needed to build and maintain relationships with office staff, even though they rarely entered the office.

Implementation challenges.

A. Through trial and error, Abbott recognized that it was not "good business" to shortcut technology. Especially for telecommuters, Abbott decided to provide the most up-to-date, efficient, and effective equipment possible. They realized that if their employees had adequate equipment and resources, they would produce better results. Therefore, the cost of upgrading and maintaining technology justifies its investment as it boosts productivity.

B. At the outset, Abbott had concerns that every employee would want to telecommute. Managers were concerned that certain employees might perceive telecommuting as a privilege reserved for them for reasons beyond their control. However, because of a comprehensive telecommuting policy and effective communication between staff and managers, employees have realized that telecommuting is not an effective fit for everyone.

Unexpected challenges.

Abbott was confronted with an unexpected challenge: the constant upgrading and maintenance of the technical equipment used by telecommuters. Abbott had anticipated that the acquisition of PCs, phone lines (subsequently upgraded to ISDN lines), home office furniture and equipment, and voice mail technology would be a one-time expense. However, Abbott quickly learned that if they did not afford telecommuters enough resources to do their work effectively and efficiently, as well as solve the majority of their problems on their own, the telecommuting program would not produce the results to justify its effort and cost.

Advice for potential telework managers.

Barbara Lietz, Medical Transcription Manager at Abbott Northwestern Hospital, offers three important pieces of advice to potential telemanagers.

- Documentation: Begin your telecommuting pilot or program with a comprehensive policy agreement that outlines specific selection criteria, safety measures, work schedule, confidentiality, and employer property.
- Communication: agree upon and maintain a communication plan. Choose specific times to talk on the phone, e-mail, and visit the office, and stick to that

plan. An effective communication plan can make telecommuting less stressful and more beneficial to the employer and the employee than working in the office.

- Continuation: Continued technology improvements, a review of telecommuting standards, procedures, and responsibilities, and improved resources allow telecommuters to be as well-equipped and self-sufficient as employees who work in the office.

3.4.1 Case briefing.

- Abbott Northwestern Hospital began piloting in 1994 with three full-time telecommuters.
- Abbott employs 51 medical transcriptionists, 13 of whom telecommute full-time, with a goal of up to 20.
- It serves as a space-saving, time-saving, and cost-effective business tool, as well as a tool for hiring and retaining valuable employees in a market that lacks experienced medical transcriptionists.
- This type of job is suitable for specific deliverables, measured in minutes of dictation per hour. Teleworkers are free from the many distractions that occur in the office, thus increasing their productivity.
- 38% telecommuted full-time, accounting for 46% of the total work volume.
- Abbott found that medical transcriptionists who telecommuted had high job satisfaction, increased loyalty to the company, and no intention of changing jobs.
- Management issues, Abbott found that medical transcriptionists who telecommuted full-time were actually easier to get in contact with than employees who were in the office.
- Telecommuting allowed both the manager and the teleworker to become better managers of time, content, and responsibility.
- Implementation Challenges: Abbott provided the most modern, efficient, and effective equipment and resources. Managers felt that employees would view it as a privilege that was given only to certain employees for reasons that were out of their control.
- The unexpected challenge was the constant upgrading and maintenance of the technical equipment used by the telecommuters.

- There are three key pieces of advice for potential telemanagers:
  - Documents: policy, agreement, work schedule confidentiality, and employer property.
  - Communication: a communication plan that specifies a specifies a specific time to talk on the phone, email, and visit the office.
  - Continuation: ongoing technology improvement, review of standards, procedures, and responsibilities.

3.4.2 Benefits from this case.

- Some hospital jobs allow for teleworking.
- They execute the process and achieve a successful outcome.
- The benefits align with the nature of the job.
- Potential telemanagers should consider the management issues, implementation challenges, unexpected challenges, and crucial pieces of advice.

3.5 Teleworking at Arizona department of Administration.

Business strategy for Teleworking.

The purpose of this worksheet is to help state agencies consider the relative costs and benefits of implementing more aggressive forms of telework as potential business strategies for the future. Implementing one or more forms of telework could address a number of challenges that many state agencies are currently facing. Some of these issues include: How can we serve our customers better, faster, and cheaper? How should we deal with the likelihood of future rent increases? How can we reduce the rising costs of employee turnover? How can we comply with current trip reduction laws and mandates?

While reading this justification worksheet, you can answer some of these questions. This worksheet will address the following four issues facing most state agencies: The rising cost of office space, enhancing organizational effectiveness, disaster recovery, and complying with the County Trip Reduction Ordinance are the four issues most state agencies face. Make sure to answer the text box questions as you read about how an enhanced telework program can help solve some of these issues. It is our hope that state

agencies will realize the sample justification for enhancing their telework program and make telework a business strategy in the near future.

The rising cost of office space.

The state spends $33 million annually to lease office space for state agencies, including $10.5 million in the Phoenix area. Currently, the state leases fifty-seven percent of its office space, with several major leases slated for renewal in the next three years. If rates continue at present levels, that could mean an increase of 2.7 million dollars per year. To help matters, ADOA has proposed that the state centralize leased offices and build 11 new state-owned buildings in the Capitol Mall area. Long-term ownership is cheaper than renting, so the building program will benefit. Unfortunately, the building program will take ten years to implement.

In the meantime, state agencies can effectively utilize telework to reduce current office space requirements. If agencies support remote Internet connectivity, their employees can be just as productive working from home several days a week. When employees are able to work several days a week from home, it becomes possible for them to share office space. In a major ASU study in 1996, nearly every state employee surveyed believed their job included some tasks suitable for telework. "Employee support for telework was evident by their willingness to make sacrifices for the opportunity to telework: 67% have access to (or would buy) the equipment they need, 87% are willing to keep daily logs in order to telecommute, and 69% are willing to share offices in order to telework."

What is the potential for telework to reduce your agency's leased office space requirements?

"The reduction in office space requirements depends on the space occupied by the employee, the rental cost for the floor area required, and the slight increase in space required for shared office space for telecommuters when they are in the office. The average reduction will be roughly 130 to 140 square feet (per remote user per year).1[1]„

_____	Enter the number of mobile workers or field positions in each leased facility
X135 sqft	Multiply (square foot requirement per employee)
_____	Total square footage of office space for field personnel
X$ ___	Insert the annual cost/square foot and multiply by total square footage above
$ _____	Total office space cost for mobile workers in the facility
X .75 ___	(About one-fourth of the office space requirement remain intact for hoteling)
=$ _____	Potential annual reduction in rent for mobile/virtual office telework.

[1] GartnerGroup, How to Save Money in Networking in the United States, Part 2, 2/23/96.

Increasing organization effectiveness.

Employee productivity is oftentimes the key to the success of an organization. More employers are asking more of their employees and seeing them as their most valuable resource. Research has demonstrated that flexible work options, such as telework, can decrease employee stress, turnover, and burnout while simultaneously boosting employee morale, productivity, and retention. The costs associated with implementing flexible work options (like telework) are small compared to the costs of not implementing such options.

Increasing employee efficiency.

For ten years, the State of Arizona Telecommuting Program surveys have evaluated agency pilots. These surveys measure changes in the working relationships between telecommuters, supervisors, and non-telecommuting coworkers. We also ask each group if the telecommuter's productivity has changed, either in terms of the quality or quantity of work they accomplish. According to survey results, both telecommuters and their

supervisors believe that telecommuting has increased productivity. Productivity increases because employees have fewer distractions and interruptions, work at their personal peak times, and are less stressed due to the absence of the commute.

After six years of program development, ADOA conducted a thorough evaluation of the State Telecommuting Program in 1996, in collaboration with Arizona State University and three other western states. The study found that qualified state employees perceive telecommuting as a positive, viable, and desirable work option, offering numerous benefits to the state, its employees, and the community. The evaluation considered the program from a variety of angles: management, telecommuters, coworkers, legislators, and the public. The study revealed many benefits of telecommuting, including increased productivity, improved employee morale, increased job satisfaction, reduced employee turnover, reduced time and energy expenses, and reduced traffic congestion and air pollution.

What are the approximate costs of implementing Telework Per User [1]

$4,000-$5,000 Per employee, including a portable computer with a modem, a printer, a telephone with at least two lines, internet service, direct virtual private networking through ADOA, fax capabilities and office supplies.

Benefits of implementing Telework Per User Per Year [1]

$9,125 The total average savings per user per year including:

$1,000 annually as increased productivity and effectiveness
$ 700 annually as increased productivity of group members

$ 400 annually as improved employee retention

$6,700 annually as reduced rental costs assuming $50/ft^2.

$ 325 annually as reduced parking space requirements

[1] GartnerGroup, How to Save Money in Networking in the United States, Part 2, 2/23/96.

Decreasing the costs of turnover.

Flexibility in the workplace has become an issue in the past decade because of the shrinking but more diverse workforce and the dramatic rise in dual-wage-earner families. The Families and Work Institute's 1993 National Study of the Changing Workforce found that 87% of the US workforce had some day-to-day family responsibility. Employees who experience work or family conflicts are three times more likely to think about quitting their jobs than those who do not. Northwestern National Life Insurance's study further reveals that companies with supportive work and family policies and flexible work hours have almost half the burnout rate of employers without such policies.

Estimates place the high cost of employee turnover between 93% and 150% of an employee's annual salary. On the lower end, one can perceive the cost of turnover as follows:

The cost of recruiting	33% of salary
The cost of training	10% of salary
The cost of the learning curve	50% of salary

This estimate makes a strong business case for employers to find ways to help their employees manage work-family conflicts.

Impacts-employee turnover.

Offering telework options could result in significant savings for the state taxpayer. State employee salaries lag behind the labor market and inflation. Over the past decade, state pay has fallen due to a lack of salary increases. The average state employee earns 13.4 percent less than other similar jobs in the region. In the fiscal year 1998–99, the state reported a 16 percent (10 percent avoidable) turnover. Using the cost of turnover model shown above, the cost of avoidable turnover in the Arizona state government during the fiscal year 1998–99 was between 83 million and 134 million dollars. Couple these trends with the fact that our workforce is getting smaller and employee retention becomes a significant issue. We estimate that one-third of our workforce will be over

65, injured, or ill by the year 2000. Our ability to retain and attract qualified employees in the future will depend on our willingness to be more flexible as state managers. By granting qualified employees more autonomy over the location and timing of work without compromising product quality, we can provide them with the flexibility they seek in a job today.

