Case Study
The Synergism of Telecommuting and Office Automation

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How one company implemented a "telework" program that transformed paper-based processes and reliance on voice communications into automated procedures supported by full-scale connectivity.

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Despite considerable research, many managers remain ambivalent about introducing telecommuting as a business strategy.[1] Should the strategy be aimed directly at solving business problems or be integrated into the reward structure of the organization? These and other questions persist. Although a few detailed case studies address telecommuting, analytical frameworks for examining cost/benefit issues are rare.

In this article, we describe in detail a successful telecommuting program implemented at a 150-person company that provides interactive marketing and sample-distribution services for the pharmaceutical industry. Each of the firm's eight divisions is headed by a director or vice president who sits on the firm's executive board. The general manager — a champion of high-tech solutions who has supported the telecommuting program since its inception — creates company policy, which the executive board members implement. The information architecture of the company consists of a mainframe, a minicomputer, and more than 200 personal computer (PC) systems linked by four file servers. Headquartered in New Jersey, the firm had also maintained sales offices in Pennsylvania and Illinois before introducing telecommuting.

In 1995, the company's twenty-person salesforce became remote workers who

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The firm achieved greater accountability and control through automation.

relied on mobile computing equipment to conduct business. By 1998, the company had expanded its telecommuting program to support two more sales-people and fourteen part-time telecommuters in managerial and analytical positions — 24 percent of the firm's workforce.[2]

The firm's telecommuting program transformed paper-based procedures and heavy reliance on voice and in-person communications into automated procedures and full-scale connectivity. The program generated real-estate savings, increased managerial control of the field force, reduced processing errors, and improved customer service. The firm achieved greater accountability and control through automation, thereby alleviating one of management's main concerns — how teleworkers allocate their time outside of a traditional office setting.

Of course, these benefits did not materialize without cost. The program affected salespeople, middle managers, and information systems (IS) personnel. Middle managers were concerned about their lack of experience managing a distributed workforce and their perceived loss of control over employees. Sales representatives were concerned about privacy issues and their lack of computer skills. The immediacy of the telecommuting program requirements forced IS personnel to set new priorities, delayed other aspects of their work, and meant working overtime.

Completing the initial support structures for the implementation of remote computing is the milestone that marks the beginning of steeply reduced ongoing direct costs. In general, an organization implements a remote-computing strategy and infrastructure designed to service a large number of teleworkers. It is not until this infrastructure is exhausted that a firm must make another significant investment. In our case study, the upgraded infrastructure supported all company employees.

We interviewed company managers, reviewed internal documents and company publications, and directly examined the systems that the firm introduced. We also conducted a user survey to evaluate teleworkers' perceptions of the program.

In the following sections, we describe the rationale for the telecommuting efforts, the program implementation and information infrastructure, participants and training, costs and savings, general business impact, social issues, performance measurement, managerial control, and unintended consequences of the program.

Rationale for Telework

The executive board determined that information technology (IT), specifically the introduction of remote-computing capabilities, would better position the organization to achieve its strategic goals. Remote computing could help the company increase its processing capacity because the improvements in the information architecture would increase throughput and decrease order-processing time. Individuals would spend less time managing paper, tracking down incomplete orders, and correcting errors, thereby creating time for revenue-producing activities. For example, an increase in productivity of at least 5 percent could be achieved by turning the sales representatives into full-time telecommuters armed with computers and cellular phones. The board objectives were also aimed at increasing accountability and improving service delivery through the introduction of telecommuting.

The activities of the sales representatives center on contacting pharmaceutical or publishing clients and trying to make a sale. Information flows through the organization from the bottom up by means of two sales divisions — the pharmaceutical sales division with twelve sales agents and the publications division with eight. Each salesperson "prospects" for new customers, calls on existing customers, writes up sales quotations and sales orders, attends sales meetings, and consults with his or her sales manager to discuss future opportunities. Each sales representative has quarterly and annual quotas and must call five customers per week. Territories are divided into customer accounts, with the accounts representing over $1 million in sales handled by the most experienced or successful sales agents.

When a sale is made, the sales agent communicates the transaction to a client-service representative via a field order form. The client-service representative, in turn, marshals the company's various resources (i.e., the MIS, production, and warehouse departments) to create and distribute the product. Missing or incorrect information may cause production delays and losses in revenue. Order instructions are placed in a folder

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referred to as a "traveler." This folder travels from division to division as each department sequentially or concurrently complete its tasks. Upon completing the job, the firm notifies the client and sends the folder to the billing department.

By providing the sales staff with laptop computers and empowering them to make decisions, enter orders, and work without supervision, telecommuting effectively pushes the locus of authority and control from middle management downward to the salespeople. Therefore, the salesforce validates data at the point of entry, which greatly reduces errors. The salespeople enter data into the traveler using their laptop PCs, and they access information on-line, thereby saving a vast amount of paper and eliminating manual labor. This approach also significantly speeds the company's responsiveness by decreasing decision-making time, programming out errors, and shrinking the chain of command.

