The Role of Virtual Communities of Practice in Knowledge Management

by

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Submitted to the Faculty of Extension

University of Alberta

In partial fulfillment of the requirements for the degree of

Master of Arts in Communications and Technology

March, 2009

Acknowledgements

I want to thank my supervisor, Dr. Marco Adria for his substantive support and thoughtful guidance. I also would like to express my appreciation to Eileen Crookes, Program Coordinator, Communications and Technology, Graduate Program for her multiple eleventh hour interventions that kept me registered in the program and provided me with the time to complete this project.

I would like to recognize and express my appreciation for the MACT faculty that opened my eyes to a whole new world. In particular I want to thank Dr. Kirby Wright for introducing me to the concept of Communities of Practice and sharing his expertise in Knowledge Management both inside and outside of the classroom and Dr. Stanley Varnhagen for his patience and persistence in getting my Research Ethics Board approval completed in time for the focus group session. A special thanks to my MACT cohorts who kept the energy going.

I am enormously grateful to Greg McPhee, my boss, who provided me with the opportunity, time and resources over the last three years to make this case study possible. Special thanks to Ray Alarie whose thoughtful reference letter helped me get into the program and made me believe that I could do this. I would like to express my appreciation to my colleagues for volunteering to participate in the focus group and providing me with their deep insights.

This project would not have been possible without the patience, understanding and gentle prodding of my wife Pat.

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Abstract

Organizations are in constant danger of losing their knowledge capital. Years of experience and expertise can be lost through turnover, reassignment, restructuring, poor documentation, and just plain forgetting. Used effectively communities of practice (CoP) are an effective knowledge management tool that will allow organizations to retain and build on its existing knowledge capital. With staff dispersed around the world, communication technologies are required to allow experts around the world to collaborate on finding solutions to a wide range of problems. What role can virtual communities of practice (VCoP) play in creating and capturing the knowledge capital of a global organization? Through direct observation and focus group discussion this study explores how employees use the communication tools provided for them by the organization and how effective they are in collaborating with their peers to share knowledge. Over the last couple of decades digital technologies have greatly improved the ability to connect people across time and space by extending the physical limitations of our voice, ears, and eyes. However something is lost in the translation. This study found that there is no substitute for the richness of face-to-face interactions that have evolved over thousands of years and use a wide range of cues, encapsulated in stories. The focus group found that although all were comfortable with the technology provided, none preferred it over face-to-face encounters. Communication technologies, it was felt, are incapable of reproducing the myriad of human cues simultaneously or with 100% accuracy. Communication technologies and the VCoPs they make possible can play a significant role producing the knowledge capital of a global organization but ultimately knowledge sharing is a human activity and must be managed accordingly.

Introduction

As modern organizations grow in size, complexity, and geographic coverage, managing communications and knowledge assets become competitive differentiators. Companies need to capture their corporate knowledge and effectively transfer them to the people that need them, when they need them. Often technology is touted as the savior of knowledge management (KM). By capturing employee knowledge in large databases, it is argued; companies can reuse this knowledge in the future. This may work for organizations where business processes can be broken down into multiple linear elements that can be followed by any qualified employee. For knowledge based organizations, however, things are not quite that simple. Success for these organizations depends upon their ability to be creative and innovate. These tasks cannot be captured by computer databases or written down in how-to manuals because they don't exist yet. As a rapidly growing knowledge based consulting firm with more than 10,000 employees in 150 offices, Global Brains, a pseudonym for a large engineering and architectural consulting firm, faces the challenge of capturing its knowledge assets and making it available to all of its current and future employees. Traditionally these knowledge assets have existed in "design binders" where people collected lessons learned working on individual projects and rules-of-thumb for completing routine tasks. This approach has worked well when projects were completed by individuals or small teams in a single location. However as the size and complexity of projects increases, talent from multiple offices is often recruited. This adds an extra layer of complexity to the management of each project as well as the consistency of the knowledge applied. Although the content of the individual "binders" is correct they reflect the biases of the author and his or her experience and expertise. They are all slightly different. What is needed is a consistent way of capturing this knowledge consistently so that the best practices can be identified and

continually improved by the best subject matter experts in the company. To achieve this vision the Building Engineering Practice Area started an electronic Best Practices Manual (eBPM) pilot project aimed at creating a knowledge repository and virtual communities of practice (VCoP) to review and improve the content.

Successful organizations can be compared to an old growth forest that "do everything we want to do. [Forests] self-organize into a diverse and integrated community of organisms with a common purpose--to maintain their presence in one place, make the most of what is available, and endure over the long haul" (Benyus p. 248). Similarly the individuals that comprise the modern organization are connected through multiple social relationships that form networks of expertise, which in turn become the structure of the organization. The challenge for a knowledge based organization such as Global Brains is to provide an environment where many diverse individuals can grow, forming "complex systems [which] are not 'run' by anyone in particular, but are instead controlled by countless individual interactions that occur inside the system" (Benyus p. 253).

The size and distributed nature of the modern organization like Global Brains means that connections between people are increasingly mediated by electronic communication technologies powered by microprocessor chips and linked through the Internet. How this technology is deployed within an organization greatly affects the network functions, both positively and negatively. Nothing can replace the richness of face-to-face communications. Our brains are wired for telling stories. However, humans continue to use technology as extensions of themselves to a point where we can now extend our personal networks around the globe.

Humans "evolved to feel strongly about few people, short distances, and relatively brief intervals of time; and these are still the dimensions of life that are important to [them]" (S.L.

Washburn quoted in Gladwell p. 177). According to Robin Dunbar cited in *The Tipping Point* by Malcolm Gladwell our biological limit is "roughly 150" (Gladwell p. 179). With the advent of electricity and its associated information technology we are regularly exceeding our limits and like jet fighter pilots that draw too many G-forces we black out. It is becoming increasingly important for modern organizations to manage their social and relationship capital in the context of ever expanding communication technologies:

> Humans have no fangs, claws, or venom built into our bodies. Instead we have devised tools and weapons—knives, spearheads, poisoned arrows. Elementary inventions such as warm clothing and simple watercraft allowed us to overrun the whole planet before the end of the last ice age. Our specialization is the brain. The flexibility of the brain's interactions with nature, through culture, has been the key to our success. Cultures can adapt far more quickly than genes to new threats and needs (Wright p. 29).

It is through culture and technology that modern organizations accumulate knowledge. Communities of Practice (CoP) have emerged as an effective tool for managing this process by separating large organizations into smaller, cohesive groups comprised of people with similar knowledge and interests. Instead of managing thousands of staff in multiple locations CoPs reduce that number to dozens of staff held together by a common interest. Continually evolving communication technologies, made widely available through the Internet, make it possible for virtual Communities of Practice (VCoP) to function in multiple locations and times.

