The impact of netcentricity on virtual teams: the new performance challenge

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Keywords

Abstract

Digital networks are changing the way people and organizations work and communicate. The twenty-first century will witness an increase in the number and use of virtual workplaces. As a result, virtual teams will also become more common. When organizations globalize their workforces to take advantage of strategic business opportunities, virtual teams will be highly diverse. In this global context, the management of diverse virtual teams represents a new performance challenge for organizations. Working closely together to accomplish specific tasks is also a major undertaking for virtual teams. This article discusses how virtual teams are formed, interact, perform their tasks, and evaluated. It also examines how team leaders emerge, and the impact of netcentricity and network security on virtual teams.

Electronic access

Introduction

Gone are the days where the only way members of a team can get together and exchange information and ideas is by setting up a face-to-face meeting. In this situation, each team member has to be physically present in order to participate in the meeting. Back then, for a team member of a company engaged in a geographically dispersed operation, participating in a meeting without physically being present was a dream. Today, however, individuals and teams from many areas of the world can *attend* and participate in a meeting without their actual physical presence. Netcentricity made this happen, and has changed the way teams work and perform their tasks.

Netcentricity is "the power of digital networks to connect a global wealth of people, information assets, and services" (Howard, 2000). Today's businesses and other organizations must understand netcentricity and use teams across functions, geographic areas, and different time zones to save time, money, and other resources. The goal of netcentricity is to have all members of a team share data, information, instructions, and some trade secrets in near real time. Powerful processors and new software allow organizations and teams to communicate faster and to enter the era of virtual connection and virtual teams whose members may never meet face-to-face. Netcentricity has made a significant impact on teams, especially in those companies doing business on a global scale. This is just the tip of the iceberg, more dramatic changes will take place in harnessing the power of netcentricity. Generally, global teams fall into one of two categories:

(1) Intercultural teams in which team members come from different geographic locations, background, and cultures to meet face-to-face to work and accomplish a specific goal.
(2) Virtual global teams in which individuals remain in their offices or homes and *meet* via the Internet or other forms of network technology.

To form a virtual team, people, purpose, and links are needed. This study discusses how virtual teams are formed, interact, perform their tasks, and evaluated. Also, it will examine how team leaders emerge and the impact of netcentricity and network security on virtual teams. Netcentricity and network

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security are two technologies that go hand in hand; without network security, netcentricity can turn businesses' dreams into nightmares.

How teams are formed?

The general pattern of team development involves five stages:
(1) *Forming*, "characterized by uncertainty about purpose, structure, and leadership".
(2) *Storming*, "characterized by intragroup conflict".
(3) *Norming*, "close relationships develop and members begin to demonstrate cohesiveness".
(4) *Performing*, "structure is fully functional and accepted by team members". (The performing stage is the last stage of permanent teams.)
(5) *Adjourning* is "the final stage of the development of temporary teams, in which the team prepares for its disbandment" (Robbins and De Cenzo, 1998).

Today we live in a networked world, "where outcomes depend upon processes and customers demand value and quality" (Gunn, 2000). A world where customers want good quality products and services at low prices, delivered to them in good condition, and in a very short period of time. Companies are seeing virtual teams as the best way to respond to the needs of their customers, suppliers, and the fast-changing business world. In a recent survey conducted in the USA, 95 per cent of the respondents from nearly 100 of the most innovative companies gave the highest priority of doing business to teamwork (Faren and Maurer, 1999). Most companies highly value teamwork because it is the key to the success of their firms.

Netcentric teams are made up of the best and brightest employees qualified for a given project so that there is no learning curve for team members. Team members must have the skills and the expertise necessary to work effectively and efficiently to achieve the desired results. The size of a team varies from company to company, and from project to project within the same company. Usually, teams are formed of 20 members or less. Most teams are formed of members from anywhere a telephone line can reach, and "can be organized without regard to traditional concerns about whether or not members are

in some reasonable proximity to each other, or what it will cost to achieve that proximity" (Townsend, 1996). However, some wireless technology and the Internet are eliminating the need for a telephone line.