Program Implementation

While informal telework requires only a supervisor's permission, a formal telecommuting effort requires careful planning, because it demands adjustment in most organizational dimensions and policies. New skills must spread quickly throughout the organization, and the firm must spend a vast amount of capital to update its information infrastructure and to train employees.[3]

Technology Introduction Issues

When the organization decided to introduce the telework program, managers expected the IS department to achieve three main objectives:

- Deploy a reliable, new information technology architecture. This consisted of installing new software and hardware resources, expanding the architecture to include remote access, and providing solutions to security concerns.
- Develop business applications to facilitate the full automation of salesforce activities.
- Provide technical solutions to business problems, that is, performance measurement and managerial control of the distributed workforce.

As in many streamlining or business-process redesign projects, the objectives of the IS department involved issues that cross the boundary between business and technological subsystems. Containing behavioral as well as technical components, these issues demanded additional cooperation between business and IS managers. For example, in performance evaluation, business managers must shift from managing by attendance to managing by results.[4] At the same time, IS managers must provide technical tools for business managers to communicate with their employees.

Employees having business skills and IS experience are the links between separate operations within an organization,[5] and they are essential for successfully implementing IT-enabled transformations such as telework programs. Because such programs have technical and business implications and because they integrate technology into the business process, a reliable IT infrastructure is essential. However, business managers' cooperation in adjusting policies and procedures is also important; technology alone does not solve every business problem. Both groups must cooperate to launch the program successfully. In this case study, the IS director (who holds a Master's degree in IS and an MBA degree) was the bridge between the business managers and IS staff.

The IS department was responsible for planning, implementing, evaluating, and maintaining the information architecture of the company. It employed twenty-two analysts, designers, and programmers. The director of the IS department was aware of the visibility of the telecommuting program and secured top management support. It was clear to him that the deployment of a reliable information infrastructure would be key to the program's success. The director was also aware of the demands that the telecommuting program would place on the resources of his department.[6]

The IS staff was under tremendous pressure to upgrade the IT infrastructure, especially during the first 6 months of the program. The firm hired two full-time network administrators, and the project stretched resources to the limit until the program became operational. Sales representatives, who were

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under great pressure to succeed, often used technical difficulties to justify lagging sales or a lack of communication between the field and management. Systems had to be operational 24 hours a day in order to coincide with the hours kept by the field salesforce. Individuals dialed in from locations overseas, in Canada, and throughout the United States. New forms of access required changes to the software running both the applications and the remote-control login apparatus.

Information Infrastructure and Business Applications

The company allocated 6 months for completing program implementation and transforming the business process (sales) from an office-based to a remote-based process. Implementation of the telework program progressed simultaneously in the following three main layers:

- Layer 1. IT infrastructure upgrade and support.
- Layer 2. Telework enablers.
- Layer 3. Salesforce applications.

The first layer involved upgrading the IT infrastructure to facilitate the virtual work environment. It included new network hardware and software, new IS personnel skills, network support and administration, remote-access capability, and automating remote-access procedures. This layer supported all teleworkers, regardless of their job assignments or status (i.e., full-time or part-time). The second layer involved equipping employees with the necessary IT devices needed to transform them into teleworkers. It included deploying laptop computers and setting up remote accounts. The third layer focused on automating sales business applications and procedures. This layer supports only sales personnel. (For the cost of each layer, see *Table 1*.)

The company decided to update its in-house information infrastructure and immediately focused on network upgrades. It then provided in-house employees with new PCs, electronic mail, the Microsoft Office™ suite of software tools, and printers. The salesforce received laptop computers, fax modems, and cellular phones. The company provided all sales representatives with remote-computing equipment and access to computer docking stations at the company headquarters in New Jersey. In addition, the IS staff simultaneously performed a pilot remote-computing study with personnel from the Pennsylvania sales office. They asked the five salespeople from the Pennsylvania office to

telecommute for the pilot study and consequently closed the office.

To fully automate sales procedures, the program progressed through the installation of three business software applications. The first was CAS, a cost-account-

Table 1

Cost of Transforming IT Infrastructure

	Start-Up Cost (US$ thousand)		Ongoing Costs (US$ thousand)	
	1995	1996	1997	1998
Layer 1. IT Infrastructure Upgrades [a]	$445.8	$93.0	$62.0	$35.0
Layer 2. Telework Enablers [b]	116.6	19.1	24.4	50.9
Layer 3. Salesforce Applications [c]	92.0	14.8	11.8	3.8
Total Direct Cost	**$654.4**	**$126.9**	**$98.2**	**$89.7**
Layer 1 [d]	$22.29 (20)	$4.04 (23)	$2.30 (27)	$0.97 (36)
Layer 2 [d]	5.83 (20)	0.83 (23)	0.90 (27)	1.41 (36)
Layer 3 [d]	4.60 (20)	0.64 (23)	0.44 (27)	0.11 (36)
Total Direct Cost per Teleworker	**$32.72**	**$5.52**	**$3.64**	**$2.49**
Layer 1 [d]	$22.29 (20)	$4.04 (23)	$2.30 (27)	$0.97 (36)
Layer 2 [d] (Additional Teleworkers)	5.83 (20)	6.37 (3)	6.09 (4)	5.65 (9)
Layer 3 [d] (Sales Staff or Full-Time Teleworkers)	4.60 (20)	0.74 (20)	0.56 (21)	0.17 (22)
Total Direct Cost (weighted) per Teleworker	**$32.72**	**$11.15**	**$8.95**	**$6.79**

[a] Layer 1: IT infrastructure upgrades include network hardware and software, office PCs, network administration and support, and IS training.