The advent of the World Wide Web has meant that people not only need to collaborate in teams but increasingly across space and time. This requires the creation of a large number of human connections that need to be maintained through relationships and "connections made through face-to-face interactions are the best foundation for social capital" (Lesser p. 26). "Humans socialize in the largest groups of all primates because we are the only animals with brains large enough to handle the complexities of that social arrangement" (Gladwell p. 179).

Rapid growth, diversification of services and geographic dispersal has resulted in a large number of Global Brains employees that don't know each other or even know of each other. This makes it very difficult to build relationships. When viewing the company as a whole you can only see the forest and major geographic features, not the individual trees and certainly not the undergrowth or roots. It would be impossible for a single person or leadership group to know, let alone understand the details about every aspect of the organization. Global Brains' leadership must learn how to transition from a rapid growth capital consuming Type I system to a mature Type III system where multiple individuals and groups of experts can "live in elaborate synergy…and put their energy into optimizing these relationships" (Benyus p. 250). Organizations need to develop a system that is sustainable over the long haul by making the most of available resources. Global Brains needs to formalize what people know, who they know and how they communicate what they know to who they know. As Lew Platt a former Hewlett-Packard CEO so eloquently put it "If only HP knew what HP knows, we would be three times more profitable" (Hinds p. 3).

This research is grounded in the Sociophsycological and Cybernetic traditions, which states that organizations are the sum of their communications. "[Max] Weber defines an organization as a system of purposeful, interpersonal activity designed to coordinate individual tasks" (Littlejohn, p. 243). This is commonly achieved through a hierarchy where layers of management coordinate numerous specialists through processes that have evolved over time as part of the corporate knowledge and memory. However organizations go well beyond the level of individuals to a point where a successful organization is greater than the sum of the contributions of its parts. "Many forms and structures 'get made' by how people interact with one another in various ways" (Littlejohn p. 245). According to Karl Weick "organizations are not

structures made of positions and roles, but communication activities" (Littlejohn p. 245). Specifically they comprise a series of acts by individuals aimed at reducing uncertainty, complication, and ambiguity. These communication acts can be further studied through the networks of social structures by taking snapshots of the dynamic relationships formed through ongoing communications. "No one communicates equally with all other members of the organization, you can see clusters of communication relationships that link together to establish overall organizational networks" (Littlejohn p. 247). These clusters form the basis for CoPs. For the most part these social networks are informal and fall outside of the formal organizational chart of the organization. All organizations develop a local hierarchy and culture through formal or informal means. Since the early tribes sitting around the fire exchanging ideas, humans have honed their communication and social skills to outperform their natural competitors. The new challenge faced by global knowledge based organizations is that they are no longer able to rely solely on face-to-face communications. Increasingly we must rely on digitally mediated channels such as telephone, e-mail and Internet. Although these channels extend our biological abilities to communicate they also lack the full spectrum of cues such as facial expressions, tone of voice, body language, emotions, etc. humans rely on to communicate at a deep level. This research explores the affect these communication technologies have on the natural ways in which we communicate, build relationships and social structures and how modern organizations can intervene to learn and apply that knowledge faster than its competitors in order to assure long term success.

Research Methodology

As an organization Global Brains is continually growing and evolving, making it difficult to draw useful conclusions from a narrowly focused qualitative survey, which would provide only a snapshot in time of a dynamic process. As a case study, this research can address a broader scope of inter related factors that have allowed Global Brains to grow faster and more successfully than most of its competitors. The author of this case study is an employee of the Global Brains and actively involved in the Knowledge Management of the Buildings Engineering Practice Area, which comprises about 10% of Global Brains' total revenue. The research takes a blended approach utilizing participation in the setting, direct observation, and a small focus group session to ensure a user perspective. Grounded in the Chicago School of Sociology participating in the setting uses a

> journalistic model [that] has a researcher get behind fronts, use informants, look for conflict, and expose what is really happening…they hold that people create and define the social world through their interactions. Human experiences are filtered through a subjective sense of reality, which affects how people see and act on events (Neuman p. 381).

The researcher focuses "on the everyday, face-to-face social processes of negotiating, discussing, and bargaining to construct social meaning" (Neuman p. 381). As a facilitator and participant in the process the researcher/author is able gather data by informally asking the participants in the various Virtual Communities of Practice (VCoP) about their communication preferences, suggestions for improvement and any emerging technologies they have encountered in different settings that might be useful and should be explored further.

> The fundamental methods relied on by qualitative researchers for gathering information are (1) participation in the setting (2) direct observation (3) in-depth interviewing, and (4) document review (Marshall & Rossman p. 78).

The focus group session was held on 28 April 2008 in Toronto over the lunch hour at a

the mechanical discipline leaders VCoP annual face-to-face meeting attended by 23 active

participants in the monthly conference calls and contributors of content to the electronic Best

Practices Manual (eBPM). By holding this session at the meeting the researcher was able to

invite attendees from offices around North America to meet face-to-face without incurring extra

travel and accommodation. One of the propositions of this case study is that a face-to-face

encounter provides the riches form of communication, especially for a group, when compared to

electronic alternatives such as telephone conference call or e-mail discussion. To ensure the

focus group comprised only volunteers who did not feel obligated to participate by the position

of the researcher within Global Brains, an announcement was made at the beginning of the

meeting inviting people to attend at lunch time in a separate room where lunch would be

provided. An information sheet outlining the purpose and background of the study was provided

to all attendees. Six of the 23 attendees participated in the focus group session that lasted just

under an hour. Each participant signed a consent form provided by the researcher before the

session started. For a copy of the information sheet and consent form refer to Appendix B. The

six participants represented six different offices and three levels of seniority with industry

experience ranging from less than 10 years to more than 30 years. Two came from acquired

companies, one within the last six months of the session and one was female, which is consistent

with the gender ratio of Buildings Engineering technical staff. The session was recorded and a

transcript of the discussion can be found in Appendix A.

