Teaching Case

Technology and the Evolution of the Workplace

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Teaching Notes

Technology is changing the boundaries of the traditional workplace. For some industries it is no longer necessary for employees to be physically present in an office. Technological improvements are giving employees the ability to work effectively from remote locations, and the virtual office is a growing trend. Telecommuting arrangements are being adopted for economic, psychological and environmental reasons. This is a case study about a fictitious company which examines the evolution of its workplace and discusses some of the benefits as well as disadvantages to these changes.

Keywords: Haptic Technology, Telecommuting, Telepresence, VPN

1. INTRODUCTION

Tom Berger couldn't help but stare at the clock. The meeting was supposed to have started 10 minutes ago. Where was everyone? He started pacing around the conference room like a caged animal. BLB Software Solutions had scheduled an early morning conference call with a potential new client on the east coast, and Tom knew that they only had one chance to make that all important first impression. The technical leads really needed to be present for the meeting to proceed. Tick tock, tick tock, another 5 minutes passed by. Finally, Mary Lauren, one of Tom's business partners, entered the conference room. "The traffic on the I-880 was horrible this morning! I never thought I'd get here. I'd be willing to bet that most of the staff is stuck in traffic too." Mary grumbled. "Well, thank goodness someone else is finally here. We need to call Porter Studios immediately. We're already running 15 minutes late, and that's not how I like to conduct business." Tom replied.

Tom and Mary called Porter Studios, apologized for the delay and after some initial pleasantries suggested that the meeting be rescheduled. Tom wasn't pleased one bit, and he knew without a doubt that they had put this client relationship in jeopardy.

2. COMPANY HISTORY

Tom Berger, Mary Lauren and Charlie Boyer were college friends. Tom was a computer engineer, and Mary had studied computer programming. Neither was particularly interested in writing BASIC, COBOL or FORTRAN programs for a living, but they were both enthusiastic about 2D animation and the burgeoning video game industry. Charlie had studied mathematics, but worked as a graphic artist. He didn't have the same technical background, but he shared his friends' interest in animation.

By 1981, the arcade video game Space Invaders had grossed more than one billion dollars (Space

Invaders, 2011). The time seemed right, so the three friends leased a small office in Brisbane, California south of San Francisco, and BLB Gaming opened their doors.

Over the next twenty-five years, they hired and retained a dedicated staff, and their business grew. Tom, Mary and Charlie often chuckled when they thought back to the simple stick figure animation that was part of their early gaming software. 3D animation and computer simulations had expanded their business into flight training software for aviation and military clients.

In 2006, they were no longer producing only video game software, so their business name was changed from BLB Gaming to BLB Software Solutions. At the same time, they opened a satellite office near Seattle, Washington. Mary Lauren selected the location because it was near The Museum of Flight and a Boeing plant. The staff in the Seattle office focused on flight training software. They operated somewhat independently, but six or seven employees travelled to California for a week approximately once every other month.

In late 2009, Tom Berger started looking for a new office location. The company had long outgrown their original office space, and Tom was hoping to find a more modern facility. During his search, the County of Alameda approached him with some attractive tax incentives that they hoped would attract new businesses to their county.