[b] Layer 2: Enablers are the hardware and software required for remote communication between the teleworker and the main office (i.e., laptop computers, docking stations, remote-access software PCAnywhere™, teleworker training, and security hardware and software).

[c] Layer 3: Salesforce applications include developing the CAS, the remote order-entry applications, and the salesforce support software (GoldMine™).

[d] Numbers in parentheses indicate the number of teleworkers supported by the layer.

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ing and computerized time-tracking system; the second was GoldMine™, a sales-contact management application; and the third was a remote order-entry system. The firm offered training for each of these Windows-based software applications. The CAS and on-line order-entry systems were developed internally using the Microsoft Visual Basic™ programming tool and the Microsoft Access™ database software. In 1999, the company migrated to an Oracle database, a change that was transparent to the user community. The GoldMine™ software was purchased and installed "off-the-shelf." These business software applications were necessary to facilitate remote sales activity and to ease management's concerns about monitoring performance.

Whenever sales activity culminated in an order, the system correlated expenses associated with that order to help determine the true cost of obtaining the sale.

CAS allowed the field salesforce to allocate daily working time across various client accounts: employees could input by client-id, travel time, meetings, and time spent editing proposals and entertaining. Moreover, whenever sales activity culminated in an order, the system correlated expenses associated with that order to help determine the true cost of obtaining the sale. Thus, the development of the CAS system and its implementation in conjunction with telecommuting allowed management to implement stricter controls on the field salesforce.

The GoldMine™ software application allows salespeople to organize all sales-related activities, such as the number of client calls and the automatic generation of thank-you and follow-up letters to clients. The firm requires salespeople to track their sales activities using this software and to download this information monthly, compiling the data into reports that the sales management team uses to determine the frequency and quality of field activities.

The order-entry application allows sales representatives to initiate job orders from the field for the client-service representatives. This application resides on the corporate local area network, and the salesforce accesses it remotely. It allows sales representa-

tives to enter orders without returning to the office and eliminates the need to relate complex order information over the telephone. The system is self-validating and does not allow the entry of an incomplete or incorrect order. It replaces the paper sales traveler entirely and has significantly reduced the order-processing cycle.

Participants and Training

In 1995 when the firm introduced telecommuting, the company had twenty sales representatives, ranging in age from 29 to 56 years with length of service ranging from 1 to 20 years. Three had experience using PCs and another five had access to PCs in their homes. All individuals attended the same in-house training classes and learned to use the Microsoft Office™ software suite and general PC functions.

Formal Training. Each salesperson received a laptop computer and several days of general PC training over a 2-month period. The human resources department conducted mandatory training, which took place during work hours after monthly national sales meetings. All the trainees simultaneously received instruction at the same place, minimizing their time out of the field. The training curriculum extended for 19 hours and covered the following applications: Microsoft Office™, PCAnywhere™, CAS, Winfax Pro™, and GoldMine™.

The quickness with which the field salesforce began using the equipment was directly proportional to the level of computer experience the individual had before the training. Those with computers at home caught on the fastest, followed by those who had toyed with the devices at the office. These individuals were also the top-ranking salespeople in the firm. Each salesperson had to pass the training examinations to qualify for field work. Tests took place 90 days after the training session. Two salespeople failed the qualification, and this, in combination with their histories of lackluster performance, resulted in their termination. Two other sales representatives, when told about the PC qualifications requirement, asked for and received early retirement incentives. The adaptability of individuals selected to telecommute plays an important role in their success at managing the change process."

Informal Training. Informal training began as soon as the field representatives received their laptop PCs. Feeling somewhat flattered that the company invested

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in a several-thousand-dollar piece of equipment for each of them, they immediately began looking for opportunities to learn as much about the hardware and software as possible. Most relied heavily on family members (i.e., their children) to teach them basic PC functions. This allowed them to learn about the system without revealing how much they did not know. For others, playing computer games helped them become comfortable with their PCs. When all else failed, the sales staff would informally quiz members of the IS staff on specific functions. Many of the field force privately stated that they used IS as a last resort for gaining information because they felt embarrassed by their lack of PC familiarity.