The purpose of the focus group was to confirm the observations made by the researcher

as a direct participant in the process. Providing feedback on the strengths and weaknesses of the

communication tools developed so far and where they can be improved. In particular the focus of

the discussion was on the role of the people within the system. Do CoPs work in producing the content for the electronic knowledge repositories? Are the current communication technology tools provided by Global Brains adequate to replicate local CoPs to become VCops? How important is face-to-face communication and which technologies best approximate it? What tools do you prefer to use and why? The participants volunteered from a group of 23 attendees at a multi-office meeting of the mechanical discipline CoP that has been active for the last two years and the second time they have met face-to-face as a community. This provided an opportunity to meet directly with senior subject matter experts familiar with CoP and VCoP experience and came from widely dispersed geographic regions. Their expertise is in the same subject matter – mechanical engineering – therefore eliminating any differences in the development and culture between the disciplines. The focus group also represented large and small offices, offices with mature as well as emerging services, and one person from a newly acquired organization with no history with the Global Brains CoP and KM initiatives. As a group they provided a wide range of perspectives in their role as experts as well as in their roles as managers and each had participated in various telephone conference calls and e-mail discussions and could represent their local Cops. A face-to-face meeting was selected over other forums such as telephone conference calls, e-mail questionnaire or discussion forum posted on the eBPM to test the proposition that face-to-face meetings offer a richer forum for open ended discussions by facilitating the ability to tell war stories in order to get your point across. Several stories were told during the gathering over food.

It is anticipated that the application of this research will provide similar companies with a more comprehensive understanding of the value social networks provide in knowledge management and provide people at all levels of the company with the tools to assess the relative

strengths and weaknesses of all parts of their organization and propose interventions that will strengthen the quality of knowledge management systems found within their company. Ultimately it is about who you know; what you know, and how you communicate what you know to whom you know. This case study will explore the role of virtual communities of practice (VCoP) in developing and continually improving the content of the electronic Best Practices Manual (eBPM) and transferring this knowledge across discipline, geographic and generational boundaries. At the same time this case study will explore the real and potential impact of existing and emerging tools for measuring the strength and frequency of relationships between people and groups within the organization using a social network lens.

Literature Review

> Sometime in the 1990's NASA lost the knowledge it had developed to send astronauts to the moon. In an era of cost-cutting and downsizing, the engineers who designed the huge Saturn 5 rocket used to launch the lunar landing craft were encouraged to take early retirement from the space program. With them went the years of experience and expertise about the design trade-offs that had been made in the building of the Saturn rockets. Also lost were what appear to be the last set of critical blueprints for the Saturn booster, which was the only rocket ever built with enough thrust to launch a manned lunar payload (DeLong p. 11).

One of the key challenges facing organizations today is the potential loss of knowledge when the baby boom generation retires. This is especially true of companies that employ primarily knowledge workers or what Richard Florida has termed "the creative class" now accounting for close to a third of work force. Much of the value that these graying workers bring to the organization is tacit and cannot be easily documented in a binder, manual or computer database. It also takes years to develop this expertise and cannot be replaced with a series of half day training sessions, as may be the case for factory workers or people in the service industry.

A perfect storm of demographics, rapid technological change, and a nineties recession has resulted in a shrinking pool of prime workers, people between the ages of 35 and 50 and with 15 to 20 years experience. The nineties recession resulted in lay-offs and buy-outs of senior staff as organizations struggled to reduce their costs. Those companies that weren't reducing their size didn't grow either, hence few new employees were hired and little attention was paid to training, mentoring or succession planning since it was easy to hire someone fully trained "off the street". Many organizations have not had to hire anyone for close to 15 years, experiencing a period of only 2-3% turnover.

As the baby boomer generation, those over 50 years old, starts to retire there are few workers available to replace them. This 15-year gap is forcing organizations to develop new strategies for retaining their knowledge. In the case of knowledge based organizations this

knowledge can literally walk out the door. According to David DeLong the primary reasons why

organizations lose their knowledge is due to poor documentation, restructuring, forgetting, staff

turnover, and reassignments.

Illustration 1 – adapted from DeLong, D. (2004) *Lost Knowledge* shows how knowledge is lost through reassignments, poor documentation, restructuring, and forgetting and how an effective knowledge management system using communities of practice can retain an organization's knowledge so that it can provide value through reuse.

Knowledge Workers

We are currently living in an information economy and are rapidly moving towards a

knowledge economy. This transformation has created a new type of worker that "engage[s] in

complex problem solving that involves a great deal of independent judgment and requires high

levels of education or human capital (Florida, p.8). This shift has forced organizations, which up

until recently created their value in the manufacturing or service industries to adapt from

employing people that are paid to "execute according to plan" to employing knowledge workers

who "are primarily paid to create" (Florida, p.8). "The complexity of the business environment

and its increasing technical specialization, [requires] the collaboration of many people with diverse backgrounds and expertise" (Morris, p. 137). With the advent of electricity, and more recently the World Wide Web, modern organizations operate simultaneously in both the physical and virtual space. The modern organization now needs to

> understand precisely what knowledge will give them a competitive advantage. They then need to keep this knowledge on the cutting edge, deploy it, leverage it in operations, and spread it across the organization (Wenger, p. 6).

The challenge for Global Brains, as well as other knowledge intensive organizations, is to effectively manage its knowledge assets by connecting its employees to technology, colleagues, clients, and information. "Very large systems are so complex that they become subtly unpredictable" (Hasenyager p. 1).

> Human minds have a unique cosmic function…the capability to act as local Universe information-harvesters and local Universe problem-solvers in support of the integrity of eternally regenerative Universe (Fuller p. xxxvi).

Social Network Analysis will help us map the terrain as we learn nature's lessons on how to create a sustainable mature eco-system comprised of multiple species, each connected by the web of life. In the knowledge economy, value is created not by producing and selling widgets but rather by ideas and innovation:

> [Creativity] – "the ability to create meaningful new forms", as Webster's dictionary puts it – is now the decisive source of competitive advantage" … [furthermore] creativity comes from people and while people can be hired and fired, their creative capacity cannot be bought or sold, or turned on and off at will (Florida p. 5).

There are three dimensions that can be used to describe the activities that a team or community can use to create and accumulate social capital:

Structural – the "information channels that reduce the amount of time investment required to gather information" (Lesser p.834) It allows individuals to make connections with

others in the organization and sometimes outside of the organization. Knowledge workers often belong to professional organizations that provide them knowledge and connections.

Relational – the ability to make connections through networking and the development of interpersonal relationships. This translates into human and social capital. Organizations can improve their human capital by fostering a collaborative climate and environment of trust.

Cognitive – the ability of communities to develop a shared context through which they can perform individual roles as part of the overall team. If done correctly the community can achieve better result than a group of individuals working on their own. One approach to overcome obstacles in learning and creation of collective intellectual capital is the concept of communities of practice (Wartburg p. 2).

In the organizational context these groups have been relatively modest in terms of size and due the linear flow of information – top down and back up again – they have been very effective and productive. Leaders have been able to make their commands known through a cascading process down the organizational chart. Modern knowledge based organizations such as Global Brains have virtually no assets other than the virtual assets found within the brains of their staff. At the same time these organizations are growing in size and complexity made possible by the Internet, which now connects anyone to everyone at the speed of light. This will require a new form of management only just being hinted at in the literature and not yet studied in enough depth to provide deep insight. In particular few publications address the impact of computer mediated information technology. How will e-mail, shared networks, portal web sites, conference calls, telephone and voice mail, and IM/text messages (Davenport p.123) affect the strength of relationships? How do they compare to Face-to-Face communications in strength, richness and effectiveness? Will large organizations have a competitive advantage over small

boutique firms loosely linked over the Internet? Or how will large organizations find, access, and leverage their knowledge? These are just a few of the questions that have yet to be answered.