It is very important for a team to have a diversified group of people. The American Management Association (AMA) surveyed more than 1,000 executives in mid-1998 and found that, "diversity is becoming more common in senior management teams, and that diversity breeds success" (Faren and Maurer, 1999). However, there are a number of obstacles that can make a team less productive. Team members need to use diversity to their best advantage in order to accomplish their tasks efficiently and effectively. There are two important variables to teamwork, technical and commercial skills. Every netcentric team must have members that have the technical and commercial skills it takes to succeed.

How teams interact in today's e-business environment?

New computer software products are bringing teams together in cyberspace called "virtual meeting rooms". These software products enable teams of few members or even hundreds of users to work together over the Internet. For example, "they can collaborate on projects, hold discussions, share documents, and reach decisions, all without leaving their keyboards" (*Fortune*, 1999). Therefore, commuting, traveling expenses and delays, weather worries, and logistical nightmares are all reduced or eliminated. Meeting in a virtual environment can replicate many of the functions and features of those in the physical meeting. Typically, there is a moderator, an auditorium format for large sessions, a way of polling members, breakout rooms for smaller sessions, and ways to hold one-on-one or small-group conversations (*Fortune*, 1999).

Cyberspace programs vary widely. Some are free while others require expensive software and monthly fees. For example, "Microsoft NetMeeting is among the simplest virtual meeting rooms to operate" (*Fortune*, 1999). Users must download this free software from Microsoft's Web site and install it on their computers to share files over an Intranet. When a team member is ready to *exit* the meeting or when the meeting is over, the NetMeeting session is closed. In addition

to NetMeeting, Lotus's Instant and Teamroom provide similar service for a monthly fee. In the physical environment, companies may rent a conference room for its team members to meet. Companies using cyberspace can rent a virtual meeting room to work on a project for a certain period of time through an Internet Service Provider (ISP). As an article in *Fortune* magazine (1999) suggested, "Even after such conclaves are over, Instinctive Technology's eRoom software makes it easy to maintain a project archive" (*Fortune*, 1999).

Companies have software and programs to help their teams communicate better and faster. Some of these programs include encryptography (the art of encrypting and decrypting messages) software that make it hard, if not impossible, for external parties to break into a company's system and "steal" or destroy information and trade secrets from the victim's (firm) information system. Some encryptography programs are free for teams and the public. However, these are not highly secure. One example of these free programs that teams can use is "AnyDay". It is a program that teams can use to communicate with each other, exchange information, and send e-mails to confirm meetings. Another feature of "AnyDay", is "re-schedul[ing]e" the meeting enabling every team member to receive a notification that an event or a meeting has been changed. This function automatically updates the users' calendars. In addition, this program allows all team members to view a calendar on a daily, weekly, monthly, and annual basis. With netcentricity, scheduling an event or a meeting is hassle free. A manager can set up a meeting and click on the "schedule it" button (key) and all the recipients receive a notification on their calendars.

Most netcentric teams interact via e-mail. E-mail is fast, cheap, and convenient. Yet, it can also expose private messages to "snoopers" and "hackers" if not encrypted. Not encrypting a message, is like sending confidential and "secret" information in an unsealed envelope or on a post card. There are many text-encryption programs that can be downloaded free from the Internet which are easy for anyone to use and understand. One example is the Fairly Good Privacy (FGP). The FGP is most useful for generating encrypted e-mails that are not meant to be read by interlopers.

How virtual teams perform their tasks?

Virtual teams allow organizations to hire and retain some of its best employees regardless of their geographic location. One way teams interact and perform their tasks is via videoconferencing. Videoconferencing has the potential to save time and money on domestic and international travel, and leads to improved performance and productivity. Much of the work done by virtual teams focuses on benefits and costs savings to individuals and their organizations. The gains from using such technologies are realized when a team's work is performed virtually instead of face-to-face.

While a team is working on a project, usually the project is like a puzzle, and each team member is responsible to work on an assigned *piece* of the project. After each team member successfully completes the assigned part of the job, all the pieces are brought together and must fit perfectly in order to get the whole project. On the other hand, in some projects all the team members must work together as one entity to get the job done. A team or its leader (if the team has a leader) must decide on how the team members will work; what part of the job is assigned to whom; and make sure that everyone has the support, information, and technology needed to accomplish the tasks in hand in order for the desired results to be achieved.