Cost of the Telework Program

The cost/benefit evaluation framework of the program distinguishes between direct costs and savings and indirect impacts. Direct costs and savings are usually tangible and easy to quantify, whereas indirect effects, while important, are difficult to quantify or isolate. Next, we analyze the cost of upgrading the IT infrastructure (layer 1) versus the cost of IT enablers (layer 2) for new teleworkers. In addition, we classify the costs as start-up or ongoing, focusing on the direct costs and savings. Later, we discuss the indirect costs.

Project IT/IS Direct Cost

The direct cost of implementing the telework program included the cost of IT resources (hardware and software), sales process redesign (automating business applications), training (teleworkers and IS personnel), and network administration *(see Table 2)*. Ongoing

direct costs dropped sharply after completing the initial installation and support structures. Among the four categories, only the ongoing costs of hardware and software did not drop, mainly because of the cost of equipping new teleworkers and the high cost of mobile computing devices. The network administration start-up costs included the cost of hiring additional network administrators to support the project.

Real-Estate and Personnel Costs and Savings

The impact on real-estate expenses was immediate. The company closed its Pennsylvania office, saving the organization $26,000 annually *(see Table 3)*. This represented 9.7 percent of the total company rent expense. Additional space in New Jersey was no longer needed. Before implementing mobile computing, the company was short seventeen offices in New Jersey and was considering moving to another location (estimated moving cost, $246,000; annual rent cost, $15,000). The migration of the salesforce out of the office allowed the organization to accommodate twenty individuals with only four offices. The firm hired an architectural firm to redesign the New Jersey office in light of the telecommuting program, making the move unnecessary. The cost of office redesign was $103,500. The savings in real estate costs associated with the remote-computing project totaled $183,500 in the first year, representing 28 percent (183.5 ÷ 654.4) of the direct IT/IS start-up costs in 1995.

In addition to real-estate savings, the project directly affected personnel costs *(see Table 4)* by eliminating one clerical position and two sales positions. Before the telework project, the salesforce maintained all order and contact information on legal pads. These

Table 2
Direct Costs by Category

	Start-Up Costs (US$ thousand)		Ongoing Costs (US$ thousand)	
	1995	1996	1997	1998
Hardware and Software	$404.9	$42.9	$36.2	$52.7
Network Administration	154.0	65.0	46.0	31.0
Automating Business Applications	85.5	14.0	11.0	3.0
Training	10.0	5.0	5.0	3.0
Total Costs	$654.4	$126.9	$98.2	$89.7

Table 3
Real-Estate Savings

	Savings (−) or Expense (US$ thousand)			
	1995	1996	1997	1998
Closing Regional Offices	$− 26	$− 26	$− 26	$− 26
Rent Savings	− 15	− 15	− 15	− 15
Moving Savings	−246	0	0	0
Office Redesign Expense	103.5	0	0	0
Total Savings	$−183.5	$− 41	$− 41	$− 41

notes were given to a sales clerk who would type and format the information for use in reports and sales orders. The automation project allowed the salesforce to enter all sales contact information into the GoldMine™ data-management application, thus eliminating the need for this clerical function. Information could be transferred directly from the GoldMine™ application into a report or the order-entry system automatically. Clerical savings were partially offset by severance payouts to terminated employees ($40,000 in 1995). Savings in personnel expenses amounted to $35,000 in 1996, $37,000 in 1997, and $38,000 in 1998. The firm had not budgeted for the termination expense or the clerical savings.

Net Cost of the Project

In 1998, real-estate savings offset 46 percent of the total IT/IS costs (i.e., start-up and ongoing costs for new teleworkers). In fact, direct savings in real estate and personnel were equivalent to 88 percent of the total direct project costs in 1998. The annual direct costs of supporting the telework program are ongoing. (See Table 4 for direct costs and savings.)

Fourteen part-time telecommuters also began using the IT infrastructure that had originally been set up for full-time telecommuters, thus reducing the cost per employee of maintaining the IT infrastructure (see Table 5). The same infrastructure that allowed sales-force personnel to work remotely also gave the firm the option of offering telework to rank-and-file personnel, consequently changing the culture of the entire organization. (For more details, see the section "Unintended Consequences," p. 93.)

The net cost for each additional teleworker decreased over time, dropping from $25,540 in 1995 to $1,190 in 1998 (see Table 5). As the number of teleworkers increases and the cost of the IT infrastructure is distributed over a larger number of employees, the cost of supporting a teleworker decreases. This pattern continues until the IT infrastructure can no longer support additional teleworkers.

Looking Differently at the Costs

In the previous section, we detailed the implementation of the telework program through three main layers: (1) IT infrastructure upgrade and support, (2) telework enablers, and (3) the automation of sales-force applications. Although the *total* direct cost of the project declined over time, this decrease did not occur across all layers of the project. The telework-enablers layer actually *increased* in cost as additional teleworkers took advantage of the remote access infrastructure (see Table 1).

The start-up cost to equip a teleworker did not substantially decrease over time, because the actual cost of hardware did not drop significantly. Although the price of computing in terms of processor speed and memory decreased, the actual price of the equipment did not fall significantly — specifically, the price of top-of-the-line laptop computers. In 1998, the start-up cost for telecommuting personnel was $5,650, compared with $5,830 in 1995.