The business partners met to discuss their California office in early 2010. A new office building was available immediately, and Tom was convinced that they should move BLB Software Solutions to Hayward near San Lorenzo, California. The discussion was heated. "Do you realize that Hayward is almost 30 miles from Brisbane?" asked Mary. "The majority of our staff is going to have a much longer commute. They are going to have to cross either the Bay Bridge or the San Mateo Bridge and travel I-880. Plus, the traffic near I-238 Northbound is horrendous!" (Christian Science Monitor, n.d.) she added. "What about the Seattle staff? When they come to town, they'll have to travel farther too. They won't be able to hop on Route 101 for a simple drive from the San Francisco airport to our office. And are there any hotels that will be convenient for them?" Mary was really distressed. The three partners had a casual approach to making business decisions, and until recently she had been quite happy with the way they ran their company. Tom didn't share her concerns. He thought the staff would love being in a brand new building, and he just assumed there had to be convenient hotels for the visiting employees. Mary couldn't help but wonder if the fact that Tom had family in Hayward was influencing his thinking, but she kept that thought to herself. "Charlie, you've been very quiet. What do you think?" Mary asked. "Well" Charlie hesitated. "Since we're discussing relocation, this seems like as good a time as any to mention this. I've been thinking about moving to Seattle. I think my background is better suited for our aviation software, and I'd like to oversee that office. I'm happy to let you two run things here in California." Tom and Mary weren't totally surprised. They knew that Charlie had been spending more time in Seattle, and his relocation did make sense to them. Mary was disappointed though. She had more of an affinity for Charlie; of her two partners, he was more sensible in her opinion. Tom had a much stronger personality; once he got an idea in his head he was hard to reason with. She knew that without Charlie's support her concerns about the new office building would be ignored.

BLB Software Solutions moved their headquarters to Hayward, California in the second quarter of 2010. Initially, the staff enjoyed their new office building along with the onsite day care center and gym. However, with the average price of a gallon of gasoline on the rise, the extra commute soon started to take its toll. It wasn't uncommon for the employees to get caught in traffic especially near I-238. Stress and frustration became part of their morning routine. Some employees started carpooling, but others resigned to accept positions with companies closer to their homes back on the west side of the San Francisco Bay. In addition, travel was less convenient for the Seattle staff. Mary Lauren was concerned that BLB Software Solutions was losing valuable, long-term employees. She also noticed that morale was down, and she was worried that the quality of work from the remaining employees might be affected adversely. It seemed that her initial concerns about the relocation had validity.

3. COMPANY DILEMMA

"I can't believe that we had to reschedule the Porter Studios meeting! Mary, that was

embarrassing. We'll be lucky if we get that contract now." Tom Berger complained. "Tom, I don't want to say I told you so, but we know the traffic has been impacting the staff's commute. I know we were trying to accommodate the time difference with the east coast, but perhaps we shouldn't have scheduled the conference call so early in the morning. I think it's time we had a discussion with Charlie. We need to come up with some options for how we work so we don't jeopardize the business. Charlie has some ideas about telecommuting and telepresence." Mary responded. "Oh, you know how I feel about that. Employees will take advantage of the situation. They'll be watching TV instead of working." Tom challenged. "Tom, we have a professional staff. Granted telecommuting may not suit every employee, so it will be up to the managers to monitor the situation. But times have changed, and technology has given us the means to work effectively outside the office. Charlie is coming in from Seattle next week. Please try to keep an open mind and listen to what he has to suggest." Mary replied.

4. TELECOMMUTING

Advances in technology have changed the definition of the workplace. For many employees being in the office is no longer a necessity. In this day and age, many employees can work from just about anywhere given a computer and internet connection. E-mail, fax machines, instant messaging software, laptop computers, smartphones, voice mail, etc … have given employees the tools to work more effectively from remote locations.

The flexible work arrangement which gives employees the option of working from a remote location, typically their home, is referred to as telecommuting. Travel to a physical office building is replaced with a "commute" via telecommunications devices such as telephone and internet.

According to a survey conducted by the National Small Business Association in 2010, the number of employers who support and/or allow telecommuting has increased from 19% in 2007 to 44% in 2010 (Driscoll, 2011).

Security Concerns

To be truly productive, a telecommuter may need to login to their office LAN (local area network) to access servers and/or directories, folders and files stored on those servers. Accessing a company's network from a remote location must be done in a secure manner.

Today, data is a very important commodity for all companies not just financial institutions. Over 250 million records containing sensitive personal information were involved in data breaches between January 2005 and May 2008 in the United States alone. "A data breach is a security incident in which sensitive, protected or confidential data is copied, transmitted, viewed, stolen or used by an individual unauthorized to do so" (Data Breach, 2011). This is of significant concern for companies and individuals alike.