To perform their tasks, team members can communicate and exchange ideas via e-mail, virtual meeting in chat rooms, NetMeeting, or via teleconferencing. For a teleconference meeting, members simply call one of the conferencing systems and enter the meeting via a telephone from anywhere in the world. With the right equipment and technology, there will be no noise and no "mere squawk boxes that distort sound and cause callers to scream every time they can't hear" (Solomon, 1998). Sophisticated teleconferencing technology allows several callers to join the discussion in a very natural way, and even listen to prior minutes of meetings in case they *arrive* late to a videoconference. Some companies use a system called "Meeting Place", in which callers use a series of codes. In this case, "One code allows access to minutes of a meeting and another allows immediate entry to a meeting" (Solomon, 1998).

While exchanging e-mails and files on-line and within a system, team members must be very careful about the files they are receiving

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and opening. Some of these files can be carriers of virus, worms, or time bombs. A virus is "a segment of code that attaches itself to a file and performs some predetermined actions", which leads to infecting, modifying, or deleting all information stored in a system. As soon as a team member opens a malicious file, the virus is activated and it starts its job. A worm "is very much like a virus in that it replicates itself and attacks a system with the potential to do irrecoverable damage. Unlike a virus, a worm is a stand-alone program that infects a single computer system as well as other computers through network connections. A "time bomb" is a malicious file that is *planted* in a system to go off at a certain time and destroy all the records stored in a certain database. Team members must make sure that any files they open are coming from a trustworthy source. Many companies have been attacked and suffered large sums of money in losses due to information technology warfare. One example is the USPA & IRA, a Fort Worth, Texas, USA-based insurance and investment company which was a victim of a "time bomb" attack that destroyed its 168,000 sales commission records (White and Udo, 1996).

The good news is that companies can purchase or develop software products to protect their information, records, and files from hackers. In a virtual team, some members have the access permissions for each file. There are five access modes, Write, Read, Execute, Delete, and List. Some team members have the access to write, read, execute, delete, and post any information "meeting room" for the rest of the team members to read. Some team members have one access mode that allows them to view and read what is posted on the bulletin board. If everyone can access the information and add, delete, and tamper with files, netcentricity will become a nightmare.

To facilitate the communication and the way its employees, suppliers and customers interact, General Electric Corporation has a program that is designed to improve information sharing regardless of geographic and cultural barriers. General Electric is "rolling out Web applications from Lotus that ultimately will reach all worldwide employees across 12 divisions and be extended to thousands of suppliers and business customers" (Drucker, 2000). In addition, there are programs that can be set to automatically send a reminder to a certain supplier, customer, or a team member

regarding a contract, order, or work to be done before a certain deadline. This helps team members and businesses focus more on other parts of the job and let the Internet work for them.

Holding cyber-meetings with other "disembodied souls" is not always easy. For example, "As in any other interchange, those who hold virtual meetings need to be clear about their roles, communication, strategies, and ways of resolving conflicts" (*Fortune*, 1999). Yet, what these high tech new products do is give control back to users. Another recent *Fortune* magazine (1999) article indicated that, "unlike traditional group ware programs like Lotus Notes and Microsoft Exchange, which are centrally administered, virtual meeting rooms can be set up in minutes by team members themselves" (*Fortune*, 1999). For any business competing in this fast changing virtual world, that is a big advantage.

Performance problems with virtual teamwork

While performing their tasks, team members may experience some problems. Unfortunately, some people experience teamwork as pure "drudgery". Some employees feel that they can do a better job if they are working on their own. Meetings can be time consuming and with conflicting ideas, which make reaching conclusions very hard.