As time passes, the ongoing cost to support teleworkers decreases due to the incremental nature of IT infrastructure upgrades that facilitate remote computing

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Table 4
Project Net Cost

	Start-Up Costs (US$ thousand)		Ongoing Costs (US$ thousand)	
	1995	1996	1997	1998
Direct Costs	$654.4	$126.9	$98.2	$89.7
Real-Estate Savings	−183.5	− 41	− 41	− 41
Personnel Expenses or Savings	40	− 35	− 7	− 38
Net Cost	$510.9	$50.9	$20.2	$10.7
Savings ÷ Direct Costs	22%	60%	79%	88%

Table 5
Net Cost Per Teleworker

	1995	1996	1997	1998
Full-Time Salesforce	20	20	21	22
Part-Time Employees	0	3	6	14
Total Number of Teleworkers	20	23	27	36
Net Cost per Teleworker*	$25.54	$2.21	$0.76	$0.3
Net Cost per Additional Teleworker*	$25.54 (20)	$16.97 (3)	$5.05 (4)	$1.19 (9)

* Costs are in US$ thousand; the number of teleworkers is in parentheses.

(see Table 1). In general, an organization implements a remote-computing strategy and infrastructure to serve a large number of teleworkers. It is not until this infrastructure is exhausted that a company has to make another significant investment. In 1998, the cost of supporting a part-time telecommuter and a full-time telecommuter was $970 and $1,140, respectively. Total cost (start-up and ongoing) was $6,790 (the sum of all layers) for salesforce personnel and $6,620 for part-time telecommuters (layers 1 and 2). The difference in the ongoing cost for the two groups is minimal.

General Impacts

Next, we examine the impact of the telecommuting program on business and personnel issues. In general, measuring these impacts involves two main problems: isolating them from other factors and quantifying them. Managers and evaluators must be careful when using subjective measures (opinions and perceptions of users or introducers of the project) to assess IS/IT projects. Often introducers focus more on justification than on evaluation. In many cases, they overstate the benefits to get their projects approved, and most organizations do not conduct post-project evaluations.[8] In this case, we carefully assessed the impact of the project. We found that introducers understated the cost of the project; however, they were realistic about their expectations of overall benefits. Indeed, there have been positive, unintended benefits that we present later in this section.

Impact on Business

The project increased revenue in at least three different ways:

- It streamlined internal operations (speed and accuracy).
- It increased salesforce field time.
- It improved customer relationships. (Doing business became easier and the company's image was modernized.)

The telecommuting project significantly upgraded the company's IT infrastructure, resulting in more streamlined operations. The increased speed with which information passed from department to department, coupled with the ability to have better information on hand for decision making (e.g., forecasts and client discounting), led to the conclusion — albeit observational — that employees were making better decisions, which resulted in increased revenue. In fact,

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A 15 percent increase in field time translated into a 10 percent increase in overall sales.

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the firm's improved infrastructure and services were credited with saving a $300,000 account.

Field salesforce time increased by 15 percent since the program's inception, as measured by the CAS system. Management determined that a 15 percent increase in field time translated into a 10 percent increase in overall sales. The opportunity cost of each day a salesperson spends in the office rather than in the field pursuing a client was approximately $3,200 in revenue. In fact, during the 4 years after the telework program began, actual sales and revenues increased more than 10 percent annually (see Table 6). Managers estimated that 80 percent of the increase was due to the telecommuting project. Considering that the external and internal environments were relatively stable (i.e., no changes in competitors, company leadership, and services), we believe that this estimate was accurate. Most of the remaining increase (approximately 20 percent) was attributed to putting more people in the field. Two additional salespeople were hired, one in 1997 and another in 1998.

Impact on Work Life and Other Issues

The quality of life of the field force changed dramatically since the incorporation of remote computing. Though freed from the office, the sales agents were not freed from a work schedule. Subjected to controls that were previously impossible, sales representatives reported on how they spend 37.5 hours per week, and the time was charged to their clients. If a representative spends 10 hours with a client and makes a sale, the cost of those hours is charged against the proceeds of the sale. Sales representatives disliked

Table 6
Benefits Associated with Telework Project

	1995	1996	1997	1998
Increased Sales	16%	18%	11%	18%
Increased Revenues	20%	21%	16%	21%

this attempt to control and manage their time, as well as the fact that it reduced the profitability of their sales. Moreover, given the many hours spent prospecting for clients, they contested the allocation of this time to overall profitability. However, managers believed that all overhead should be allocated and that those unwilling to submit to the disciplines of such a system were probably unproductive.

The salesforce spent less time in the office and more time selling.