Government regulations have been enacted to require notification of security breaches that involve personal information (National Conference of State Legislatures, 2010). Nevertheless, hackers have become bolder and more sophisticated, and companies must always be on guard.

A virtual private network (VPN) is a secure way for a company to allow their employees to remotely connect to their LAN via an internet connection. Exhibit A provides a diagram of a virtual private network.

Authentication software is used to deny or grant access to a VPN. A VPN can use encryption to protect data on its journey across the internet from the employee's computer to the office LAN. Theoretically, if a hacker intercepts the data, he/she will be unable to read it.

One way of adding an extra layer of protection to remote access is through the use of authentication devices. RSA, a division of EMC Corporation, manufactures SecurID hardware and software tokens which are used in conjunction with authentication software. When an employee attempts to access a company's VPN, he/she is prompted to enter a user ID along with a password. Unlike singular, static passwords, RSA tokens use a dual password which is made up of a static PIN established by the employee and a 6-digit code displayed by the token. The token code changes every 60 seconds resulting in a dynamic password. The authentication software then validates the password and instructs the system on whether to grant or deny the employee's access to the VPN (RSA, n.d.).

Benefits

Employers, employees and the environment can all benefit from telecommuting.

For employers, telecommuting can mean a reduction in costs. Less physical office space may be needed leading to savings in terms of equipment, furniture, heating/cooling, lighting and parking. Travel expenses such as airfare, car rentals, hotels and meals can also be reduced.

A telecommuting option can allow a company to retain valuable employees who might otherwise be forced to resign due to a life change like a spouse's transfer or elder care issues. It can also allow a company to draw from a larger candidate pool when they need to hire new employees. A flexible work environment can also permit a company to more easily accommodate clients in different time zones.

For employees, the flexibility of telecommuting can lead to an increased sense of balance between work and personal obligations. The stress that results from a long commute is eliminated; they aren't exposed to inter-office socializing, and they have fewer distractions. This can all result in happier, healthier, more productive workers. "Studies have shown that telecommuters are more productive than their office-bound colleagues. … They use less sick time, there's less tardiness …" (Driscoll, 2011). Telecommuting can also provide financial savings in regard to wardrobe, meals, vehicle maintenance and/or commuting costs such as bus or train passes.

Corporate Social Responsibility (CSR) supports a business model which addresses a company's responsibility for its actions in regard to the environment (Corporate Social Responsibility, 2011). One way for a company to become more eco-friendly is to allow telecommuting. Reducing the number of vehicles on the highways leads to reduced gasoline consumption and carbon dioxide emissions, i.e. pollution.

Disadvantages

A telecommuting arrangement may not suit every personality, job or corporate culture.

Some employees may not be as productive if they are unable to focus on work responsibilities. If the activities of a home environment such as watching TV, playing with children or relaxing by the pool are too tempting, telecommuting is not a viable option. "Telecommuting is not for everyone; you have to be self-disciplined and independent enough to work on your own. If you thrive in a group setting, you may miss the interaction with your colleagues" (Driscoll ,2011).

Telecommuting can lead to a sense of isolation. The employee has no physical presence in the office and may feel like he/she is "out of sight, out of mind." He/she may miss out on the impromptu brainstorming sessions that some groups thrive on.

If an employee works from home, he/she may have trouble differentiating between work time and personal time. He/she may actually work more hours than if there was a carpool or train to catch at the end of the day.

Since telecommuters aren't in the office, there is no direct supervision. Managers can't observe their actions and have to find different ways of accessing or monitoring employees' productivity. Some managers may have trouble trusting an employee and allowing him/her to work remotely especially if he/she doesn't have a proven track record with the company.

Employers may be concerned about network security, but this can be addressed at least in part by the aforementioned authentication techniques.

5. TELEPRESENCE

Telepresence is related to the ability to feel physically present. In a traditional telecommuting arrangement, employees connect to the office via phones and computers. They are working in the background, but they don't have any real presence in the office. Telepresence systems attempt to add a sense of presence.