How expensive is employee turnover in your agency?

_____	Enter the number of employees who left for "avoidable reasons" in 98-99[1]
X $29,208	Multiply by the average annual salary of State employees[2]
X .93	Multiply by the annualized cost of turnover[3] (between 93% and 150%)
= _____	This is the actual cost of avoidable turnover in your agency. It will also serve as a benchmark for tracking the benefits of your extended telework plans for the agency.

[1] The Arizona Department of Administration's Human Resources Division compiles a quarterly Employee Turnover Report by agency and class code. The report tracks avoidable turnover in 13 classes. Call Joan Toner, ADOA personnel analyst, for your agency's avoidable turnover percentage at 542-1774.

[2] The average State employee earns $28,887 annually as per ADOA Human Resources on June 30, 1999.

Disaster recovery.

Although we normally say that the advantages of telecommuting are economic (increasing productivity and attracting and retaining employees) or family-friendly (spending more time with family instead of commuting), we can now say that telecommuting is also a viable disaster recovery strategy. During the 1993 bombing of the World Trade Center, the California earthquake of 1994, the Federal Building bombing in 1995, and the mid-west floods of 1997, organizations that were familiar with telecommuting were able to remain operational while most other organizations closed down.

Meeting the country trip reduction ordinance.

By law, all employers with more than 50 employees at one site are required to reduce employee trips each year in order to help solve our air and traffic congestion problems. Each employer is required to submit plans and collect data to show that they are complying with the law. Similarly, each state agency, board, and commission appoint a travel reduction coordinator to work closely with ADOA travel reduction programs to comply with the law.

Telework can help your agency comply with the law (Maricopa County's Travel Reduction Ordinance)

The State requires each agency, board and commission to have at least 15% of its employees in Maricopa County participating in telework. How well is your agency doing in meeting this telework requirement?

_____	Insert the number of agency employees currently employed in Maricopa County
X .15	Multiply by 15% - agency telework participation goal
=_____	Number of agency employees that should be participating in telework
-_____	Insert actual number of agency teleworkers and subtract from line 3 above (your agency's Travel Reduction Coordinator will know this number – or call 542-3637)
=_____	If this is a negative number, your agency is not in compliance and this is your agency's telework target.

Maintaining control of a decentralizing organization.

Technology allows employees and managers to track business products and services. The Arizona Department of Administration (ADOA) recently announced a new enterprise network service, known as the MAGNET, to provide direct access services to state agencies connected to its fiber optic ring in Phoenix. This new service will use virtual private networking (VPN) to allow state employees to securely access state resources via the Internet from virtually anywhere. To help agencies secure direct access, ADOA provides a Telework Services Guide.

Have you found that an extended telework program is justified?

If the facts and justification for an enhanced telework program in your agency have impressed you, it is likely that telework will have a place in your agency's future. Share this document with others in your organization, particularly senior management, as well as those involved in writing and updating your strategic and technology plans. Contact the ADOA Travel Reduction Office at (602) 542-3637 for more information about enhanced telework programs in other organizations like yours around the country. Attached are just a few of Arizona's success stories.

State telework success stories.

Many state agencies have found that telework makes beneficial business sense. After reading these three examples, consider how telework could fit into your agency's business plan.

The Department of Health Services found the mobile/virtual office form of telework to be an innovative business strategy. Six Environmental Laboratory Consultants, now connected to the office by phone and e-mail, were able to increase their time in the field by 18–25% per day just by eliminating the traditional daily commute. Furthermore, by connecting the six through a phone and modem, the department saved $11,102 on office rent in the first year alone. "The telecommuting opportunity has truly been a win-win situation for our customers, the program team, and the department," said Steve Baker, Laboratory Licensing Program Supervisor. ADHS has become another virtual success story for the State of Arizona Telecommuting Program.

The Department of Weights and Measures conducted a 12-month study to measure the costs and benefits of implementing a telecommuting program in conjunction with a vehicle take-home policy for their inspectors. As a result, they discovered that:

- inspection time increased 6.9% (or 880 hours) which saved $10,551
- travel time reduced 14.4% (or 5,623 hours) which saved $55,387
- Total savings of $65,938

The Structural Pest Control Commission collaborated with Project ADOPT (Arizona Donates Office Products for Telecommuting) to provide 12 home computers for their inspectors. Inspectors received the computers free of charge, provided they telecommuted at least one day per week for a full year, thereby reducing travel and improving air quality. While it is true that inspectors drive during the day, they still save the state time, energy, and air pollution by completing reports on their home computers instead of driving all the way to the main office every day. The commission's innovative telecommuting program will be an example to many other field workers across America. John Herwehe, Telecommuting Coordinator for the Structural Pest Control Commission, will appear on the PBS series Livelihood this October. Humorist Will Durst hosts the one-hour special of the Livelihood program. The program "takes viewers on a cross-country journey into the everyday lives of working Americans. The series is about our work life and its relationship to our families and communities, as well as the larger questions the country faces as the economy shifts at lightning speed."

3.5.1 Case briefing.

- The study examines the relative costs and benefits of implementing more aggressive forms of telework as potential business strategies for the future.
- Most state agencies are dealing with the following four issues:
  - The rising cost of office space.
  - Increasing organizational effectiveness.
  - Disaster recovery.
  - Meeting the country's trip reduction ordinance.
- With the rising cost of office space, the state spends $33 million annually to lease office space for state agencies, or 57% of state office space, an increase of 2.7 million dollars a year if rates continue.
  - State agencies can effectively telework to reduce current space requirements.
  - Several days a week, employees can work from home, making it possible for them to share office space.
  - A study found 67% have access to the equipment they need, 87% are willing to keep daily logs in order to telecommute, and 69% are willing to share offices.

- The reduction in office space requirements depends on the spaces occupied by the employee, the rental cost for the floor area required, and the slight increase in space required for shared office space for telecommuters when they are in the office.
- The average reduction will be roughly 130 to 140 square feet per remote user per year.

Increasing Organizational effectiveness.

Employees are essential to an organization's success. The expenses of introducing flexible work arrangements pale in comparison to the consequences of not doing so.

- Productivity increases because employees have fewer distractions and interruptions at their personal peak times and are less stressed due to the absence of the commute.
- The benefits from the study are:
  - Increased productivity.
  - Improved employee morale.
  - Increased job satisfaction.
  - Reduced employee turnover.
  - The company has cut employee time and energy costs.
  - Reduced traffic congestion and air pollution.
- $4,000-$5,000 Per employee to implement per user.
- $9,125 The total average savings per user per year including:
  - $1,000 per year to increase productivity and effectiveness.
  - $700 annually increases group members' productivity.
  - $400 annually as improved employee retention.
  - $6,700 a year in reduced rental costs is assumed.
  - $\$50/ft^2$.
  - Reduced parking space requirements: $325 per year.
- According to estimates, the high cost of employee turnover ranges from 93% to 150% of an employee's annual salary.
  - The cost of recruiting accounts for 33% of the salary.
  - The training cost is 10% of the salary.
  - The cost of the learning curve 50% of the salary.

Disaster recovery.

Organizations that were familiar with telecommuting were able to remain operational, whereas most other organizations closed down from any natural risk.

- Meeting the country trip reduction ordinance.
- Maintaining control of a decentralized organization. Using Virtual Private Networking (VPN).

3.5.2 Benefits from this case.

- Consider the relative costs and benefits of implementing the business strategies.
- How can we serve our customers better, faster, and cheaper?
- How can we reduce the rising costs of employee turnover?
- The majority of successful state agencies face four issues.
- The calculation methods involve estimating expenses, saving costs, and calculating the benefit return.

3.6 Cases summary.

Increased access and more affordable connectivity to advanced ICTs, especially wireless and Internet services, enhances the ability of development professionals and an increasingly diverse range of citizens of developing countries to access the world's storehouse of information—the Internet. Proper management of the knowledge networks is required to ensure that the Internet will be a tool for reducing rather than enhancing the digital divide between developed and developing countries. By exchanging information across communities, regions, nations, firms, and industries, we can enrich the world. As a result, we offer our insights into the factors that determine telecommuting success, as well as strategies to overcome the obstacles.

- **Technology.**

Clearly, increasing network bandwidths and developing more symmetric, high-speed network access technologies for residential users will hasten the degree of telecommuting from today's rather small (but increasing) numbers. But as we have seen, it's not just the technology that matters; the following two points elaborate on two important determinants of the success of telecommuting programs.

- **Management methods.**

We need improved management techniques to manage teleworkers, which will lead to rapid increases in productivity. Clear and concise performance goals are essential, and this aids in setting targets for employees, establishing guidelines by which managers can perform reviews, and improving planning. Traditionally, many managers manage by process rather than by results, a method that needs to change. To put it another way, in the words of a successful CEO, "Manage not the way school teachers do, by attendance, but the way college professors do, by results."

These improved management techniques will result in improved overall productivity because of the clearly established targets for telecommuting employees. As a result, telecommuters act as incentives for managers to set clear performance goals for their projects, which in turn improves performance. However, this is a two-edged sword: managers unwilling to change their management style will result in the failure of an organization's telecommuting program.

- **Organizational support.**

As a result, it is important for any successful telecommuting program to have the support and blessings of higher-level management. In fact, telecommuting case studies show that executive "buy-in" is crucial to program success. In fact, we can generalize this to most efforts that involve the adoption of collaborative technologies. Executive and managerial support and belief in the programs are crucial to their success.

According to the case studies above, there are strong economic incentives for the adoption of collaborative technologies in the telecommuting sector. The benefits of telecommuting include increased productivity, reduced real estate and facility costs, labor pool expansion, flexible working hours, and improved employee quality of life.

However, despite these advantages and technological capabilities, teleworking is not a done deal. Managerial and executive support, as well as changing management styles, are critical to the success of teleworking programs in any organization.

Chapter 4
Teleworking Implementing in Thailand

Implement teleworking in Thailand. The main population area, located away from any economic area and connected to the capital via a telecommunications network, should be the starting point for teleworking implementation. Teleworking encompasses a variety of non-traditional work arrangements that move work to people rather than people to work. Businesses, public agencies, employees, and policymakers have recently shown interest in teleworking due to their desire to increase productivity, reduce costs, balance family and work responsibilities, and address traffic congestion and environmental issues. Recent advances in telecommunications and computer technologies have also enhanced the ability to communicate and work at home or from remote sites.