In the past, salespeople might be out of contact for days when traveling or participating in trade shows. After implementing the telework program, they were required to dial in daily to the host network to check e-mail and to call in to check voice messages. Their lifestyle changed: The image of salespeople as working independently, without supervision, vanished. They received timely information on pricing and competitor actions by e-mail rather than by telephone, and they remained up-to-date on dealings inside and outside of the organization. The extensive use of e-mail enabled salespeople to stay informed at all times. Consequently, the salesforce spent less time in the office and more time selling.

Another positive aspect of introducing telecommuting for both managers and salespeople was the improved quality of sales presentations made possible by computer. Using flip charts and slides, it became increasingly difficult for sales agents to favorably represent their company. The sales agents quickly began helping each other translate their materials into state-of-the art digital presentations. They soon convinced managers to purchase a color video projector for group presentations. Two salespeople helped develop a Windows-based demonstration software package with "point-and-click" synopses and examples of all the company's services.

Impact on Performance Measurements and Control
The salespeople worried about being out of sight and out of mind. After implementing the telecommuting program, managers became concerned that the field salesforce would spend time at home instead of visiting clients.[12] Although quota systems were in place at the company, making or not making quota seemed an insufficient means of governing the salesforce.[13] By the time quotas reflected dropping performance, it

might be too late for the organization to recover from the financial loss.

To remedy this situation, the cost accounting system (CAS) was installed on each laptop computer to facilitate the allocation of field-force time across client accounts. Using the CAS system, managers implemented stricter controls on the field force, allowing them to monitor activities related to the sales function from a field service perspective. The sales management team used these data to determine the quality and quantity of field-force activity as well as to perform sales territory analyses.

Ironically, management control over the field salesforce increased dramatically as a result of the remote-computing program. The data recorded in the GoldMine™ and CAS systems track a sales agent's business life, since every minute spent using the computer is accounted for and catalogued. The cost of this increased control was difficult to measure but is obviously invaluable to managers.

Unintended Consequences
We identified three unintended outcomes of the project: informal telecommuting, using CAS as the organization platform for accounting functions, and enhanced knowledge management.

Informal Telecommuting. The advanced infrastructure enabled other employees to become teleworkers. Although no formal company policy existed, approximately 12 percent of nonsales personnel (fourteen people) telecommuted part-time. These employees were mainly from three groups: high-level executives, purchasing agents, and IS personnel. Some part-time telecommuters were managers who use this option in conjunction with child-rearing responsibilities. Programmers telecommuted during normal business hours and on nights and weekends for projects that were behind schedule. Others telecommuted when they felt the need for a different work environment or when traveling. The organization had no formal telecommuting policy, nor did it encourage employees to become teleworkers. At the end of our study, instituting telecommuting as an integral part of the organization's reward system was still under review.

Using CAS as a Company-Wide Platform. The CAS accounting system began to be viewed as the best corporate accounting system in the company. Other divisions began adopting it or systems derived from

it; gradually CAS became the company platform for all accounting functions, allowing individuals to track their time by order number to specific clients and client activities. Managers used this detailed information to calculate the profitability of projects. The firm also used CAS in tandem with the GoldMine™ software to track sales representative time and activity in the field. Sales representatives update their CAS electronic time sheets weekly and upload the information to the corporate database. This enables sales managers to track activities such as client prospecting and sales calls — including which ones result in orders. The CAS system evolved into a mature activity-based cost-accounting system for the entire organization.

Enhanced Knowledge Management. The information gathered using GoldMine™ transformed sales forecasting from an art to a science. The company began forecasting projections from detailed and accurate information obtained during on-site visits. Previously, sales projection consisted only of educated guesses based on informal talks with sales agents. Afterwards, managers routinely analyzed productivity, such as the ratio of sales calls to actual sales or of time spent on account maintenance versus additional revenue gained.

Conclusions

We described a telework program that enabled twenty-two salespeople and fourteen other employees to work outside the traditional office. The program resulted in deploying new technologies, automating sales procedures, and acquiring new skills. The program transformed paper-based procedures and heavy reliance on voice communications into automated procedures and full-scale connectivity. Though initially the program affected IS personnel, sales personnel experienced the greatest change in their routine. The program generated new restrictive controls on the salesforce (e.g., made them accountable for detailed time charged to individual accounts) and required them to be continuously accessible to provide and receive timely information.

Although limiting employee autonomy may negatively influence motivation over the long term, an improved, two-way flow of information and more time spent in the field should increase sales commissions. Other incentives include fewer hours doing paperwork at the office and less commuting to and from the office. Newly hired individuals will likely view the telecommuting situation as a normal work arrangement.

Telework's main impact is in driving cultural change, specifically stimulating the rapid adoption of IT that would otherwise occur at a slower pace.

The program affected every level of the organization. At the strategic level, the program helped the company maintain existing accounts, develop a new image, enhance relationships with clients, increase forecasting capabilities, and improve responsiveness. At the tactical level, the program helped increase management control, improve resource management, and promote accountability. At the operational level, the program freed more time for sales, thus increasing productivity. It enabled high-quality presentations, created a new information flow with clients, and simplified business procedures. Any negative impact on IS personnel and sales representatives, while costly, were only short term. Real-estate savings and other benefits of having individuals work remotely were simply "icing on the cake."