Present Day

Telepresence videoconferencing or video telephony allows employees at different locations to communicate with sight and sound in real-time. "Telepresence conference rooms use state-of-the art room designs, video cameras, displays, sound-systems and processors, coupled with high-to-very-high capacity bandwidth transmissions"

(Telepresence, 2011). Each meeting attendee dials in to a virtual room and can interact with the other attendees just like they were sitting next to each other.

A true telepresence experience requires technologies that support the human senses of sight and sound. A meeting attendee should be able to view the entire remote location, and his/her perspective should change with head movement. This can be achieved through the use of large, wraparound screens in conjunction with cameras that accurately mimic head movement in a synchronized manner so as to prevent a sense of disorientation or motion sickness. Readily available high quality sound equipment gives meeting attendees the ability to clearly hear the other attendees. (Telepresence, 2011).

Telepresence videoconferencing is more expensive than traditional telephone conferencing, but the ability to see body language and facial cues improves the overall meeting experience. "The realism and quality of telepresence enhances the communication value of your meetings. … Suddenly, you're able to catch every comment and nuance of the conversation" (Cisco, n.d.). Ultimately, there is a return on investment. According to Cisco, "Many customers reduce their business travel by 30 percent or more when implementing video. The typical organization saves enough on travel to gain back its video investment in a matter of months. Trygvesta, a large Nordic insurance company with two million customers, reduced travel from 180 to 130 trips per month, saving at least $120,000."

Futuristic

Another aspect to a true telepresence system relates to the sense of touch. This might seem like an ultramodern concept, but robotics is making this possible. A meeting attendee can wear a glove input device, and a robot in the remote location mimics his/her hand movements.

"Haptic technology, or haptics, is a tactile feedback technology that takes advantage of a user's sense of touch by applying forces, vibrations, and/or motions to the user" (Haptic Technology, 2011). The purpose of haptics is to allow the manipulation of real or virtual objects.

One of the first glove input devices was the Power Glove created by Nintendo in 1989; it was used with a very limited number of video games and was criticized for its clumsy and difficult controls. Perhaps ahead of its time, the Power Glove was a commercial failure (Power Glove, 2011). Some current applications that use haptic technology are surgical training, flight simulators and landmine clearance / detonation.

Perhaps the most futuristic example of a telepresence device is the telepresence robot or personal remote avatar.

Typically, telepresence robots have a video screen, a camera, speakers and a microphone. A telecommuter can control his/her robot via the internet moving it around an office allowing him/her to see what's going on and to talk with onsite employees.

This emerging technology doesn't come cheap, but it will definitely change the traditional workplace. "As the technology and related interfaces improve, we could envision an office setting in which humans and human-controlled robots coexist and collaborate effectively" (Titlow, 2011).

6. CONCLUSION

Tom Berger, Mary Lauren and Charlie Boyer came to an agreement that it was time to offer telecommuting options to the employees of BLB Software Solutions. Their hope was that it would be a morale booster, allow them to retain valuable employees as well as become more adaptable to different clients' needs.

"I'm not totally convinced, but I'm willing to give this a try." Tom said. "I'd like our employees to be in the office at least 2 days per week. That should still give the staff an opportunity for face-to-face collaboration. The managers will need to work out rotating schedules since we can't have everyone out on the same days. They'll also need to monitor the situation and handle any problems. I also expect there to be constant, open communications."

"I almost hate to mention this," Mary continued. "but God forbid there's another earthquake like the Loma Prieta earthquake in October 1989! Do you remember how the Cypress Viaduct collapsed? That's I-880 which has become a major travel route for our employees" (Vibration Data, n.d.). "A telecommuting option should

allow us to continue conducting business if the unthinkable happens." Mary hoped.