Teleworking is a relatively new approach to work arrangements. Therefore, we are just beginning to document the extent of teleworking programs, the various techniques used, the benefits and limitations of different approaches, the keys to successful programs, and other related issues. Further, the roles federal, state, and local governments can play to encourage telecommuting are not well known. The government can initiate the teleworking project by clearly defining regulations or policies. The teleworker can alternatively describe teleworking patterns as follows:

Teleworking involves non-traditional forms of work that eliminate the need for an employee to commute on a daily basis to a central employment location. Teleworking may involve the use of advanced communications technology, or it may just focus on doing regular work tasks outside the office. Home-based telecommuting is the most familiar form of teleworking. In this case, a teleworker works at home and communicates with the organization's main office by telephone, computer modem, or other means. Telecommuting may also involve mobile workers, home-based business owners, and employees working at satellite, local, or neighborhood centers.

4.1 Step to teleworking.

There are eight steps to teleworking, including the following:

Step 1: Your position must be suitable for teleworking.

Not every position in classifications identified as suitable for teleworking may be equally well-suited. For example, one position in the Administrative Officer classification may require the analysis of survey information (suitable for teleworking), whereas another position may require extensive contact with agency clients (not suitable for teleworking).

Your supervisor determines which, if any, positions in the work unit are suitable for teleworking.

Jobs appropriate for teleworking:

- Schedule face-to-face interactions on designated days.
- have clear work objectives.
- do not require immediate feedback, and;
- benefit from quiet or uninterrupted time.

Possible teleworking tasks:

The tasks include analysis, evaluations, spreadsheet analysis, auditing reports, graphics, and typing, calculating, preparing budgets, writing, computer programming, preparing contracts, data entry, project management, design work, reading, drafting, record keeping, editing, and research.

Step 2: Your work habits must be suitable for teleworking.

Not all employees in positions deemed suitable for teleworking will receive automatic permission to do so. Your supervisor will make the final decision regarding your ability to telework. Teleworking is not suitable for new employees, for employees who require on-the-job training, for employees who need close supervision, or for those who thrive on interaction with co-workers.

Employees who telework should be organized, highly disciplined, and conscientious. These employees should be self-starters who require minimal

supervision. Their performance during prior performance evaluation periods must at least "meet standards." Offsite work usually retains personality traits but may highlight them. If employees are hard workers, they may work even harder as teleworkers. If employees struggle with their attitude or work performance, these challenges may intensify as they transition to remote work.

Teleworkers are:

- Self-motivated and responsible;
- results oriented;
- able to work independently;
- They are familiar and comfortable with their job requirements;
- knowledgeable about the organization’s procedures;
- successful in the current position;
- effective communicators;
- adaptable; and
- committed to teleworking.

Step 3: Know the Teleworking Policy.

Teleworking Policy. It is important for the teleworker to be familiar with this policy. If the teleworker has any questions, they should discuss them with the supervisor. Then, if you have additional questions that your supervisor cannot answer, you should contact your agency teleworking coordinator.

These is the example of the policy.
THE POLICY STATEMENT
SUBJECT: Teleworking **Effective: DD/MM/YYYY**
Revised: DD/MM/YYYY

_____

OPSB Executive Director

AUTHORITY: …….

1. STATEMENT OF POLICY

1.1 The city or company has a teleworking program that allows selected employees to You may occasionally choose to work from home, a satellite office, or a telework center.

1.2 Each agency will strive to enable at least 10% of eligible employees to participate telework.

2. DEFINITIONS

2.1 **Eligible Employee**: A worker who holds a position they have identified. supervisor, as being suitable for teleworking.

2.2 **Main Office**: The Teleworker's usual and customary worksite.

2.3 **Remote Workplace**: An Alternative Work Location for an Employee's Customary Worksite (Main Office). The remote workplace may include the employee working from home, a satellite office, or a telework center.

2.4 **Telework Center**: To house telecommuting employees, city agencies can use this facility, which offers office-like workstations and electronic equipment.

2.5 **Teleworker:** A person who works at home for at least four days a month. An agreed-upon task at a satellite office or a telework center is required.

2.6 **Teleworking:** The practice of working at a location other than the employee's usual one (customary worksite).

3. EMPLOYEE PARTICIPATION

3.1 The supervisor will determine which employees are in positions suitable for teleworking.

3.2 The supervisor may permit employees in jobs suitable for teleworking to telework on designated days.

3.3 At any time, the employee or supervisor may terminate teleworking.

3.4 Before permitting an employee to telework, the employee's supervisor should discuss the following with the employee:

(i) the Agency Teleworking Agreement;

(ii) the Remote Workplace Self-Certification Checklist; and

(iii) the Teleworker Work Plan.

3.5 Before teleworking, the employee shall be required to complete and return the Agency Teleworking Agreement and the Remote Workplace Self-Certification Checklist to the supervisor.

3.6 The supervisor and the teleworker at a remote worksite should complete a Teleworker Work Plan before each day, outlining the tasks the employee must complete while teleworking.

4. <u>EMPLOYMENT</u>

4.1 The teleworker's duties, obligations, responsibilities, and conditions of employment with the city will be unaffected by teleworking.

4.2 The teleworker's salary, retirement benefits, and insurance coverage will remain unchanged by the teleworking arrangement.

4.3 All work hours, overtime compensation, and leave usage must conform to the Annotated Code, the provisions of the State of Teleworker's Agreement, and the terms otherwise agreed upon by the employee and the supervisor.

4.4 The teleworker must have the pre-approval of the teleworker's supervisor before working overtime at a remote workplace.

4.5 You cannot conduct work-related meetings at home.

5. <u>EQUIPMENT AND SUPPLIES</u>

5.1 The teleworker must have a designated work space and a telephone. The necessary tools and supplies are available to complete the assigned tasks at the remote location. workplace.

5.2 The teleworker is not required to provide equipment, software, and supplies.

5.3 Agencies may provide the teleworker with the following equipment:

5.3.1 laptops;

5.3.2 desktop computers;

5.3.3 printers;

5.3.4 modems;

5.3.5 faxes;

5.3.6 scanners;

5.3.7 cables; and

5.3.8 software.

5.4 The teleworker's specific teleworking job duties must align with the equipment purchases.

5.5 Agencies must obtain approval from the Office of Budget Analysis before purchasing any equipment not listed in Section 5.3.

5.6 When an employee's participation in the telework program ends, they must return any agency-provided equipment to the agency.

5.7 Only authorized individuals, as well as those conducting city business, may use equipment, software, data, supplies, and furniture provided by an agency.

5.8 The teleworker will be in charge of securing all city-provided items.

5.9 The teleworker shall obtain from the main office all supplies needed for work at the remote workplace.

6. WORK SPACE

6.1 The teleworker must have a designated work space.

6.2 Keep the work area in a safe condition, free of hazards that could endanger the employee or agency equipment.

6.3 The supervisor is required to ensure the teleworker completes and returns the Remote Workplace Self-Certification Checklist.

7. EXPENSES

7.1 Schedule work-related long-distance phone calls for in-office days.

7.2 The supervisor may, at their discretion, reimburse expenses for long-distance calls made from a teleworker's home, provided they document the reason and cost of the call.

7.3 The teleworker bears the cost of maintaining, repairing, and operating personal equipment that the city does not provide.

7.4 The supervisor of the teleworker will not reimburse expenses for supplies that are regularly available at the main office unless they grant pre-purchase approval.

8. LIABILITY FOR INJURIES WHILE TELEWORKING

8.1 The city's Workers' Compensation Law covers teleworkers for injuries sustained while performing their official duties at a remote location.

8.2 The teleworker or someone acting on the teleworker's behalf shall immediately notify the teleworker's supervisor of any accident or injury that occurs at the remote workplace.

8.3 The agency and the supervisor should then follow the city's policies regarding the reporting of injuries for employees injured while at work.

8.4 The agency is not liable for damages to the teleworker's personal or real property while the teleworker is working at the remote workplace, except to the extent adjudicated to be liable under the law.

9. CHILD/DEPENDENT CARE

9.1 Teleworking is not a substitute for child or dependent care.

9.2 The teleworker must continue to plan for child or dependent care to the same extent as if the teleworker were working at the main office.

10. INSPECTIONS

10.1 The supervisor may make an on-site visit to the teleworker's remote workplace for the purposes of determining that the site is safe and free from hazards, and to maintain, repair, inspect, or retrieve agency-owned equipment, software, data, or supplies.

10.2 Before an inspection of the remote workplace, the supervisor shall provide the employee with at least 24 hours of notice of the inspection.

10.3 Inspections must only take place during regular business hours.

11. CONFIDENTIAL INFORMATION

11.1 The teleworker and the supervisor shall take appropriate safeguards to secure confidential data and information.

12. DISCIPLINE

12.1 An employee's status as a teleworker has no bearing on the city's disciplinary procedures or drug and alcohol policies.

12.2 An agency may take appropriate disciplinary or adverse action against the teleworker for failing to comply with the provisions of the Agency Teleworking Agreement.

STEP 4: Review the agency teleworking agreement.

The Agency Teleworking Agreement is the document that outlines the telework expectations of the teleworker. The supervisor should review the agreement with the teleworker. Since the supervisor understands the agreement, they require the teleworker to sign it before starting. The supervisor will keep the signed agreement and provide the teleworker with a copy. Teleworkers should remember that teleworking does not have to occur on a weekly basis. If teleworkers do not have enough work to perform at home on a regular basis, teleworking can occur as infrequently as one day per month. The most important thing to remember is that the teleworker and supervisor must agree on a teleworking schedule that is suitable for both the teleworker's and the agency's needs. The supervisor ultimately decides the days on which the teleworker can work remotely. (See example agreement in Appendix C.)

Step 5: Choose your remote worksite.

You have three options to choose from when you decide your remote worksite. You can work from:

- your home;
- a satellite office; or
- a telecenter.

If you choose to work from home, you will have to set up a home office to meet your work needs. You may use your own equipment if you have it. Your agency may or may not provide you with equipment (a computer, fax, modem, etc.). If your agency refuses to provide you with the equipment you believe you need to work from home, and you don't own it yourself, your options are limited to working at either a satellite office or a telework center. Simply put, a satellite office is a city facility closer to your home where you can work during your teleworking days. Of course, you and your supervisor will need to obtain the appropriate agency approvals to use the office space.

Designed to help teleworkers work closer to their homes, a telework center is a fully equipped office.