The extent to which these impacts stemmed from introducing telework as opposed to extensive business-process reengineering was difficult to determine. Earlier rudimentary remote-computing technology installed in the organization did not promote radical change in the company. Had the firm not totally altered the cost-accounting, order-entry, and sales functions, the introduction of teleworking would have been fruitless. Without a reliable technological infrastructure, the company would not have realized the full benefits of telecommuting and redesigned work processes.

Not only do benefits accrue from business-process redesign and automation, but telework's main impact is in driving cultural change, specifically stimulating the rapid adoption of IT that would otherwise occur at a slower pace.

Essential factors for successfully implementing the telework program were top management support, comprehensive training, deployment of a reliable IT architecture in less than 6 months, and addressing technical and personnel issues immediately. Linking IT improvements with the mission and the survival of the organization mobilized the salesforce, IS person-

nel, and middle managers to adjust quickly to the new changes. Although careful planning is necessary, the organization's flexibility and its ability to respond to problems as the project was implemented was critical to success.

When a corporate IT infrastructure is out of date, the start-up cost of a telecommuting program is high. Yet, it seems that direct costs and savings offset each other within 3 to 4 years, with ongoing costs declining rapidly, depending on how many new teleworkers join the company.

Formally sanctioned telecommuting requires personnel adjustment and cultural change,[11] and managers must be ready to help employees adjust to this new work life. Both informal telecommuting, which spreads readily when the IT infrastructure is in place, and formal telecommuting instigate different degrees of change. However, changes instilled by teleworking still occurs within the traditional structure and boundaries of the organization.

At the level of telecommuting observed in this case study (24 percent of total employees), the virtual office is an extension of the traditional office, not a replacement for it. In our opinion, only when a majority of employees are teleworkers and firms introduce radically new ways of conducting business, such as customers directly entering orders or accessing information on new products, will a major structural change occur.

References

■ 1. For example, see:
M. Watad and P. Will, "Telecommuting: IT-Enabled Alternatives Work Arrangement," in *Proceedings of the 4th World Multiconference on Systemics, Cybernetics and Informatics* (ISAS98), Orlando, Florida, 12-16 July 1998.
S.M. Jacobs and M. Van Sell, "Telecommuting: Issues for the IS Manager," *Information Systems Management,* volume 13, Winter 1996, pp. 18-21.
B. Patterson, "Eleven Steps for Success," *Computing Canada,* volume 23, 17 March 1997, p. 38.
J.M. Niles, *Making Telecommuting Happen: A Guide for Telemanagers and Telecommuters* (New York: Van Nostrand Reinhold, 1994).
J. Kugelmass, *Telecommuting: A Manager's Guide to Flexible Work Arrangements* (Lexington, Kentucky: Lexington Books, 1995).
D. Schepp and B. Schepp, *The Telecommuters Handbook. How to Earn a Living Without Going to the Office* (New York: McGraw-Hill, 1995).
W. Master and W. Joice, "Reinventing Workplace: Interplay Telecommuting Centers," *The Public Manager,* volume 22, Fall 1993, pp. 11-13.
R. Maynard, "The Growing Appeal of Telecommuting," *Nation's Business,* volume 82, August 1994, pp. 61-62.
G. Dutton, "Can California Change Its Corporate Culture?" *Management Review,* volume 83, June 1994, pp. 49-54.
N.K. Austin, "How Managers Manage Flexibility," *Working Woman,* volume 19, July 1994, pp. 19-20.
J.M. Weiss, "Telecommuting Boosts Employee Output," *HR Magazine,* volume 39, February 1994, pp. 51-53.
■ 2. We use the terms "telework" and "telecommuting" interchangeably and "teleworker" to describe any employee who telecommutes full-time or part-time. Typically, a full-time telecommuting arrangement is similar to the "virtual office" concept, i.e., the employee has no traditional office at the company facilities. In the case of part-time telecommuting, the employee may not lose a physical office, but the company may save on real estate