A critical knowledge most organizations have lost over the last 15-years of relative stability is their ability to attract, retain, develop and motivate staff. In recent memory, staff retention has not been an issue but now people come for 3-5 years to build the resume for the next job. Shortsighted policies of layoffs, early retirements, and hiring freezes have resulted in a disillusioned work force with no loyalty to their employer. Conventional organizational wisdom has always been an attitude of "we're a great company. We can hire anybody we want. We can fix the problem by hiring people" (DeLong p. 32). Today however hiring rates are much lower than the attrition rate and "even if you can attract promising new hires, considerable resources are required to assimilate them (DeLong p. 36). Furthermore there is a limit to how many people you can assimilate at once.

This brain drain means that "talent has become the world's most sought-after commodity" (Wooldridge p. 3) especially in the knowledge economy. As the boomers begin to leave the workforce in larger numbers this competition is really heating up.

> Goldman Sachs, for example, increased its emphasis on formal training, setting up a Goldman Sachs University, and encouraging senior partners to put more effort into developing talent…it has rejigged its internal organization to appeal to well-qualified young people (Wooldridge p. 5).

The challenge for organizations remains, who is going to develop this talent? It can take 20 years or more to develop a top knowledge worker and requires a combination of formal training, mentoring, and practical experience. According to DeLong there are significant barriers to knowledge transfer between experts and less experienced employees, including:

- Lack of motivation to share/reuse knowledge

- Poor Communication
- Employees valuing knowledge differently
- Changing social context for knowledge transfer
- Types of knowledge may pose a problem

Many of these barriers can be overcome but they require trust and good will from all parties. Unfortunately when many people leave their jobs today, they are angry and alienated.

Knowledge workers are fiercely independent and do not like being told how to do their jobs. As the knowledge economy grows the traditional "command and control" management will no longer work. In its place organizations will need to grow a working environment that is flexible for its staff. They need to create an environment where people are presented with an objective, but no step-by-step instructions on how to achieve the objective. By changing the work environment, organizations have the opportunity to retain their staff longer, attract experienced staff from less flexible competitors, attract talented young staff looking for career development, and motivate them to work collaboratively towards the best solutions. In an interview with Wharton author David Sirota states that:

> People are basically looking for three things at work - to be treated fairly, to have a sense of achievement, and camaraderie, working together as a team. On the financial side employees want to know that they are getting fair pay while on the non-financial side they want to be treated respectfully, not as children or criminals (Knowledge@Wharton).

Employees also want a sense of achievement. According to researcher Sigal Barsade "one of the biggest complaints employees have is they are not sufficiently recognized by their organizations for the work that they do" (Knowledge@Wharton).

> Few [people] yearn to be managed; most talented people despise the very idea. You do not manage people. You create goals so compelling that your employees manage themselves to achieve them (Beckwith p. 38).

The challenge for modern organizations is to make work less command and control, more collaborative, more flexible, and most of all provide people with work that matters.

Rapid emergence of disruptive technologies means that no organization can guarantee lifetime employment. At the same time very few employees are willing to work at the same job for their entire career. Knowledge workers are always looking for the next challenge. Therefore the focus should be on lifetime employability. That is, an employee should be more employable in the job market when he or she leaves the company than when they started. Organizations need to offer employees a career plan that will engage them throughout their tenure with the organization. This can be achieved through a combination of money, social networks, and opportunities to work on exciting projects that can be achieved through formal and informal contracts with a 3 to 5-year horizon.

If knowledge workers can ply their trade anywhere, why do they still belong to organizations? Mostly it is because of the resources organizations can provide things that individuals can't and don't want to do. Services such as accounting, IT, marketing, etc. dilute a free agent's focus from what they really want to do. Organizations also offer career development, processes, co-workers and social networks. "Talent may reside in the brains of individuals, but it is also nurtured by organizations" (Wooldridge p.18). In fact a Harvard Business School research project showed:

> An immediate decline in [an individual's] performance if they switched employers. This was most marked for those who moved to lower-rated firms and did not take other members of their team with them…Talented people may think that their brainpower allows them to walk on water, but in reality many are walking on stones that their employers have conveniently placed beneath them (Wooldridge p.18).

A hot Alberta economy and rapid growth primarily through acquisitions has exposed a weakness in Global Brains' succession planning process. The recession in the early ninety's and subsequent spending freezes on infrastructure investments by the government and private sector have resulted in a 10-year gap in hiring and training of new staff. As a result there is a shortage of people with 10 to 15 years experience that have traditionally been the engine of any consulting engineering company.
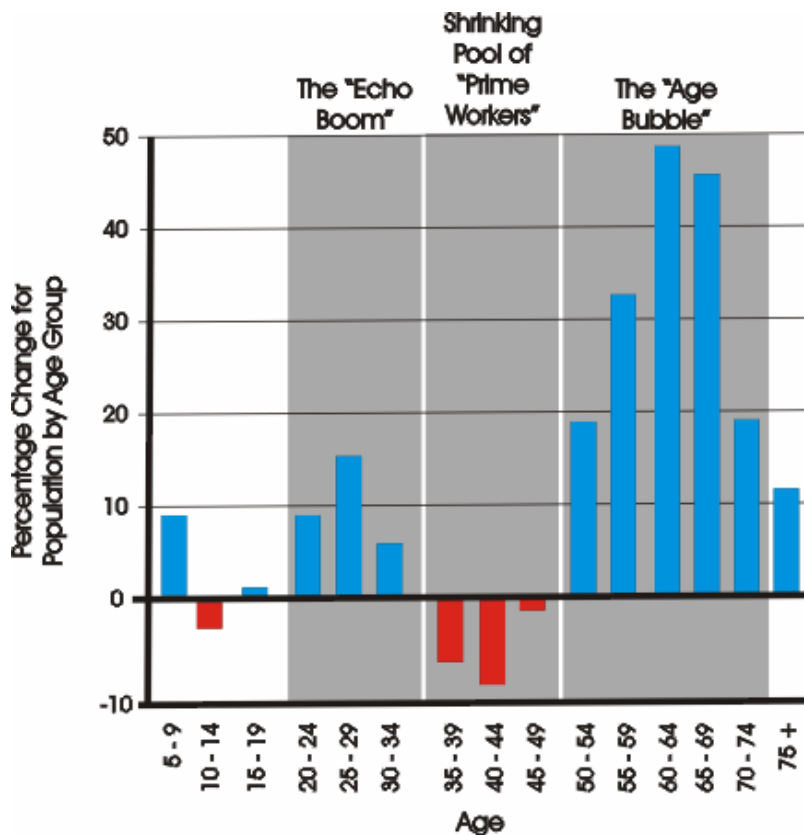

Illustration 4 - adapted from DeLong, D. (2004) *Lost Knowledge* shows the large number of "boomers" that will leave the workforce in the next decade and the shortage of prime workers to take their place. The challenge for organizations especially knowledge based organizations, will be to find ways of transferring their knowledge from the boomers to the gen Y (echo boomers) quickly.