Step 6: Complete the remote workplace self-certification checklist.

Before you can telework, you must complete and return the Remote Workplace Self-Certification Checklist to your supervisor. Your supervisor will keep the signed checklist and provide you with a copy. (Appendix D.)

Step 7: Complete the teleworker work plan with your supervisor.

Supervisors are encouraged, but not required, to complete a Teleworker Work Plan before each day you are allowed to telework. The work plan clearly identifies the assignments that you will be expected to complete while teleworking.

Step 8: Maintain open communication with supervisor.

Teleworkers must communicate with their supervisors, have a plan to evaluate their job performance together, and keep in touch with one another.

This project proposal will delve into the specifics of step 5, which involves selecting the remote worksite. This is how the employee, employer, teleworker, and government agency would decide on the teleworking program, using an example case.

4.2 Home office or home-based working project and case study.

Executives, managers, salespeople, operators, and other teleworkers who frequently work at home require advanced technology equipment in their home offices in order to perform their jobs effectively. When making the decision to work from home, any device or piece of equipment must consider whether its cost and ability to work are reasonable or not. That device can be interconnected. The cost of the device might surpass the income or the desired outcome. Any teleworker or employer has the option to consider the following type of investment:

- The teleworker or employee invests in all equipment.

- The corporate or telework agency invested in any equipment or devices for teleworkers.
- The employee and employer shared the investment in the teleworking project.

The table below shows the approximate cost of the necessary equipment and optional items that teleworkers require to work.

Table 4.1- Home offices devices and approximately cost.

Device	**Price (Approximately): Baht**		
Personal Computer	20,000-50,000		
PCs with Internal Modem		25,000-50,000	
Laptop with PCMCIA Card			30,000-200,000
Modem	2,000-15,000		
Printer	2,000-60,000	2,000-60,000	2,000-60,000
Fax	5,000-25,000	5,000-25,000	5,000-25,000
Telephone	2,000-8,000	2,000-8,000	2,000-8,000
Answering Machine (optional)	2,000-8,000	2,000-8,000	2,000-8,000
Scanner (optional)	2,000-30,000	2,000-30,000	2,000-30,000
Web camera/Video camera (optional)	2,000-50,000	2,000-50,000	2,000-50,000

Reported (February, 2003)

Some software and applications are free or require a license, depending on the agreement between the employer and employee. Depending on the employee's career, estimating the expense may not be possible.

You have the option to choose an access line or communication link for the home offices:

- Home workers can connect to their offices from PCs using a modem via an analog line, also known as a telephone line. The initial investment cost ranges from 35,000 to 150,000 Baht, depending on the speed, quality, and performance of each communication device. However, for the analog line, the speed is limited, which is one of the most important things to consider when any teleworker or home worker connects digitally to the computer and pulls down virtually any data file or working document.

- Avoidance For the problem of speed limitations, ISDN or ADSL can be a solution. Home workers should review the costs and coverage area of the rural telephone network services company and ensure that the investment cost exceeds the stated range of 50,000 to 300,000 Baht.

Home workers should focus on studying and reading more about practical knowledge and ICT literacy. Home workers must understand the fundamental functions of any device, which they can occasionally repair or maintain appropriately. Other considerations include the working environment, the planning schedule, the work process checklist, and ongoing monitoring by a manager or supervisor who has reviewed the details in Chapter 2. Practically speaking, we should adopt it for appropriate events.

Case Scenario: Operator for Food delivery in the Home-based working.

Case Background.

One of the employees, who aspired to become an operator and work from home, decided to apply for a position at a renowned delivery company. She is responsible for receiving any phone calls, locating the nearest food delivery shops, and delivering food or products to customers within the assigned time. She is aware of the company's policies and has entered into an agreement. She made the decision to purchase any equipment or devices she already owned. As a result, she must pay using the table below (Table 4.2).

Case summary.

Workspace.

At home

Access line and technology.

Twisted pair phone line with ADSL connection technology.

Remote site equipment.

PCs, ADSL Modem, printer, telephone set, fax machine, answering machine.

Network access.

PSTN Network from existing telephone service network.

The expense.

The initial investment around 69,000 Baht.

The monthly expense around 4,300 Baht.

The revenue.

The salary depending on the agreement (N/A), which may be some, fixed salary plus variable number of calls.

Evaluation Methods.

Works schedule and orders line record in the program.

The key benefits.

- There is a decrease in transportation time and expenses, encompassing car insurance, maintenance, and wear.
- The city or company can save money on office space, sick leave absences, and energy conservation.
- Automobiles have reduced air pollution and traffic congestion.
- Increase your working hours to earn more money.
- The employer can reduce some investment costs for this case.

Table 4.2- The estimate expense for the case scenario.

Lists	**Price (Approximately): Baht**
Initial Investment	
Personal Computer	30,000
ADSL Modem	10,000
Printer	5,000
Fax	10,000
Telephone set	2,000
Answering Machine	2,000
Software	8,000
ADSL installation fee	1,000
Connection line and necessary component device	1,000
Total	69,000
Monthly payment	
ADSL service charge (128 kbps)	4,300 /m
Internet hours	1,000 /m
Telephone number	100/m
Total	4,300

The table above suggests investing in ADSL technology because of its faster speed and more reliable communication, making it ideal for this type of career.

4.3 Telecenter project and case study.

Many parts of the country are implementing regional, metropolitan, and state-wide teleworking programs. Government policies lead some of these efforts, while state or regional transit agencies spearhead others. These programs frequently contain a mix of elements and activities, including the adoption of goals and objectives supporting teleworking, the production and distribution of videos and brochures, marketing, public education efforts, the establishment of telework centers, and the implementation of teleworking programs within the agency. When preparing to establish the telecenter, this project presents five crucial factors to consider:

- Location.
- Access line and technology.
- Central site equipment.
- System management (provide both security and policy).
- Sources of funds.

4.3.1 Location.

The manager must be aware of the key factors that influence the decision to choose the telecenter's location, including information that is easily accessible and not too far away. The facility should offer amenities like a service bus, a parking lot, and a food center, among others.

In communities with a shortage of accessible meeting spaces, providing a meeting room could also be an important service to business and economic development organizations. Telecenters should closely collaborate with local community colleges and business and economic development organizations to identify community needs and develop appropriate technology services and resources for their offerings. The object is to optimize, not duplicate, technology services and resources for the business and economic development communities.

To ensure long-term sustainability, it will be necessary to connect and collaborate with community colleges and their small business centers, local and regional economic development and business groups, community-based and non-profit economic development groups, and entrepreneurship training programs.

The conceptual design recommended dispersing the telecenter across communities close to Bangkok and beyond, including Thonburi, Bangna, Rangsit district, Nontha Buri, Samut Prakarn, Samut Sakorn, Chachong Sao, and Pathum Thani province. Set up the design calls for the establishment of 50 service rural telecenters throughout the region, each capable of accommodating at least 100 teleworkers, resulting in a total of 5,000 teleworkers within the program. Despite being relatively small compared to the population in each province, we can still support and expand this number.

Organizations with teleworking programs typically provide an increase in productivity for their teleworkers. Teleworkers reported faster completion of assignments, fewer sick and absent days, improved time management, and increased morale and commitment to the company or agency. Other benefits realized by some companies include reduced office space needs and associated costs, enhanced ability to attract and retain high-quality employees, and improved customer service.

The teleworker knows their needs well and approved their ability to support and enhanced the program; avoid any problem with their community committee or supervisor.

When choosing a location for a telecenter, it's crucial to consider the rental expenses, which are separate from the total number of teleworkers. The building rental costs are lower than in the main economic zone. One worker utilizes a workspace of 3 m x 2 m = 6 m^2, resulting in a total workspace of 600 m^2, plus an additional area of approximately 1,000 m^2. However, the cost of a workspace of the same size varies between economic and non-economic zones. By the way, the manager or supervisor must decide on the best location for working, implement the shift technique as an alternative, and expand to meet the needs of teleworkers, such as providing 24X7 services.

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Figure 4.1– The Map of Bangkok and Outbound

Source http://www.bangkokmap.com

From the map that will easy to focus in each area, grouped to be the appropriate zone by the regional relative zones:

Zone 1**:** Silom, Sathorn, Surawong, Siphraya, Rama III, Rama IV, Suanplu, Ngam Duplee, Attakarnprasit, Nanta, Sathupradit, Chan, Yen-A-Kat, ...

Zone 2: Sukhumvit 1-71, Ploenchit, Siam, Langsuan, WirelessRd.(Wittayu), Chidlom, Nailert, Ruamrudee, Rajadamri, Na-na, Asoke, Prompong, Wattana, Thonglor, Ekamai, Phrakanong, ...

Zone 3**:** Ratchada, Ladprao, Rama 9, Ramkamhaeng, Petchaburi, New Petchaburi...

Zone 4: Sukhumvit 77-103, Srinakarin, Bangna-Trad, ...

Zone 5: Phahonyothin, Vibhawadee-Rangsit, ...

Zone 6: (Thonburi) Pinkhlao, Charoen Nakorn, Charansanitwong, Petchakasem, ...

Zone 7: (Old City of Bangkok) Rachadamnaern, Banglumpoo, Khaosan, Samsen, Dusit, Yaowaraj (Chainatown), ...

Zone 8: Sukhapiban, Ramindra, Minburi, Lamlukka, ...

The teleworking program provided a single telecenter for a specific district or zone at the teleworker's initial convenience, thereby minimizing travel time and costs. Supervisors, managers, or employers monitor and evaluate based on quantity, quality, and job performance. The other concept workplace selected is located at the outbound telecenter. However, the most effective telecenter should offer numerous function rooms, as outlined below:

- The reception serves as a point of contact for customers and anyone else seeking useful information.
- In the conference room, meetings with a group of clients or employees in the telecenter take place.
- In the telecenter's working area, the command center orders and controls the work flow process.
- The computer room provided LAN/WAN connections for computers, peripherals, and electronic data equipment.
- Air conditions regulate the air environment system throughout the entire telecenter area.
- Balon Room.
- The UPS equipment room collects the electricity and provides it when the power goes out.
- The security room uses the security system to control strangers.

4.3.2 Access line and technology.

This project focuses on communication networks that utilize either access line technology or carrier services. Chapter 2's overview served as the basis for dividing this project into two sections.