costs by implementing open space, shift work, and shared offices. For more information on these different arrangements, see:
T. Davenport and K. Pearlson, "Two Cheers for the Virtual Office," *Sloan Management Review,* volume 39, Summer 1998, pp. 51-65.
A. Mahlon, "The Alternative Workplace: Changing Where and How People Work," *Harvard Business Review,* volume 76, May-June 1998, pp. 121-136.
■ 3. For more details on organizational issues that arise when an organization upgrades its information infrastructure, see:
G. Hay and R. Munoz, "Establishing an Architecture Strategy," *Information Systems Management,* volume 14, Summer 1997, pp. 67-69;
J. Knowles, "Build an IT Architecture on a Business Foundation," *Datamation,* volume 42, July 1996, p. 25;
Jacobs and Van Sell (1996);
R. Wilkes, M. Frolick, and R. Urwiler, "Critical Issues in Developing Successful Telework Programs," *Journal of Systems Management,* volume 45, July 1994, pp. 30-34;
B. Farrah and C. Dagen, "Telecommuting Policies that Work," *HR Magazine,* volume 38, July 1993, pp. 64-71;
M.A. Mahmood and G.A. Mann, "Measuring the Organizational Impact of IT Investment," *Journal of Management Information Systems,* volume 10, Summer 1993, pp. 97-122;
F.J. Corbato, "On Building Systems That Will Fail," *Communications of the ACM,* volume 34, September 1991, pp. 72-81; and
M.J. Ginzberg, "Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions," *Management Science,* volume 27, April 1981, pp. 459-478.
■ 4. K. Hildebrand, "Managing Telecommuters," *Colorado Business,* volume 25, March 1998, pp. 48-49.
A. Fowler, "How To Benefit from Teleworking," *People Management,* volume 2, March 1996, pp. 34-35.
■ 5. L. Sigfrido, "Connect Business and Technology," *Datamation,* volume 40, 15 November 1994, pp. 61-64.
■ 6. IS directors must carefully monitor several

issues when their organizations introduce complex IT-based projects that have strategic implications. For example, stress and burnout are major problems. Some companies hold retreats at which IS personnel engage in fun activities and team building. Furthermore, there is a tendency to reward IS personnel who can resolve crises instead of rewarding managers who keep their operations running smoothly. In general, reliability and continuity are as important as crisis handling; consequently, the reward system should be designed to reflect these values. See:
R. Sturm, "When Quality of Service, Not Crisis Management, Is the Real Standard," *Communicationsweek,* 26 August 1996, p. 45. Organizations cannot afford to lose IS personnel during an IT-enabled major organizational change. As a company's needs change, retaining IT staff with older skills is a challenge. The cost of replacing IS professionals is much higher than retraining them. Most IS organizations designate someone to be in charge of recruiting, but usually no one is directly responsible for retention. IS managers should view successive waves of IT as evolutionary rather revolutionary and, therefore, institute continuous training programs. See:
J. Champy, "It's Not Who You Hire, It's Who You Keep," *Computerworld,* volume 31, 29 September 1997, p. 74.
■ 7. Training teleworkers and managers minimizes risks and ensures the success of telecommuting programs. Training should include technical and communications skills, as well as address issues related to cultural and organizational change. The organization that we studied paid little attention to corporate culture training, whereas we believe formal training in this area helps an organization handle change and reduces stress and uncertainty. See:
Jacobs and Van Sell (1996);
Hildebrand (1998); and
Patterson (1997).
Not all jobs are appropriate for telecommuting. For example, see:
P. Korzeniowski, "Telecommuting: A Driving Concern," *Business Communications Review,* vol-

ume 25, February 1995, pp. 45-48; and
Fowler (1996).
Neither are all employees appropriate. See:
Hildebrand (1998), and
Jacobs and Van Sell (1996).
Successful telecommuters have certain general
characteristics: outstanding communication skills,
the ability to work well independently, and techni-
cal skills. See:
Hildebrand (1998).
Managers of telecommuters must be effective com-
municators and be supportive of the telecommuting
policy. See:
Austin (1994).
■ 8. J. Ward, P. Taylor, and P. Bond, "Identification,
Realisation and Measurement of IS/IT Benefits: An
Empirical Study of Current Practice," in *Proceedings
of the Second European Conference on IT
Investment Evaluation* (Henley-on-Thames,
Oxfordshire, U.K.: Henley Management College,
1995).
■ 9. For a telecommuting program to succeed,
business managers need to change their focus of

control from attendance monitoring to managing for
results. For examples, see:
Hildebrand (1998);
Korzeniowski (1995);
Fowler (1996);
Weiss (1994); and
Austin (1994).
Logs and time sheets may indicate to managers
when telecommuters are working, but the lack of
visual control can be a problem when managers
have not been adequately trained to focus on
results. See:
Austin (1994); and
Fowler (1996).
The importance of communication in performance
management is emphasized in:
F.W. Campagna, "Managing Telecommuters,"
Training & Development, volume 50, December,
1996, p. 9.
■ 10. Master and Joice (1993).
■ 11. For the importance of an appropriate corpo-
rate culture for telecommuting, see:
K. Girard, "Ditching the Commute," *Computerworld*,

volume 31, 1 September 1997, p. 1 and p. 16;
S. Cohen, "On Becoming Virtual," *Training &
Development*, volume 51, May 1997, pp. 30-32; and
J. Zeidenberg, "Telecommuting: A Fiscal
Phenomenon," *Computing Canada*, 18 January
1996, pp. 5-6 (special issue on mobile corporate
computing).
According to most authors, organizations adopt
telecommuting when the corporate culture finds
telecommuting suitable to its needs. As more firms
institute telecommuting policies to reduce costs,
they may have to change the culture of the firm to
foster an acceptance of telecommuting. See:
Zeidenberg (1996); and
Dutton (1994).

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