As the economy continues to expand the consulting engineering industry is unable to find sufficient qualified people to complete the available work. With little hiring and virtually no training, firms are now finding that their staff is comprised of very experienced baby boomers

ready for retirement and bright young graduates that lack the experience to lead a project team, especially the large and complex projects currently being built throughout North America. Desperate to find qualified staff, Global Brains has started to recruit people currently working for their competition by offering more money. The weakness in this approach is that by paying a higher salary to new employees they have pay more to their current staff or risk losing them to competitors. Given the exceptionally poor working conditions in the industry over the last decade there is little good will, let alone loyalty left in the industry. Most baby boomers are happy to cash-in on the newfound demand for their services just before they retire. There is little a company can do to motivate their graying staff especially with promises of future rewards. Boomers are only interested in short-term contracts where cash is king. Although private sector companies can afford to pay the higher salaries by raising their rates they charge their clients the challenge is creating a sustainable business plan that will see the company continue to be successful for the next decade and beyond.

The challenge for Global Brains is similar to that faced by all knowledge based companies. They must find a way to bridge the mid-career staffing gap before the last of the boomers retires. This challenge is multiplied by the heavy workload that offers little time or focus to train or mentor either junior or intermediate staff. Clients expect senior personnel to lead their project and expect them to be at all project meetings. However with an increasing number of projects senior staff members are being asked to lead several projects simultaneously while at the same time lacking the experienced staff to whom they can delegate the work to. At the same time this increased workload allows no time to sit down with junior staff to explain the project with them, let alone mentor them. If this situation continues unabated Global Brains runs a real risk of losing a significant amount of its knowledge within a decade and as a knowledge based

company would be effectively out of business. Every night, all of Global Brains' assets walk out of the door and the company hopes they will return in the morning.

Having recognized the threat to their continued success, Global Brains has embarked on a knowledge retention strategy aimed at retaining, attracting, developing, and motivating their staff. The strategy starts with paying a competitive salary, recognizing the contribution their stars make to the company's success, and making it more difficult for competitors to attract them on salary alone. Furthermore Global Brains can offer staff interesting as well as large and complex projects to work on. Projects that look good on resumes and not available by working for smaller companies that lack the resources to complete such projects. With more than 80 offices throughout North America Global Brains also offer opportunities for people to move geographically and/or laterally without having to leave the company and associated loss of seniority and accrued benefits.

In the medium term Global Brains is investing significantly in enterprise wide technology systems such as project accounting systems that help project managers track the budgets on all of their projects in real time from anywhere with an Internet connection, a marketing knowledge center allowing business development staff access the resumes all staff and project data and convert into a customized proposal anywhere, anytime. An electronic best practices manual (eBPM) that provides design staff with resources such as design software tools, codes, standards, design aids and access to globally recognized experts.

In the long term Global Brains senior leadership needs to get its thinking out of the ninety's when they could adjust their staff to match the available work by continually laying people off and rehiring them when a new project was procured. The boom, bust echo demographics will ensure that the search for talent facing companies will be experienced by

organizations throughout North America and globally in the near future. Senior management must replace its command and control management style with a more flexible collaborative approach.

> Knowledge workers are different from other workers…they don't like to be told what to do, the flow of their work is difficult to structure and predict, they work best when working with other people in social networks, and they are better led by example than by explicit management (Davenport p. 14).

Communities of Practice

According to Etienne Wenger "Communities of Practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger (2002) p.4). This group can include "a tribe learning to survive, a band of artists seeking new forms of expression, [or] a group of engineers working on similar problems" (Wenger (2005) p.1).

> Communities of Practice are not a new idea. They were our first knowledge-based social structures, back when we lived in caves, and gathered around the fire to discuss strategies for cornering prey, the shape of arrowheads, or which roots were edible. In ancient Rome "corporations" of metal workers, potters, masons, and other craftsmen had both a social aspect … and a business function (training apprentices and spreading innovations). In the Middle Ages, guilds fulfilled similar roles for artisans throughout Europe (Wenger, (2002) p. 5).

Within modern organizations many communities already exist. Some are recognized while others remain under the radar. Some operate within a business unit, while others cross several business units, institutional boundaries and even multiple organizations. We are all members of multiple communities in our work, at home and our hobbies. Wenger identifies five relationships of communities to their organization – unrecognized, bootlegged, legitimized, supported, and institutionalized. (Wenger (2002) p.28).

Formal CoP's are united by a common purpose and have a physical structure, processes and practices, and some form of enabling technology. Their focus can be on helping members share ideas and solve problems, or developing, validating and distributing new or best practices, or acquiring and disseminating knowledge, or foster innovation.

In the past the value of a Community of Practice was seen as primarily benefiting the individual who volunteered to achieve a specific goal or increase their skills and knowledge on a specific subject of interest. In the knowledge economy, however, CoPs are increasingly being recognized for their benefits to the host organization through their "potential to overcome the inherent problems of a slow-moving traditional hierarchy in a fast-moving virtual economy" (Lesser p. 831). They are "acknowledged to be a means of developing and maintaining long-term organizational memory" (Lesser p. 831). This is an important outcome for organizations increasingly concerned about capturing and retaining the knowledge of retirees as an increasing number of "baby boomers" leave the organization. At the same time organizations are looking for ways they can "derive competitive advantage by transferring knowledge internally while preventing its external transfer to competitors" (Argote p. 150).

"Communities of practice create value by connecting the personal development and professional identities of practitioners to the strategy of the organization. Successful ones deliver value to their members as well as the organization" (Wenger (2002) p. 17). As more and more work becomes knowledge based it will become increasingly important for organizations to develop a collaborative climate where workers can creatively solve problems.

> Communities of practice, like all human institutions, also have a downside. They can hoard knowledge, limit innovation, and hold others hostage to their expertise … it is important not to romanticize communities of practice or expect them to solve all problems without creating any. They are not a silver bullet (Wenger (2002) p.139).