1) The private network link in the central site or telecenter uses a corporate LAN (UTP) in the computer room and extends into the office zone when users use laptops, PCs, or other related devices to access data.
2) The public network uses ISDN, ADSL, or VPN. The ISP, or NSP, links the device from the inside to the other site.

Set up the telecenter in Thailand and suggest ISDN, ADSL, or VPN networks to ensure the connection.

4.3.3 Central site equipment.

The central site must set up any device to ensure accuracy and high speed, catering to the unlimited needs of customers or any teleworker members in the teleworking system.

Machines' primary significance lies in their ability to fulfill requests from clients within the data center, telecenter, or external members. These machines fall into the following categories:

The Application Server houses the system and any necessary applications for the business process, including MIS, payroll, and point of sale.

The database management system itself manages the database server, which collects the organization's data. The app can link database data to clients or users.

The Internet Server is responsible for storing organizational content, managing corporate websites, retrieving useful information from a database server, and manipulating it to provide 24x7 services to users.

Electronic Mail Server. This server, either separate or integrated with the system server, is used to store employee information for corporate connections with clients, other businesses, or file transfers.

Particularly, we need to consider other crucial and essential network devices like routers, bridges, switches that connect to access line technology, or any other network design. However, the data center should have another terminal for monitoring and managing the system, depending on the size of the network.

4.3.4 System management.

The telecenter is being prepared for the two main managers to conduct and manage, and the details are as follows:

1) Organizational management should designate a manager for the telecenter who oversees all service patterns, excluding those related to technology or networks, such as customer service. The general manager should have the skill and ability to administer personal systems, as well as IT literacy.
2) Information and communication technology are at the core of system management. The system manager oversees all information and network systems within the telecenter, including monitoring, control, design, and analysis. The role of the system manager is to cater to the requirements of the program's teleworkers. Important things to do are:
   - Resources planning by consider these factors:
     - System resources at each user level.
     - Network System.
     - System device and equipment.
   - Open the system for work, then shut it down for maintenance.
   - Make sure to include backup and recovery in your working process and future work plan.
   - Correct the problem of computer resource limitations (such as disk space and CPU memory).
   - When the link is down, terminate communication and alert the users.
   - Update the operating system and maintenance.
   - Training and answering the working trouble.
   - Manage the system and database security.
   - Group management and authorization.
   - The hardware configuration includes adding, upgrading, and deleting application software.

To ensure simple administration, system managers must concentrate on any operational process. We categorize the working function according to the frequency or duration of the monitoring period, such as daily or monthly operations. However, the frequency will depend on the system size or network complexity. In a small telecenter, a single person can handle all the described jobs; however, as the site grows in size, more people should assume responsibility.

4.3.4 The telecenter set up expense's worksheet.

Telecenter programs may also provide benefits to the community and society as a whole. These may include reductions in energy consumption and pollution associated with commute trips, as discussed in this section. In addition, teleworking programs may help to enhance the economy and human capital in some areas and neighborhoods. However, technological advancements and revolutions have led to new software and hardware releases. Don't worry about the costs associated with these changes. Because the manager may have a way out, rent PCs for lower maintenance costs.

If we decide to start the teleworking program with 100 teleworkers, the costs can vary.

Table 4.2- Iimplementation costs for the interested area.

(e.g. Bungkum, Bang kae, Silom to setup the telecenter fot 100 teleworkers)

List of the expenses	Bungkum	Bang kae	Silom
Offices Rent			
Pay per square meter (approximately) in Baht	200 *	200*	400*
100 Teleworkers used 6 m^2/person	X600 =120,000	X600 =120,000	X600 = 240,000
Another facilities room around 1000 m^2	200,000	200,000	400,000
Total (1.1)	320,000	320,000	640,000
Equipment in telecenter			
Offices Desk 100 sets	250,000	250,000	250,000
(Can set up PCs)			
100 Chairs	100,000	100,000	100,000
Conference Room			
Table	20,000	20,000	20,000
10 Chairs for meeting	50,000	50,000	50,000
Microphone	10,000	10,000	10,000
Projector	100,000	100,000	100,000

List of the expenses	Bungkum	Bang kae	Silom
Projector Screen	10,000	10,000	10,000
Commander Equipment	50,000	50,000	50,000
10 Air conditioners	200,000	200,000	200,000
UPS	100,000	100,000	100,000
Security System	250,000	250,000	250,000
Electronics and network device			
120 PCs			
Around 20,000 each	2,400,000	2,400,000	2,400,000
(Alternatively, can be PCs leased)			
5 Servers			
Around 200,000 each	1,000,000	1,000,000	1,000,000
Router	200,000	200,000	200,000
6 Switching (s)	300,000	300,000	300,000
PABX	350,000	350,000	350,000
Outlet and equipment Installation cost (LAN/Wireless LAN-Power)			
250 points: 2,000 Baht/point	500,000	500,000	500,000
10 Printers @ 20,000 Baht	200,000	200,000	200,000
Color Printer	200,000	200,000 t	200,000
10 Scanners @ 3,500 Baht	35,000	35,000	35,000
5 Faxes @ 20,000 Baht	100,000	100,000	100,000
100 Telephone sets @ 1,000 Baht	100,000	100,000	100,000
Photocopy Machine	100,000	100,000	100,000
Web Cameras			
20 sets @ 2,000 Baht	40,000	40,000	40,000
Software License	500,000	500,000	500,000
Other necessary office devices	300,000	300,000	300,000
Total (2.1)	7,265,000	7,265,000	7,265,000
Communications technology			
ISDN			
- ISDN installation fee	100,500	100,500	100,500
- ISDN Remote device	400,000	400,000	400,000
Total (2.2)	500,500	500,500	500,500
- Numbering rental fee	7,500	7,500	7,500
- Internet connection fee/month	5,000	5,000	5,000
Total (1.2)	12,500	12,500	12,500
Supervisors Expense/Month (1.3)	300,000	250,000	500,000
Utilities Expenses: Water, electricity, telephone bill (1.4)	250,000	200,000	300,000
(Based on number of user and open hours)			
Total Operation expense for (2.1) + (2.2)	7,765,500	7,765,500	8,095,500
Total for variable expense per month (1.1) + (1.2) + (1.3) + (1.4)	882,500	782,500	1,452,500

Note * This number is from the Government Savings House Bank for the average assessment.

Table 4.2 provides an example of an expense calculation for setting up a telecenter in each district, where the controllable variables include the network, communication devices, and services from the same vendors. In fact, you can select any reasonably priced equipment for each telecenter. Variable costs include the building rental cost and the employee or supervisor's salary. These factors account for the higher building rental and salary expenses in the primary economic area. When they decided to implement the telecenter outside, they were able to reduce the costs associated with building rentals and transportation.

The districts are required to set aside funds for environmental preservation, other public services, and facilities for workers who commute to traditional offices. When we compare these costs to the setup costs of a telecenter, we find that the former is significantly higher. Teleworking programs can benefit the transportation system by reducing commute trips. These benefits can help companies, agencies, and areas meet air quality legislative requirements and other policy directives. Teleworking programs should have a positive impact on traffic congestion, air quality, and energy consumption because they remove work trips from congested peak periods.

Enhancing the local economy and providing resources for local residents are significant benefits. For instance, the government implemented policies at the Telework Center with the aim of boosting the local economy and human capital. The location of telework centers may help stimulate the area's economy. In addition, the presence of teleworking may enhance the vitality and security of neighborhoods during the day.

The above table's result only serves as a recommended model; for further implementation, you can modify the rate to reflect the current situation and compare it to realistic decision-making criteria.

4.3.5 Sources of funds.

A number of states have implemented legislation, administrative policies, or other actions that are supportive and encouraging. Teleworking Regional agencies, transit authorities, and local governments can play important roles in supporting teleworking funds or activities from labor unions and other employee groups at the

national level, which could aid in interacting with these organizations at the state and local levels. Initiating national-level discussions could support teleworking programs at public agencies and private businesses across the country. Providing financial or other incentives to companies or agencies to implement teleworking programs represents another potential strategy. Possible incentives could include tax breaks, reductions in parking requirements, zoning bonuses, and other benefits to public and private sector groups. Advances in technology make things better, faster, and more convenient for a higher quality of life.

Case Scenario: Set up telecenter for the government agencies.

Case Background.

The government decided to establish a telecenter in Bungkum, where a large number of officers resided. For instance, the telecenter accommodates Clark, operators, administrators, and managers. They can work at any time and stay approximately 5 kilometers away from the telecenter. In this scenario, they must develop teleworking hardware, software, and a handbook. The telework units are responsible for writing the policies. The warehouse underwent renovations to establish a telework hub. At the designated sites, we installed desks and other necessary equipment or devices.

Case summary.

Workspace.

At Sukapibal, Bung Kum.

The telecenter leases the building. By the options of:

- One or two floors can accommodate 100 teleworkers.
- 10 floors or 5 floors; each floor can support 100 or 200 teleworkers, depending on the area zone. mobile office concept.

Access line and technology.

- The private network used UTP Cat6 for the LAN connection and fiber optics for the switch connection.
- The public network recommends two alternatives: ADSL and ISDN.

Table 4.3- The estimate expenses for the case scenario.