In addition, some employees may try to get away with doing nothing and let the rest of the team members carry the load. Employees who carry a heavier load because others cannot do their jobs properly, often, feel frustrated and dissatisfied. These employees may become less productive, unhappy about their jobs, and may consider quitting and working for a competitor. Managers must make sure that team members are getting along and that each one is contributing. Also, managers must facilitate communication and give teams the power and freedom they need to function effectively. In this context, freedom refers to "the liberty to use ones' creative powers to shape a role that works in concert with others", and power is "to allow people to express their talents in ways that complement one another and further the team's purpose" (Gunn, 2000).

Videoconferencing can save companies money. Yet, it can sabotage communication among team members, which make it hard to

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develop trust. Many virtual teams experience communication breakdowns due to the technology used, misunderstanding, mishearing, and misinterpreting messages. All the technology used by team members to communicate takes away the eye contact, facial expressions, and gestures and the trouble flags. In a face-to-face conversation, we can detect when a listener is confused, or frowns. All these cues are trouble flags that tell us that the listener did not understand our message, puzzled, or just not paying attention. A good example of misunderstanding and miscommunication via videoconferencing is explained by a virtual team member:

> You talk and then you pause, but the expected response doesn't come. So you say something else and find yourself "stepping on"-talking simultaneously with another person. You stop. More silence. Then you start again, and you step on someone else. You may ask a question, pause, ask another and hear the answer to the first question, mistaking it for the answer to the second (Melymuka, 1998).

This employee recommended that it should be the company's policy not to expose people to people remotely via videoconferencing until they have met face-to-face.

How teams are managed

Some teams are self-managed with each team member having a responsibility in the decision-making process as well as shared leadership. Having only one team leader can slow decision making and the response to the needs and the demands of customers or suppliers. In addition, for psychological reasons, employees who work in teams and have shared leadership roles, feel more secure and are more productive than team members who are not empowered to participate in making decisions.

However, some teams cannot function properly without a team leader who will make sure the work is done the right way and at the right time. Team members may ask the question: "Who will lead and provide oversight for the activities of a team?". This question must be answered either by group members or by top management. A team leader must motivate team members. Motivation is needed to increase the effort and performance level of team members. In addition, managers must be realistic about the amount of work and deadlines team members must meet. If a project requires two weeks to finish, management should not put pressure on a team and expect it to finish the work in one week. Also, top management must understand that things will not always run seamlessly among team members. Taking into consideration that problems and conflicts may occur among team members, and that some team projects may take longer to finish then expected, can help a company meet its deadlines and even be ahead of time on some other projects.

While managing a virtual team, team leaders must make sure all the team members are familiar with whatever groupware, videoconferencing systems, software, computer system, network security, and any other technology necessary to perform their jobs. People in general tend to avoid using technology they are not familiar with. In the case of netcentricity, team members *must* know how to use technology in order to do their job. Therefore, management must provide team members, who are not familiar with the technology used, training to help them update their skills.

Like in traditional teams, virtual teams need leaders to facilitate communication among team members. A set of questions team members must address include: Who needs to talk to whom; about what; through what medium; how often; who needs to be informed; at what time; and by whom" (Chase, 1999). Team leaders must also make sure that no team member is procrastinating or falling behind schedule due to either low performance or miscommunication. This causes a negative impact on everyone in a team. A virtual team "can get further afield or further behind schedule before it's noticed if the feedback loops aren't tight, if the milestones aren't noticeable, and if the communication isn't good" (Chase, 1999).

Trust among team members is very important. They do not need to be best friends to work together, but there is a need to trust, respect, and be confident in each other's competency. Trust takes a long time to develop, yet it can be destroyed instantly. Team leaders should plan at least one face-to-face meeting for all team members. Giving team members the opportunity to meet will help develop trust and understanding of each other's viewpoints, ideas, and expertise. However, if financial resources and time do not allow team leaders to bring all the members to a face-to-face meeting, they (team leaders) should make sure that team members get acquainted virtually through

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chat rooms, white board, home pages, e-mails, or video conferencing.

Team leaders must have the experience and the training required to solve communication problems that occur due to interacting by phone or via e-mail. In virtual communication, the lack of body language, facial expression, eye contact, and the tone of voice can make an e-mail message rude and harsher than a sender intended. To reduce miscommunication, team leaders must explain to their team members basic e-mail and voice-mail etiquette.