Organizations must learn to understand communities of practice and how, when effectively deployed, they can build social capital.

As organizations grow in size and complexity, success increasingly depends on teams or multi-disciplined groups, not "a genius with a thousand helpers" (Collins, p. 46). To be successful organizations must understand how people, working in teams, create value and positively influence performance. "The concept of social capital has been widely addressed in the sociology, political science, and economic development literatures" (Lesser p. 833) and it seems to hold a lot of promise for measuring the success of organizations. Social capital is defined as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit" (Lesser p. 833). Companies that employ knowledge workers are increasingly searching for "collaborative techniques that enable these people to work together quickly and effectively to solve problems" (Morris p. 137).

As more and more work becomes knowledge based it will become increasingly important for organizations to develop a collaborative climate where workers can creatively solve problems. "Globalization and ever changing organizational structures affect the modes in which collective knowledge is created, retained, and used within an organization (Wartburg). In response organizations such as Shell, Schlumberger, the Jet Propulsion Laboratory (JPL), Buckman Laboratories, the US Navy, IBM, CH2M Hill, Macmillan Cancer Relief and Wishard Memorial Hospital are turning to the Community of Practice (CoP). Just like an organization can be compared to a mature forest, a CoP can be visualized as a plant that

> does its own growing, whether its seed was carefully planted or blown into place by the wind. You cannot pull the stem, leaves, or petals to make a plant grow

faster or taller. However, you can do much to encourage healthy plants: till the soil, ensure they have enough nutrients, supply water, secure the right amount of sun exposure, and protect them from pests and weeds. There are also a few things not to do, like pulling up a plant to check if it has good roots (Wenger p. 12).

Within the organization these "Communities of practice create value by connecting the personal development and professional identities of practitioners to the strategy of the organization. Successful ones deliver value to their members as well as the organization" (Wenger, (2002) p. 17).

Virtual Communities of Practice

So far we have looked at communities of practice (CoP) occurring in a single location where members can easily communicate with each other face-to-face, whether that is through an official meeting or impromptu discussion at the proverbial water cooler. With the advent of globalization however, organizations are dispersed not only geographically but also temporally. The people with the knowledge are often several time zones away. No longer are the master and the student working side-by-side. This provides a special challenge for the establishment of communities since they can no longer "rely on face-to-face meetings and interactions as the primary vehicle for connecting members" (Wenger (2002) p.115). This requires the creation of virtual communities of practice (VCOPs) or distributed communities of practice which require a different approach and communications tool kit from than the local communities. Distributed communities are increasingly becoming the norm rather than the exception.

Distributed communities of practice are possible because of the rapid improvements in global communications. Radio, television, telephone, internet, e-mail, etc. put the world at our fingertips. They also expand the sphere of influence and diversity of knowledge available to any community. In fact it is now much easier to be a member of multiple communities. Although

there are added challenges to the establishment and cultivation of virtual communities, new

technologies offer emerging opportunities for creating, retaining, and applying collective

knowledge or intellectual capital. Wartburg, et al in their paper "*The Creation of Social and*

Intellectual Capital in Virtual Communities of Practice" hypothesize that

> VCOPs enhance the innovation and the productivity of individual actors and
> collectives beyond the degree of formal organizational structures …VCOPs
> contain relationships between actors that are more far reaching in terms of
> quantity and quality than in formal organizational structures [because] members
> of VCOPs can take part in a larger number of communities than members of
> organizational entities who rely on personal interaction only (Wartburg).

It is worth the time and effort for any organization operating in a knowledge intensive

environment to become skilled at cultivating CoPs since in "any situation requiring the real-time

combination of multiple skills, experiences, and judgments, a team inevitably gets better results

than a collection of individuals" (Katzenbach, p. 15).

Global Brains needs to develop a "knowledge-sharing culture [by organizing] around

knowledge – how to create it, share it, capture it, and apply it – rather than around *structures* and

processes" (Buckman, p. xii). This means breaking down the organizational silos and moving

away from the command-and-control style of operating. Staff at all levels need to be rewarded

for contributing to the overall knowledge of the company "The greatest danger to communities

is for them to lose energy and drift into apathy, letting the coordinator carry all the responsibility

for caretaking" (McDermott, p. 5). "Communities cannot be measured and managed in

conventional ways. Traditional methods are not likely to appreciate the creativity, sharing and

self-initiative that is the core elements of how a community creates value" (Wenger p.185).

Face-to-Face Communication

For people, whether in an organization or culture, "there is really nothing to replace firsthand experience" (Wensley, p.113). "Face-to-face meetings have been shown to be important for building relationships and trust…and the sense of belonging necessary for open exchange and sharing [that] may be much more difficult through computer mediated interactions" (Dube, p. 6). "Human beings are wired for stories. Throughout history, knowledge was transferred through speech, pictures, or writing" (Neilson. P.26). "Although the oldest known written narrative (*The Epic of Gilgamesh*) dates back only 5,000 years, the written literary traditions of many ancient cultures are known to be rooted in longstanding oral traditions" (Sugiyama p.233). "Literate or not, all known cultures, past and present, practice storytelling" (Sugiyama p.234). "For all practical purposes, the relationship is made in a face to face meeting: this enables the relationship to develop quicker and to go further" (Kimble, p. 231). In interviews community members "felt that during the periods of communication by e-media the momentum gradually slowed until a physical meeting picked it up again" (Kimble, p. 230). A key tool for keeping virtual meeting focused is "the use of a document as a shared artifact for communicating and sharing of soft knowledge" (Kimble, p. 228). "It is not the artifact per se which is important but the process involved in its creation … [members] were able to share knowledge by both participating in the process of creating it, and by participating in the discussions and collaborations which resulted from it" (Kimble, p. 231).

> When design tasks take place in a collaborative context, the reflection results in articulation of solutions in language or in other symbolic representations…that can be supported by computer-based systems of organizational memory if the articulated knowledge is captured in a digital symbolic representation (Stahl, p. 7).

Successful organizations provide their people with an effective work environment, physically in the form of an office space that encourages ad-hoc meetings and collaboration, and virtually through connectivity that provides access to the organization's knowledge base and the e-media tools that allow them to collaborate with anyone in the organization regardless of their physical location.

We are only at the dawn of the knowledge economy and many issues will need to be resolved as we move forward. Successful organizations will transform their culture from one where everyone feels they must have the answer to one where everyone knows something, nobody knows everything, and we will find the best solution together. Moving forward management must recognize that learning is exclusively a human activity. Computer technology can support but not replace creative employees, which are truly the company's most valuable assets. Information has become a commodity and technology is available to everyone.