List of the expenses	100 teleworkers		1000 teleworkers	
Offices Rent				
Pay per square meter		200		200
used 6 m^2/person	X600	120,000	X6000	1,200,000
Other facilities room around	(1000 m^2)	200,000	(4000 m^2)	800,000
Total (1.1)		320,000		2,000,000
Equipment in Telecenter				
Offices Desk	X2500	250,000	X2500	2,500,000
(Can set up PCs)				
Chairs	X1000	100,000	X1000	1,000,000
Conference Room				
Table	1 Table	20,000	5 Tables	100,000
Chairs for meeting	20 Chairs	50,000	100 Chairs	250,000
Microphone	4 sets	10,000	20 sets	50,000
Projector	1 set	100,000	5 sets	500,000
Projector Screen	1 set	10,000	5 sets	50,000
Commander Equipment	1 set	50,000	2 sets	100,000
Air conditioners	10	200,000	5 flsX10	1,000,000
UPS		200,000		1,500,000
Security System		250,000		2,000,000
Electronics and network device				
PCs	120 sets		800 sets	
	X20000	2,400,000	X20000	16,000,000
(Alternatively, can be PCs leased, which will be lower the cost in each year)				
Servers	5 sets		10 sets	
	200,000	1,000,000		
Router	1	200,000	2	400,000
Switching (s)	6X50,000	300,000	12X50,000	600,000
PABX		350,000		350,000
Outlet and equipment Installation cost				
Outlet	250 x2000	500,000		
Printer	10 x20000	200,000		
Color Printer	1	200,000	2	400,000
Scanner	5X3500	17,500	20X3500	70,000
Faxes	2x20000	40,000	10x20000	200,000
Telephone sets	100 X1000	100,000	500x1000	500,000
Photocopy Machine	1	100,000	5	500,000
Web Cameras	20 X 2000	40,000	100X2000	200,000
Software License		500,000		2,000,000
Other necessary offices device		300,000		500,000

List of the expenses	100 teleworkers		1000 teleworkers	
Total (2.1)		7,487,500		30,770,000
Communications technology				
(1) ISDN				
- ISDN installation fee		100,500		100,500
- ISDN Remote device		400,000		400,000
Total (2.2.1)		500,500		500,500
(2) ADSL				
- Installation fee per node	X5	20,000		
- Monthly fee for 128 Kbps	X5	86,0000		
Total (2.2.2)		21,200		
- Numbering rental fee		7,500		37,500
- Internet connection fee/month		5,000		30,000
Total (1.2)		12,500		67ม500
Supervisors Expense/Month (1.3)		300,000		500,000
Utilities Expenses (Water electricity telephone bill) (1.4)		250,000		2,000,000
(Based on number of user and open hours)				
Total Operation expense for (2.1) + (2.2)	ISDN	7,988,000		31,270,500
	ADSL	7,507,500		
Total for variable expense per month (1.1) + (1.2) + (1.3) + (1.4)		968,500		4,5675,500

Table 4.2 reveals that implementing 100 teleworkers results in costs per teleworker ranging from 75,000 to 80,000 Baht, while implementing 1000 teleworkers reduces the fixed cost to 32,000 Baht.

Sources of funds.

The government must support the budget by considering the community proposal reports.

The ways of evaluate.

- Set up the standard form of self-working schedule.
- The evaluation of job performance and job volume is crucial.

The key benefits.

- Teleworking saves on the cost of transportation:

    - The average trip expenses for one teleworker are around 60 Baht per day, which means that 100 teleworkers can save 6,000 Baht per day. 1,000 teleworkers can save 60,000 baht per day.
    - Teleworkers who use a car for the trip will save 1 liter of gasoline per 10 kilometers, meaning they can save money.
- The government saves on building rental costs.
- The community's learning center.
- Automobiles have reduced air pollution and traffic congestion.
- Workers experience less stress.

In this chapter, we provide information on how to implement teleworking, outline the steps involved, and explain how to do it. In some cases, this may involve setting up a teleworking program that enhances organizational effectiveness and aligns with government policies aimed at extending technology to remote communities.

Chapter 5
Conclusion and Recommendations

The world is getting more complex, but that doesn’t mean the workplace has to. Telworking brings more freedom and flexibility to a company and its workforce, which in turn can improve more than just the bottom line. It can simplify workflow and solve lifestyle problems in the workplace.

5.1 Conclusion.

Teleworking introduces the idea that businesses can improve their operations in many ways by reducing the need for people to travel to a physical office.

In today’s mobile business world, the keys to success are speed and autonomy. Giving workers ubiquitous access to the organization's communications and computer systems liberates them from the confines of the office desk. Teleworking is a key weapon to deploy in the new economy.

Despite the opportunities afforded by location-independent work and the proven business benefits listed, few large organizations have yet instigated formal telework programs. In practical terms, the reasons for this fall into four main categories.

There is a lack of appreciation for the business benefits and the strategic necessity. Many companies have yet to fully comprehend the implications of the 'global workplace'. They also seek 'proof' of the benefits. Nevertheless, many of the most successful early teleworking implementations were not fully cost-justified in advance. As with many innovations, there were often hidden costs but equally unanticipated benefits. These benefits are now better understood by those who ventured.

Inappropriate Technology: People often perceive the extension of the corporate network into 'insecure' homes as problematic. However, with proper planning and procedures, this is not a major stumbling block, as one government agency has proved to its satisfaction. Other issues concern helping end-users make appropriate choices

among the plethora of computer and communications technology available. In the corporate environment, the information systems department often supports a "standard package." Outside of that, the user is on their own. With increased IT literacy and more tools to help users make decisions, this dependency on the corporate IS department is diminishing. Overall, the lack of suitable technology, including ISDN, is no longer a challenge. Optimizing workflows for the new working arrangements is crucial, along with effectively packaging, documenting, and supporting the technology through user training and 'help desks'.

Those who have become accustomed to working from home also raise social and psychological concerns. One concern often mentioned is the ‘isolation’ of the home environment with its lack of social contact. Some people find satisfaction in socializing in "cyberspace," which is the realm of electronic networks. Others find new opportunities to socialize in their local community. However, they need appropriate face-to-face interaction with their coworkers and manager, and this requires proper attention.

Management and organizational issues the fourth barrier, as hinted at in the introduction, is the need for management attitudes to change, particularly among middle managers. This, in the opinion of many, represents the single most important hurdle to overcome. Traditional organizational hierarchies engender a culture built around position, status, and control. Teleworking needs a culture of delegation, autonomy, and empowerment in order to thrive. We must not dictate how workers should perform their tasks. Many middle managers feel uncomfortable about not seeing and closely supervising their own work. Many middle managers feel uncomfortable about not seeing and closely supervising their workers. There needs to be a shift from management by input (hours at work) to management by output (managing by results).

Teleworking creates a flexible and responsive workforce, enabling companies to instantly connect employees to critical office telecommunications and ICT functions without being in the office. Teleworking also expands the geographic distribution of an organization’s workforce.

The following factors are driving the increasing adoption of teleworking:

- In economics, the pressure on the bottom line is growing.
- Cultural influences are important because, as productivity increases, workers are looking for a more diverse set of benefits that go beyond common salary demands.
- Environmental factors extend beyond their social or employee impact. Air pollution, congestion, and the environmental impact of reducing commutes are also becoming bottom-line business issues.
- As promised, the emergence of the Internet, e-commerce, and corporate LANs/WANs genuinely boosts global productivity.
- Teleworking has specific advantages, including a better overall work environment that increases employee intellectual capital retention and reduces recruiting costs. IT enables improvements in workforce effectiveness and productivity, reduces overhead, increases ROI from existing infrastructure, and improves customer service and satisfaction.

5.2 Recommendations.

The project details are merely guidelines, based on the conclusion and any barriers we encountered. Implementation is practical in the real world. Its content and benefits may be useful to any teleworker, manager, supervisor, or anyone who is interested. However, based on the effort planning and troubleshooting overview presented in the practical case study, I would like to recommend the following:

- Study the organization's goals, policies, and strategies for a clear understanding.
- Understanding the impact of the technological revolution on the business chain is fascinating.
- The teleworking implementation costs more in comparison to the outcome.
- The members of the teleworking program demonstrate their abilities.
- There is a clear evaluation pattern for the teleworking program's outcome.
- Study the cultural influences, social impacts, and psychological concerns of workers.

- The government should clearly define policy statements and laws, as well as improve any factors that contribute to a successful teleworking program.

Anyway, it's important to analyze what constitutes an effective teleworking program for a specific area or business, as what works well for one may not work well for others.

Finally, this project report contains some limitations that warrant further in-depth analysis. The pilot project's implementation took place in a different economic zone. Before and after recruiting for the program, survey any useful information from the expected sample to ensure satisfaction and benefits aligned with the goal. The program's benefits extend beyond a single individual, business, or community, impacting the nation both directly and indirectly.

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http://www.theunixguy.net/docs/System_Management_Design.htm

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http://www.ttt.co.th

http://www.europarl.europa.eu

Appendices

Appendix A. Glossary.

Access Equipment	A Device specifically designed to connect remote LANS or workstations to the corporate LAN.
Access Lines, Remote Site	Telephone circuits which connect access equipment at remote site with a carrier's network
Access Line, Central Site	Circuits which connect a Company's central site with the carrier's network. They are used to route incoming data from remote workers onto a corporate LAN.
Authentication	Any one of a number of security measures that can be used to verify the identity of a remote caller.
Authorization	A system of establishing access privileges for users or group of users.
Bridge	A protocol-independent access device that transfers data packets between LANs or LAN segments over wide area network connections.
Central Site	A centralized location, such as company's corporate headquarters or regional office, which acts as a data collection point for branch offices, mobile workers, telecommuters and other remote callers.
Central Site Equipment	Remote networking equipment that connects telecommuters and other remote users to the corporate LAN.
Channel	A transmission path between two points. Usually refers to the smallest subdivision of a circuit or access line.
Circuit Switching	A communications method that dedicates an entire circuit to each call.
Compression	A feature of some access equipment that reduces the quantity of bandwidths required transmitting a block of information.
Digital Modem	A system component, which allows modem users to communicate over digital access facilities. They work by converting the PCM-encoded digital data streams sent by analog modem users into their original analog waveform.
Digital Subscriber Line	High-speed network service with speed from 128 Kbps to 6 Mbps over existing copper telephone lines.

Dynamic Bandwidth Allocation (DBA)	A process that optimizes overall networks efficiency by automatically increasing or decreasing the bandwidth of a channel to accommodate changes in data flow from end-user equipment.
E1	A digital transmission link with a total capacity of 2.048 Mbps that is divided into 32 channels, each capable of carrying a 64 Kbps voice or data stream. Used outside of North America.
Encryption	A method of transmitting a message on secretes code so that the contents of the message remain unintelligible to anyone that might monitor or copy it.
Frame Relay	A fast-packet switching technology that divides data into variable-length packets for high-speed transmission over a shared digital communications channel.
File Transfer Protocol (FTP)	A program for transferring over the Internet or other TCP/IP environments.
Internet	A global system of interconnected computers and computers network used by millions of users.
Internet Access	A method by which users connect to the Internet.
ISDN BRI	A digital access line that is divided into three channels. Two of the channels, called B-channels, operate at 64 Kbps and are always used for data or voice. The third D channel is used for signaling at 16 Kbps.
ISDN PRI(E1)	Based physically and electrically on an E1 circuit, but channelized so that two channels are used for signaling and 30 channels are allocated for user traffic.
ISDN PRI(T1)	Based physically and electrically on an E1 circuit, but channelized so that one channel (24) is used for signaling and framing information. The other 23 channels are available for user voice and data traffic.
ISDN Terminal Adapters	Simple Devices that provide ISDN Compatibility by connecting an ISDN line to the serial port of a personal Computer.
ISDN Integrated Access Bridge/Router	A remote access device that connects your computer to an ISDN line performs bridging and/or routing and supports analog devices such as phones or faxes.