"I know that the company doesn't pay commuting costs, but I did some quick figuring using a Corporate Average Fuel Economy (CAFE) amount of 27.5 miles per gallon for a passenger car" (Research and Innovative Technology Administration, n.d.). By working from home 3 days per week each of our San Francisco employees can expect to save about $1000 per month in terms of what it's costing them for the extra commute to Hayward. Plus, there will be less wear and tear on their cars, and their parking fees will be reduced. I think the staff is going to be quite happy." Mary said enthusiastically. Refer to Exhibit B for additional San Francisco commuting expenses.

"I'd like to purchase a telepresence system. That will allow us to cut down or even eliminate the travel between Seattle and San Francisco." Charlie suggested. "I know that's going to be expensive, but we could see a savings of $70,000 dollars each year from reduced travel expenses." Refer to Exhibit C for Seattle to San Francisco travel expenses. "I'm also suggesting that the Seattle team start researching haptic technology. It could give our flight simulation software a competitive advantage." Charlie concluded.

As the meeting was wrapping up, Charlie asked "Tom, what are you smiling about?" "I support your idea of exploring haptic technology, but you didn't mention telepresence robots." Tom said with a smirk. "Frankly, I don't think we're ready for that. I can't imagine having robots roaming the halls or sitting next to me at a conference table. Not to mention the expense." Tom concluded. "Maybe someday" Charlie thought to himself.

7. REFERENCES

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APPENDIX

Exhibit A – Virtual Private Network Diagram (Digital Inspiration)

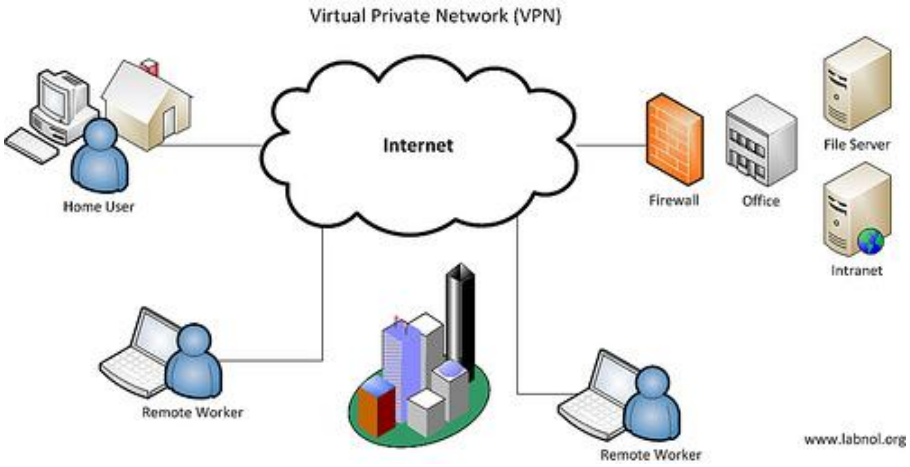

Exhibit B – Additional San Francisco Commuting Expenses

Price Per Gallon	Avg MPG	Price Per Mile	Avg Additional Mileage	Daily Cost	Monthly Cost	Annual Cost	Staff Cost
3.50	27.50	0.13	57	7.25	87.05	1,044.65	39,696.87
Based on 12 business days per month and 38 employees							

Exhibit C – Annual Seattle to San Francisco Travel Expenses

Employee ID	Round Trip Airfare	Hotel - 5 Nights	Car Rental - 5 Days	Meal Allowance - 5 Days	Avg Trip Cost	Trips Per Year	Annual Cost
1109	220.00	1,000.00	405.00	320.00	1,945.00	6	11,670.00
2929	220.00	1,000.00	405.00	320.00	1,945.00	4	7,780.00
3117	220.00	1,000.00	405.00	320.00	1,945.00	6	11,670.00
4731	220.00	1,000.00	405.00	320.00	1,945.00	6	11,670.00
5048	220.00	1,000.00	405.00	320.00	1,945.00	6	11,670.00
6311	220.00	1,000.00	405.00	320.00	1,945.00	2	3,890.00
9101	220.00	1,000.00	405.00	320.00	1,945.00	6	11,670.00
							70,020.00