Storytelling

Information gathering and application is essential to our survival and storytelling is the most effective way of sharing knowledge and learning from each other. It is extremely improbable that a single individual could acquire through experience all information necessary or potentially useful to the multitude of fitness-related tasks encountered over a lifetime (Sugiyama p.237). "The flexibility of the brain's interactions with nature, through culture, has been the key to our success. Cultures can adapt far more quickly than genes to new threats and needs" (Wright p.19).

> We can trace [storytelling] back thousands of years to the days of the shaman around the tribal fire. It was he who recorded the oral history of the tribe, encoding its beliefs, values, and rules in the tales of its great heroes, of its triumphs and tragedies (Guber p. 55).

"Sharing your story at work brings you into community. In telling stories and listening to others' narratives, you discover you walk on common ground" (Iffrig, p. 32). "Story is productive for sharing and spreading new knowledge in the organization" (Iffrig, p. 35). In the modern knowledge economy we are re-discovering the power of narrative or storytelling to share our tacit knowledge. "We organize our experience and our memory of human happenings mainly in the form of narrative – stories, excuses, myths, reasons for doing and not doing, and so on" (Bruner p 4). With the growing realization that the codification of implicit knowledge and the construction of massive management information systems does not provide the silver bullet solution to an organization's collective knowledge needs more and more are turning to storytelling as way of creating, retaining, and applying knowledge.

An increasing number of articles are touting storytelling as a potential solution to the challenge of sharing tacit knowledge effectively over great distances and timeframes Since CoPs are composed of people, stories or narrative can make the information found within the organization understandable. "Stories are the foundation for many formal and informal communities that form within an enterprise. The act of sharing stories creates the knowledge flow that makes a community alive and valuable" (Reamy). The water cooler is the CoP's metaphorical equivalent of the campfire. The place where people share stories and find out how things are really done within the organization. The grizzled veterans tell war stories and how they solved a particularly sticky problem or "trouble", where the Xerox technicians learned how to fix copiers in spite of the manuals.

CoPs are the ideal medium for capturing the lessons embedded in the narrative. A shared mythology is precisely what holds communities together and allows them to grow:

> It is telling not only that we enjoy listening to stories, but that we enjoy listening to them repeatedly. The acquisition of useful information, or learning, is a plausible explanation of this phenomenon, as learning tends to be accomplished through repetition" (Sugiyama p.245).

What Shannon would refer to as redundancy in the channel. As stories are repeated and passed on to the new kids on the block, communities become the organization's memory. This becomes increasingly important as a large number of experienced people – the human capital – prepare to leave the organization, taking their hard earned knowledge with them. Social capital is created in the organization as CoPs capture the human and intellectual capital by providing an environment that encourages knowledge sharing and group learning. This new knowledge or innovations become an organization's competitive advantage. CoPs do however; offer a strong value proposition that can be measured by the amount of social capital it generates. The more social capital is present within an organization the better people are able to perform their role, which ultimately translates into the ability of an organization to achieve its stated goals.

Communication Technology

Evidence of the increasing value corporations place on social capital can be found in the physical design of office space, the natural habitat of the knowledge worker. Companies such as IDEO, Nickelodeon, Regus, SEI Investments, CityTV, Nortel, Herman Miller, and Bloomberg are designing their offices to increase the number of chance meetings where staff can socialize and share ideas. "Much of work revolves around connections – to technology, to colleagues, to customers, and to information" (Salter, p. 260). An office needs to provide "a place to enjoy, invent, talk, cross-pollinate" (Dault, p. 54). In the new Bloomberg headquarters in New York:

> all offices have a central pantry, with free food for breakfast, snacks, or a collegiate lunch; all have floors grouped around a single elevator stop, with intra-company movement by staircase and escalator; all have "break-out spaces",

where a chance encounter can turn into a quick business meeting; and all have glass conference rooms for private meeting (Lange, p. 91).

Bloomberg provides us with a glimpse of the "future of a 24-hour global organization" (Lange, p. 101). In its newest offices in Edmonton, Calgary and Vancouver, Global Brains has provided large common areas with coffee and snack station, open stairwells and multi-media equipped conference rooms to encourage staff interaction in both real and virtual space. Although there are added challenges to the establishment and cultivation of virtual communities, new technologies offer emerging opportunities for creating, retaining, and applying collective knowledge or intellectual capital:

> VCOPs enhance the innovation and the productivity of individual actors and collectives beyond the degree of formal organizational structures … [furthermore] VCOPs contain relationships between actors that are more far reaching in terms of quantity and quality than in formal organizational structures … [because] members of VCOPs can take part in a larger number of communities than members of organizational entities who rely on personal interaction only … VCOPs are a managerially desirable form of virtual communities in which learning in practice takes place, i.e. Professionals are bound together by the exposure to common problems in the execution of "real work", shared expertise and experience, and the need to know what each other knows (Wartburg, p. 19).

At the same time VCOPs allow people to collaborate asynchronously when individual schedules and geographic separation make face-to-face meetings difficult.

Members of the organization, CoP's or project teams, communicate in virtual space through electronic means – telephone and computer. The World Wide Web and the web-based tools have made the global 24-hour organization possible. "The web is an intensively interactive medium providing for rich communication between any user regardless of his or her location or equipment. The Web allows for an unprecedented degree of integration of different representational and communicational media" (Wensley, p. 116). There are a variety of web

based e-media tools available to organizations and as people learn to use them effectively they are woven into the fabric of the work processes until there comes a point where they are no longer considered a technology, just a natural extension of our work. It is beyond the scope of this paper to explore all the e-media tools currently available let alone the variations within individual products. A listing of generic e-media tools and brief description is provided in Appendix D to provide a context. Ultimately the success of any e-media tool will depend on its simplicity of use and its ability to let people exchange ideas within a group or culture.

It is important to match the message to the medium when selecting the appropriate channels for communicating knowledge and gain insight on a topic:

> The term richness refers to the ability of media to change human understanding by clarifying ambiguous issues. Ambiguity is the key to understanding the amount and kind of interaction, and the communication medium most appropriate for delivering a message … The richness of a medium is defined by (i) the ability to provide rapid feedback, (ii) the ability to communicate multiple cues (iii) the ability to convey personal feelings (iv) the ability to use natural language … The integration of various computing technologies allows information to be stored so that organizational members can retrieve the information from the collective database. These characteristics of new communication technology can be collapsed into four additional criteria for media choice: reach, recordability, memory and occurrence (Buchel p. 19).

Companies that employ knowledge workers are increasingly searching for "collaborative techniques that enable these people to work together quickly and effectively to solve problems" (Morris, p. 137). To measure the strength of people relationships there are four features that

> distinguish effective from ineffective relationships: (1) knowing what another person knows and thus when to turn to them; (2) being able to gain timely access to that person; (3) willingness of the person sought out to engage in problem solving rather than dump the information; and (4) a degree of safety in the relationship that promoted learning and creativity (Lesser (2004), p. 63).