Inverse Multiplexing	A method of combining individually dialed low-speed circuits into a single high-speed data stream.
Local Area Network (LAN)	A data communications network connecting computers in workgroups, departments of buildings.
Modem	A remote access device that connects to PCs and Converts digital data into analog signals.
NT1	A device used to connect terminal adapters and other terminal equipment such as ISDN telephones to an ISDN line. In North America, NT1 functionality is often integrated into an access device. In other areas of the world, the NT1 is a separate device that must be leased from the local telephone company
Packet Switching	A data transmission method that devices data into individual packet fro transmission over shared network facilities.
Perimeter Firewall	There are two types of perimeter firewalls:static packet filtering and dynamic firewalls. Both work at the IP address level, selectively passing or blocking data packets. Static packet filters are less flexible than dynamic firewalls.
Ping	A command that sends an echo request from a management workstation to an end-user device to determine if the equipment and network link are operational.
R2	A series of ITU-T specifications which refer to analog and digital trunk signaling, using compelled handshaking on every Multiple Frequency signaling digit.
Private Network	A network made up of dedicated lines leased from carriers, and switching equipment located on a customer's premises.
Remote Authentication Dial in User Service (RADIUS)	A security administration standard that functions as an information clearinghouse, storing authentication information about users and administering multiple security systems across complex networks.
Remote Access	The process of allowing remote workers to access a corporate LAN over analog or digital telephone lines.

Remote Access Server	Access equipment at a central site connects remote users with corporate LAN resources.
Remote Network	The access equipment and telephone lines that connect remote users at multiple locations to the corporate LAN.
Restricted Access	A security measure which admits or rejects callers by checking them against a list of remote node addresses programmed into a central site server.
Router	An intelligent access device that interconnects LANs of the same type and routes data according to parameters such as destination and route availability.
SNMP (Simple Network Management Protocol)	A defector standard for managing devices on a network.
S/T Interface (ISDN BRI)	A four-wire interface between an NT1 device and a terminal adapter. Outside North America, the local carrier usually provides the NT1 and the end user has the option to buy or lease a TA.
Spoofing	A method of fooling access equipment into thinking a network connection is active even when it's not.
T1	A data communications link with a total capacity of 1.544 Mbps that is divided into 24 channels, each capable of a carrying a 56 Kbps data stream. Used in North America.
Teleworker/Telecommuter	A work-at-home computer user who connects to the corporate LAN using remote access technologies.
Teleworking/Telecommuting	The use of remote access technology to establish a useful office away from the traditional workplace.
Telnet	A management tool that establishes a virtual terminal session with a teleworker's computer over wide area links. Used to perform remote configuration, diagnostics and other control functions.
U Interface (ISDN BRI)	The two-wire interface that connects to the Nt1 on a user's premises. In North America it can be integrated into the customer premised equipment. In other countries, it is typically supplied by the local carrier.
Virtual Private Network (VPN)	A method of connecting geographically dispersed locations over secure connections using the public telephone network or the Internet.

Wide Area Network (WAN)	A communications network that connects geographically remote LANs over local and/or long distance telephone lines.
World Wide Web (WWW)	An Internet service that uses a graphical, hypertext information system to create links between information resources.

Appendix B. Network technology service charge.

1. **ATM (Asynchronous Transfer Mode)**

   Service Charge.

   Installation Fee 4,000 Baht per node.

   Domestic ATM Service Fee start at 9,200 Baht per month separate by service CBR, VBR, UBR and speed from 2 Mbps up to 155 Mbps.

2. **CES (Circuit Emulation Services)**

   Service Charge.

   Installation Fee 4,000 Baht per node.

   Domestic CES Service Fee start at 5,000 Baht per month separate by speed 10 Levels; 64 Kbps, 128 Kbps, 256 Kbps, 384 Kbps, 512 Kbps, 768 Kbps, 1 Mbps, 1.5 Mbps, 2 Mbps.

3. **FR (Frame Relay)**

   Service Charge.

   Installation Fee 4,000 Baht per node.

   Domestic Frame Relay Service Fee start at 5,000 Baht per month separate by speed 10 levels; 64 Kbps, 128 Kbps, 256 Kbps, 384 Kbps, 512 Kbps, 768 Kbps, 1 Mbps, 1.5 Mbps, 2 Mbps.

4. **RAN (Remote Access Network)**

   Service Charge.

   Remote access network Service charge start at 18,000 Baht per month separate by speed 8 levels; 512 Kbps, 1 Mbps, 1.5 Mbps, 2 Mbps, 8 Mbps, 34 Mbps, 45 Mbps, 140 Mbps

5. **ADSL (Asymmetric Digital Subscriber Line)**

   Home-based user.

   - Installation Fee 1,000 Baht per node (exclude VAT)
     (not include basic telephone installation fee)
   - ADSL Modem (for rent).

Service charge.

- Normal Rate (Limited Usage Hour).

Speed	Monthly Fee (Baht) (Usage 80 Hours)	Extra Hour fee (Baht/Hour)
128/64 Kbps	500	10
256/128 Kbps	700	13
512/256 Kbps	900	17
1 Mbps / 256 Kbps	1,200	23
2 Mbps / 256 Kbps	1,600	30

- Extra Rate (Unlimited Usage Hour).

Speed	Monthly Fee (Baht) (Unlimited Usage Hour)
128/64 Kbps	4,300
256/128 Kbps	5,900
512/256 Kbps	8,100
1 Mbps / 256 Kbps	9,300
2 Mbps / 256 Kbps	10,600

- Corporate user Rate or ISP
  - Installation fee 4,000 Baht per node
  - Domestic ADSL service fee start at 17,200 Baht per month separate by speed 11 levels; 128 Kbps, 256 Kbps, 1 Mbps, 2 Mbps, 4 Mbps, 6 Mbps, 8 Mbps, 16 Mbps, 34 Mbps, Mbps, 155 Mbps

6. LAN System / BIZ Connect

Installation fee

1. First investment (exclude VAT)
   - 1.1 ISDN Connect fee 3,350 Baht
   - 1.2 ISDN LAN Modem / ISDN Router / ISDN Remote Access Fee 16,000 Baht up.
2. Monthly Fee (Exclude VAT)
   - 2.1 Telephone line leased 100 Baht

2.2 Network terminal (for rent) 100 Baht

7. PABX (Private Automatic Branch Exchange)

ISDN PABX usage fee (pass PRI)

Installation Fee

1. First investment (exclude VAT).

1.1 ISDN Connected Fee 100,500 Baht

1.2 ISDN PABX Fee 300,000 Baht up.

2. Monthly fee (exclude VAT).

2.1 Telephone line leased (30 lines) 7,500 Baht

8. Huge Datacenter / Internet service Center

ISDN Fee

Installation fee.

1. First investment (exclude VAT)

1.1 ISDN Connect fee 100,500 Baht

1.2 ISDN PABX fee 300,000 Baht up.

2. Monthly Fee (exclude VAT)

2.1 Telephone line leased 7,500 Baht

***Table 1**- The Comparison expenses in each Operators for the connection services charge*

Type of Technology Services	TOT	TA	UCOM	TT&T
ATM (Asynchronous Transfer Mode)				
- Installation fee	4000 Baht/node	-	-	-
- Monthly fee for CBR, VBR, USR Speed from 2 Mbps-155 Mbps	Started at 9200 Baht/m.	-	-	-
CES (Circuit Emulation Service)				
- Installation fee	4000Baht/node	-	-	-
- 10 Levels Monthly fee from 64,122,192,256,384,512,768 Kbps 1,1.5,2 Mbps	started 5000 Baht/m	-	-	-
FR (Frame Relay)				
- Installation fee	4000Baht/node	8000 Baht/node	-	-
- 10 Levels Monthly fee from 64,122,192,256,384,512,768 Kbps 1,1.5,2 Mbps	started 5000 Baht/m	started 4500 Baht/m	-	-

RAN (Remote Access Network)	**TOT**	**TA**	**UCOM**	**TT&T**
- Internet connection at speed 64/128 Kbps	3 Baht/time	-	-	3 Baht/time
- 8 Levels Monthly fee from 512,1024,1536,2048 Kbps 8,34,45,140 Mbps	Started 18000 Baht/m	-	-	started 20000 bath/m
1.First Investment				
1.1 ISDN Installation fee	3350 Baht	3350 Baht	-	3400 Baht
1.2 ISDN LAN Modem/ISDN router/	16000 Baht up	16000 Baht up		1600 Baht up
ISDBN Remote Access				
2. Monthly fee for				
2.1 Numbering	100 Baht	100 Baht		100 Baht
2.2 Network Terminal Devices	100 Baht	100 Baht		100 Baht
PABX				
1.First Investment				
1.1 ISDN connection fee	100500 Baht	100500 Baht	-	100500 Baht
1.2 ISDN PABX devices	300000 Baht up	300000 Baht up		300000 Baht up
2. Monthly Fee				
2.1 Numbering (30 circuits)	7500 Baht	7500 Baht	-	7500 Baht
ISDN for Data Center				
1. First Investment				
1.1 ISDN connection fee	100500 Baht	100500 Baht	-	-
1.2 ISDN Remote Access devices	400000 Baht up	400000 Baht up	-	-
2. Monthly Fee				
2.1 Numbering	7500 Baht	7500 Baht	-	-
ADSL (Asymmetric Digital Subscriber Line)				
1. Normal user services charge				
- Installation Fee	1000 Baht/node	1000 Baht/m	1500 Baht/node	1000 Baht/node (T-Speed)* 2000 Baht/node (T-Express)*
- ADSL Modem*(For Rent)		-		
- Service Charge		-		
Normal	(less than 80 hrs./m.)	Exclude internet hours	Less than 100hrs.	
128/64 Kbps	500 Baht/m	1000 Baht/m	1000/m	-
256/128 Kbps	700 Baht/m	1200 Baht/m	1400/m	1400/m
512/256 Kbps	900 Baht/m	-	3000/m	1900/m
ADSL (Asymmetric Digital Subscriber Line)				
1 Mbps /256 Kbps	1200 Baht/m	-	-	-
2 Mbps /256 Kbps	1600 Baht/m	-	-	-
Extra Fee (Unlimited usage)				
64/64 Kbps		-	3000 Baht/m	
128/64 Kbps		4600 Baht/m	4200 Baht/m	
128/128 Kbps	4300 Baht/m	-	4750 Baht/m	4300 Baht/m
256/128 Kbps		68000 Baht/m	6200 Baht/m	
256/256 Kbps	5900 Baht/m	-	7000 Baht/m	5900 Baht/m
512/256 Kbps		11000 Baht/m	10500 Baht/m	