A team leader must be able to catch any early warning signs when "something" is going wrong and support team members to the degree necessary to accomplish their tasks. Usually, problems with virtual teams are due to a breakdown in communication, misunderstanding, or failure of a team member to carry the assigned load of work. This is true in any group of people that come together for a certain project and purpose, "it's just exacerbated in a virtual environment" (Chase, 1999). Team leaders must have the skills to catch individual conflict early and deal with it before it *spreads out* and affects the rest of the team. Most team members "would prefer to avoid a fight; conflict of one sort or another will eventually surface in any team"; in a virtual environment, some team members "may tend to sweep a problem under the rug until it becomes so large it can no longer be ignored" (Chase, 1999). In a situation like this, the skills of a team leader will come into play to solve any conflict quickly if it is caught at an early stage.

How virtual teams are evaluated

Typically, virtual teams are evaluated once or twice a year. Some teams are evaluated upon completing each project. Team members can be evaluated in three ways: self; peer; and management; assessment. Self-evaluation takes place when team members assess their own work based on certain criteria set by management or the team. In peer evaluations, each team member examines the rest of the team members based on certain criteria. Finally, peer assessments are turned in to management to use in evaluating team and rewarding individual members. The most common type of assessment is done by management evaluating team members based on their efforts, the progress made while

working on the project, and other criteria that may include:

- regular attendance of team meetings;
- quality and timeliness of individual work submitted;
- attitude toward the project and team members;
- percentage of effort in completing the project;
- willingness to accept tasks;
- ability to plan project and help keep team on track;
- willingness to help other team members; and
- creating a fun atmosphere/being a pleasure to work with ("Peer ... ", 1997).

What is in it for me? This is a question asked more often by some virtual team members. Team members must be evaluated and rewarded for their work. Rewards can be either verbal or written acknowledgments and appreciation for team members' hard work. In addition, rewards can be in the form of increase in salary, longer vacation, time off, or promotion. Many team members work as hard as they can in order to gain a reward or compensation for their work. For desired outcomes, firms must reward and show appreciation for their employees' work. Rewards are necessary to the retention of employees in general.

Virtual teams, network centricity, and network security

An important issue that is related to netcentricity is network security. Without network security, netcentricity is almost useless. Imagine a team is exchanging ideas and information via the Internet on how to improve quality and reduce the cost of production. Without network security, a competitor may be "spying" on this team and can have access to critical information exchanged among the team members, or team members might be exchanging information regarding their plans and designs for a new product. Then, to their surprise "their new product" is already on the shelves selling at a competitive price. This is an example of a "cyber crime". Cyber crimes are happening everyday.

As mentioned earlier, netcentricity is the power of digital networks to connect a global wealth of people, information assets, and services. Virtual teams must be very careful

what kind of information they are exchanging, via what mean, and how secure is the software they are using. Exchanging valuable information, passwords, bank accounts of numbers, customer information, and any top-secret information via insecure media can cost a business millions of dollars, if not drive it completely out of business. *Meeting* and exchanging top-secret information without having the computer network security necessary, is like meeting and exchanging top-secret information in public where outside parties, including competitors, may be *watching, listening,* and reading whatever information is exchanged between team members. In addition, firms with unsecure network systems are at a high risk of being attacked by hackers.

In the business world, network security is an important issue that must be addressed and understood whenever network centricity is used. To protect themselves from hackers and unauthorized users to break into their information systems, firms must use cryptography software. In this cyber world where most business activities are becoming virtual from e-commerce, to e-banking, e-shopping, e-mailing, e-communicating, e-meeting, and e-inverting, cryptography can provide firms with the network security they need.

Cryptography is the art of encrypting and decrypting messages. Encryption is the transformation of data into an unreadable form. The main purpose of encryption is to ensure privacy by preventing access to the information, having the message written in a very complex form to understand, or by having the information hidden from anyone the information is not intended. Even if this information is read by a third party, the message read will not make sense unless it has the *key* to solve the puzzle. A plain *message* is a "*plaintext*" and some times it is referred to as "*cleartext*". An encrypted message is called "*ciphertext*". However, decryption is the reverse of encryption and it refers to transforming the encrypted message into its original form.

For instance, if a team member encrypts and writes a message "lqfuhdvh wkh sulfh". These two words make no sense to anyone who reads them unless the person has the key. Throughout history, the major problem with cryptography has been the key exchange. Encryption and decryption require the use of a *key.* The key is a password that is known by both the sender and the recipient. The key to

the puzzle "lqfuhdvh wkh sulfh" is the "Rule of 3". To find what each letter stands for, the receiver of the message must move each letter to the third alphabet in the alphabet order. Therefore, every A is replaced by a D, R by U and so forth through the 26 alphabet that rotate from Z to A again. After decrypting our encrypted message, "lqfuhdvh wkh sulfh" stands for "increase the price". This is the simplest and easiest way to encrypt a message. There are different kinds of software that required long mathematical and complex calculations. These calculations are impossible for a human being to calculate and figure out how to decrypt a message. Cryptography programs cost vary from 15 to thousands of dollars. The prices are based on how complex they are, how much privacy they provide, and how hard it is for hackers to break into a system. Usually, governments and big businesses use very expensive programs to encrypt their private and secret documents. However, no one can guarantee 100 per cent security.

Companies should strive to keep communication among their virtual teams and top management as secure as possible when security of information is key to survival and success. However, many firms put teams together and some team members have no idea how dangerous it is to exchange information on-line if they are not computer-security literate. It is crucial to the success of an organization to make sure that all of its team members and top management are network-security literate. However, most security programs are not as secure as they claim to be:

> After all, weak cryptography looks the same on the shelf as strong cryptography. Two e-mail encryption products may have almost the same user interface, yet one is secure while the other permits eavesdropping. A comparison chart may suggest that two programs have similar features, although one has gaping security holes that the other doesn't. An experienced cryptographer can tell the difference. So can a thief (Schneier, 2000).

Many businesses spend billions of dollars on netcentric technologies and computer security in order to keep up with the fast changing virtual world. Yet, their security systems are broken by the people or the team members who use them. Transfer of money into personal bank accounts and fraud against commerce systems is usually perpetrated by insiders. Honest users leave all doors open to attackers to have access to a system by writing down their passwords, give friends and

relatives their private keys (to solve encrypted messages), and leave computers logged in.

People and businesses expect the government to look out for their safety and security in areas where they lack the knowledge to make educated evaluations of such things as food packaging, transportation, and medicine. But for cryptography, businesses should assume the responsibility of protecting their information systems. In the area of computer security:

> History has taught us: never underestimate the amount of money, time, and effort someone will expend to thwart a security system. It is always better to assume the worst; assume our adversaries are better than they are; assume science and technology will soon be able to do things they cannot do yet; give ourselves a margin for error, and give ourselves more security than we have today. Therefore, when the unexpected happens, we will be glad we did (Schneier, 2000).

Conclusions

Netcentricity is a major challenge for new and established teams. Working collaboratively is hard enough when team members work together face-to-face. When individuals work together in dispersed geographic locations, it is even harder to prevent work fragmentation, misunderstanding, distrust among team members, unachieved goals, and wasted organizational resources. After a virtual team is formed, all its members and team leaders must work together to make the interactions among them as easy and as seamlessly as possible in order to perform their tasks in an efficient and effective way. Team leaders must make sure that all team members have the training, technology, and the skills necessary to achieve the desired results. Also, they must make sure that team members are evaluated and rewarded based on their work performance, and other important criteria for the success of a firm and for the development and retention of effective team members.

Netcentricity and network security have a big impact on how virtual teams work today. Virtual teams are saving thousands of dollars for firms, which, in most cases, can pass the benefits/savings on to customers by lowering the prices of their products. Lowering price enables many firms to compete and makes products/services affordable to their target market. Be it a firm, an employee, or a customer, netcentricity benefits everyone. Every person using netcentricity for personal, business, or political matters must understand network security. Network security makes netcentricity a very powerful tool contributing to the success of every organization that uses it. Virtual teams, who focus on network security, can utilize netcentricity to their advantage.

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