	TOT	TA	UCOM	TT&T
512/512 Kbps	8100 Baht/m	8000 Baht/m	14000 Baht/m	8100 Baht/m
1 Mbps /512 Kbps	9300 Baht/m	14800 Baht/m		9300 Baht/m
2 Mbps /512 Kbps	10600 Baht/m	Exclude internet hours		
ADSL (Asymmetric Digital Subscriber Line)				
2. Enterprise or ISP User				
- Installation fee	4000 Baht/node		5000 Baht/node	
- 11 levels Monthly Fee 128,256,512 Kbps 1,2,4,6,8,16,34,155 Mbps	started 17200 Bath/m			

DSL Modem Price list

Generation	Supported OS	Price (Baht)
Logix Atalnata -PCI	Win95/98/ME/NT/2000	5,500
Alcatel 1000-Ethernet	All Platforms	14,000
Nokia M5122-Ethernet	All Platforms	15,800
Nokia M1122-Router	All Platforms	23,600

Table2 *- The comparison of Tspeed and Texpress from ADSL user of TT&T.*

Comparison	T-Speed	T-Express
Implementation	Work with 1 PCs	Work with more than 1 PCS e.g. LAN
Channel	Asymmetry that mean ddownstream speed greater than upstream	Symmetry means up and downstream are the same except T-Express 1024
Speed	2 Level 2 Max. at 256 Kbps	Alternatively, at 4 level max. to 1024 Kbps.

Appendix C. Sample of Teleworker Agreement.

The Teleworker Agreement is a legal document identifying the responsibilities of both the teleworker and the employer. The agreement mirrors the policies. The employee signs the agreement.

Teleworker Agreement.

This Agreement, effective _____, is between _____, an employee (referred to as "Employee") and_____(referred to as "Employer").
The parties, intending to be legally bound, agree as follows:

Scope of Agreement: The employee agrees to perform services for the employer as a "teleworker." Both the employee and the employer have the right to terminate the teleworking arrangement at any time, with or without cause.

Term of Agreement: This agreement shall become effective as of the date written above and shall remain in full force and effect as long as the employee teleworks, unless the agreement is terminated.

Termination of Agreement: The employee's participation as a teleworker is entirely voluntary. Teleworking is available only to eligible employees, at the employer's sole discretion. The entire organization does not intend to use teleworking as an employee benefit. Therefore, the organization does not guarantee or grant any employee the right to telework. Either party may terminate the employee's participation in the program, with or without cause, upon reasonable notice in writing to the other party. The cessation of participation in the teleworking program will not incur any costs, damages, or losses for the employer. You should not interpret this agreement as an employment contract.

Salary, Job Responsibilities, and Benefits: Participation in the program won't alter the employee's salary, job responsibilities, or benefits, unless they would have if they had remained in the office full-time. This includes scheduled regular salary reviews and the right to any company-wide benefit changes. The employee agrees to comply with all current job requirements in the office.

Work hours, overtime, and vacation: work hours are not expected to change during the program. If you anticipate overtime, you must discuss and approve it in advance with the manager, just like you would with any other overtime scheduling.

Work Schedule: The daily work schedule for the days when working at home is subject to negotiation with and approval by the employee's manager. The manager may require that employees work certain "core hours" and be accessible by telephone during those hours.

Equipment: The employer may provide the necessary computer, modem, software, and other equipment needed for teleworking. The company owns all these items and requires their return upon request. The employer provides the computer, modem, software, and any other equipment or supplies for use on company assignments. Other household members or anyone else. You may not duplicate company-owned software unless you receive formal authorization. The employer will be responsible for the insurance and maintenance of all company-provided materials. Employees may use personal equipment for teleworking. In such cases, the employee will be responsible for the maintenance and insurance required for the equipment.

Workspace: The employee commits to designating a specific area within their remote work location for the placement and installation of equipment necessary for teleworking. The employee agrees to maintain this workspace in a safe condition, free from hazards and other dangers to the employee and equipment. The employer must approve the site chosen as the employee's remote workspace. Before implementation, the employee must submit three photos of their home workspace to management. Employees must store any company materials they bring home in their designated work area, ensuring they remain inaccessible to others. The employee agrees that the employer can make on-site visits (with 48 hours advance notice) to the remote work location for the purpose of determining that the site is safe and free from hazards and to maintain, repair, inspect, or retrieve company-owned equipment, software, data, or supplies. In the event that legal action is required to regain possession of company-owned equipment, software, or supplies, the employee agrees to pay all costs incurred by the employer, including attorney's fees, should the employer prevail.

Office Supplies: The employer will provide office supplies as needed. The manager's prior approval is required to reimburse employees' out-of-pocket expenses for other supplies.

Worker's Compensation: Under our state's Workers Compensation laws, the employer will be liable for any work-related injuries, but this liability is only applicable to injuries that directly result from work and only if the injury occurs in the designated work area. Any worker's compensation claims will be handled according to the standard procedure.

Liability for Injuries: The employee understands that the employee remains liable for injuries to third parties and/or members of the employee's family on the employee's premises. The employee pledges to shield the employer, its affiliates, employees, contractors, and agents from and against any claims, demands, or liabilities (including any associated losses, costs, expenses, and attorney fees) stemming from or connected to any personal injury (including death) or property damage, either directly or indirectly, resulting from the services the employee provides or from the employee's deliberate misbehavior, careless actions, or omissions during the execution of the employee's responsibilities under this Agreement. This includes claims, demands, or liabilities arising from the employer's gross negligence or willful misconduct.

Dependent Care: Teleworking is not a substitute for dependent care. Teleworkers will be unavailable to provide dependent care during company core hours.

Income Tax: It will be the employee's responsibility to determine any income tax implications of maintaining a home office area. The employer will not provide tax advice or assume any additional tax liabilities. We encourage employees to consult with a qualified tax professional to discuss their income tax implications.

Evaluation: The employee agrees to participate in all studies, inquiries, reports, and analyses relating to this program. The employee remains obligated to comply with all of the employer's rules, practices, instructions, and this agreement. The employee comprehends that any breach of the aforementioned guidelines could lead to their exclusion from teleworking.

I have read and understood this agreement, and I accept its terms.

EMPLOYEE _____DATE _____

EMPLOYEE MANAGER _____ DATE _____

PROGRAM DIRECTOR_____DATE _____

Appendix D. Employee Self-Assessment Form.

Please use this assessment to help determine whether or not you think teleworking is a viable option for you. Once you have rated yourself in each category, add up the individual scores to develop a composite score for position characteristics. Follow the same procedure to develop a composite score for professional characteristics. Record the composite scores in the provided space.

Part I: Score your answers to the items below by using this scale;

"Always" = 3, "Frequently" =2, "Sometimes" = 1, "Never" = 0

Does your position:

Position Characteristics	Score
1. allow grouping of any face-to-face meetings with public or internal clients on specified days, leaving the other days for teleworking?	
2. have tasks that can be grouped and scheduled for teleworking?	
3. involve research or processing of information?	
4. involve communications that can be handled by phone, voice mail, or e-mail?	
5. allow for the creation of milestones, timelines for product delivery, or other measurable completion criteria?	
6. allow remote access to online information?	
7. have a low-level need for special equipment that only exists in the main office?	
8. have enough flexibility that would allow you to still meet internal and external client needs even while teleworking?	
9. allow a high level of interpersonal contact to take place via electronic communication?	
10. involve continuous tasks in large blocks of time, rather than fragmented tasks (i.e. "fighting fires") that continually require your coordination efforts?	
11. have a low-level need for physical access to special, fixed resources?	
12. involve a low level of sensitive information that requires physical security?	
13. use information resources that, if necessary, can be removed from the office and taken home for a day or two?	
Position Score	

Part II: Score your answers to the items below by using this scale;

"Always" = 3, "Frequently" =2, "Sometimes" = 1, "Never" = 0

Do you have:

Professional Characteristics	Score
1. the ability to design and schedule your work flow?	
2. the ability to define tasks and work products in terms of objectives and measurable activities?	
3. the ability to complete work projects on-time with minimal supervision and feedback?	
4. a good working knowledge of DOT's procedures and policies?	
5. the ability to set your own priorities and deadlines?	
6. the ability to be productive even when no one is checking on you or watching you work?	
7. strong organizational and time management skills?	
8. a job performance track record that is "outstanding" to "very good?	
9. an effective working relationship with co-workers?	
10. well-established work, communication, and social patterns at your main workplace?	
11. the ability to continue providing support to co-workers even while working at home?	
12. the ability to objectively express needs?	
13. the ability to develop solutions after expressing a need?	
14. flexibility around changing a work routine?	
15. the self-motivation to start something that you really don't want to do?	
16. the self-discipline to stick with something until it's done?	
17. the ability to work independently of your team when you need to?	
18. the ability to adapt to a changing work environment?	
19. the ability to set a comfortable pace if you worked at home?	
20. the ability to remain focused on work and not be distracted even if you worked at home?	
21. the willingness to come into the office on a regularly scheduled telework day if supervisor, co-workers, or customers need you there?	
22. the ability to adjust to the relative isolation of working at home?	
Professional Score	

	Scores
Position	
Professional	

Have you already taken work home?

Yes. ☐ No. ☐

Does the idea of teleworking make you uneasy about completing your work on time?

Yes. ☐ No. ☐

How do you feel telework will impact the quality of your work?

☐ Not at all.

☐ Improve.

☐ Decline.

Do you think telework will help you improve your time management skills?

Yes. ☐ No. ☐

Are you concerned that your relationships between your supervisors and co-workers might change after you begin teleworking?

☐ Not concerned.

☐ A little concerned.

☐ Very concerned.

What benefits do you anticipate from telework (check all that apply)?

☐ Increases in productivity.

☐ Improvement in morale.

☐ Improvement in communication skills.

☐ Allows a better balance of work and personal life.

☐ Avoids stressing commutes.

☐ Other (Specify) _____