To measure the strength of electronic connections and how they enhance or detract from the personal relationships we will use the level or richness provided by each of the existing or emerging technologies. As part of the literature review, communication technologies will use measures such as "richness" using a scale that ranges from face-to-face meetings to memo, space and time characteristics – same time and same place, same time and different place, different place and different time -- the number of people involved – one-on-one, one-on-many, many-on-many -- and the amount of inter personal interaction using a scale based on Marshall McLuhan's concept of hot (one-way i.e. television) and cool (two-way interactive i.e. telephone).

Communication Medium	Richness
Face-to-face	1.0
Telephone	0.94
Video Conferencing	0.79
Decision support systems	0.55
Memos	0.27
E-mail	0.13
Fax	0.11

Richness scale adapted from (Buchel, p. 18)

Global Brains and Knowledge Management

On 01 January 2004, Buildings Engineering officially became a Practice Area within Global Brains by combining the electrical, mechanical, and structural disciplines that had previously operated independently in 23 offices. Although this restructuring was done primarily for operational reasons to streamline the financial reporting, there was a secondary objective to integrate the practices of the disciplines and the offices. For more than two decades Global Brains had grown mostly by acquiring smaller companies in strategic locations and market sectors. A process much accelerated at the turn of the millennium. These acquired companies had continued their practice as they had done successfully prior to the acquisition. As a result the newly formed Buildings Engineering Practice Area operated as a loose network of independent Profit Centers each with its own standards, processes, and areas of expertise. In 2004, the first full year of operations, Buildings Engineering had 421 employees and accounted for 9.14% of Global Brains Inc.'s net revenues. By 2007, the last year for which data is available, Buildings Engineering had 751 employees and net revenues had more than doubled accounting for 12% of Global Brains Inc.'s net revenues reflecting the growth of the company as a whole.

The challenge for the Buildings Engineering Practice Area was to harmonize the standards and capture the knowledge found within all Profit Centers so that work and talent could be shared across the Practice Area. The ability to share work and talent would allow Buildings Engineering to improve its staff utilization rate by reducing the peaks and valleys of the typically cyclical construction industry. Furthermore the ability to draw on expertise not often found in a local office to will create design teams capable of tackling large and complex projects such as hospitals, research laboratories, post secondary facilities, resorts, airports, etc. and finally train junior staff in anticipation of an industry wide talent shortage caused by "baby

boomers" retiring and shortage of prime workers, those with 15 to 20 years of experience, to

replace them.

To meet this challenge it was decided to create a knowledge repository that would

capture and publish the technical knowledge found within the company. The electronic Best

Practices Manual (eBPM) was created as a pilot Intranet project focused on the technical aspects

Buildings Engineering and connected to GlobeNet, the corporate Intranet providing staff

information on operational issues such as policies, employee programs, forms, company history,

project and employee directories and the Global Brains Marketing Knowledge Center (SMKC)

that provides project managers with customized personnel and project profiles used to respond to

requests for proposals (RFP) and other marketing activities in all of the more than 150 offices.

Traditionally knowledge in the consulting engineering industry has been captured by individuals

in the form of a "design binder". This binder houses a collection of documents gleaned from

standards published by professional associations, product catalogs, company processes and tables

based on the "rules of thumb" used by senior designers. The intent of the electronic repository

was to capture and scan this information, collected by individuals over decades, and post it in the

best practices manual so it could be reused by junior staff. It was quickly discovered however

that there was no consistency among the binders. Although few were totally wrong, each did

reflect the biases and preferences of the owner. This issue is exacerbated by the fact that Global

Brains is comprised of a collection of acquired companies, each of which had its own standards

and processes developed over decades and proven on hundreds of projects. What was needed

was a process for reviewing the available information and selecting the best ideas from each

before integrating them into consistent standards and processes that could be adopted by

everyone. What was needed was a "Global Brains" way of engineering buildings. To achieve this

challenging goal Buildings Engineering looked to Communities of Practice (CoP) to develop the content of the eBPM so that it would be consistent, correct, and reflect the best ideas available within Global Brains and the building industry.

Knowledge creation, retention, and reuse – the main reasons for losing organizational knowledge is staff turnover, restructuring and poor documentation. Global Brains's rapid growth through acquisitions and resulting structural changes required to respond make knowledge retention and acquisition especially challenging. Each acquisition brings with them their own set of standards and procedures that work well within the context of a smaller organization but need to change within the context of Global Brains. Not because they are wrong but because of the need for consistency at a large organization. This is the only way to achieve efficiency and effectiveness. At the same time it also provides an opportunity to identify and adopt practices that are better than the ones currently in use. Each acquisition brings new ideas and the opportunity to improve the best practices available at the time. This process is easier to accomplish for implicit knowledge already documented within the knowledge repositories of both organizations and identified during the due diligence phase. The more difficult aspect is capturing the tacit knowledge that each new employee brings to Global Brains after the acquisition has been completed. How do you do Global Brains employees discover the skill sets and knowledge of the new employees and how do the new employees access the resources of their new organization?

Knowledge repository – the first step for Buildings Engineering's knowledge management initiative was to build an electronic knowledge repository where explicit knowledge available within the practices manuals of each office and design binders of senior employees could be posted and made available to all staff. The electronic Best Practices Manual (eBPM) as

it became known was a pilot Intranet site hosted on an un-partitioned server within the Global

Brains network so that anyone with a valid employee account could access it without extra

security barriers. The eBPM was deliberately hosted outside of GlobeNet, the primary Intranet

site used by all employees to access company information. This was done so that the limited

resources available to Buildings Engineering for this task would not be overwhelmed by multiple

requests for specific documents or knowledge that was not posted. It also allowed for some

experimentation of the taxonomy of the site so that this could evolve organically from the grass

roots rather than being decreed from the top down. This strategy allowed the site to grow in

response to the content provided by the most engaged employees and information required for a

specific project. An early success was the procurement of electronic codes and standards so that

they are available to all staff anytime and anywhere. This was an improvement over the

traditional method of purchasing a hard copy and placing it in the local office library. The quality

of library varied significantly from office to office depending on local management and

resources available. The larger offices had more resources to build and maintain a library than

smaller offices. At the same time codes were often out of date and could be inaccessible when

someone took the document home to work on the weekend. Making the documents available

electronically ensured that the latest version is always available to anyone that needs it. In 2004

this was still a very new concept to most publishers who were unsure how to license their

intellectual property in a networked environment where physical locations are irrelevant. Each

vendor had a different approach ranging from Internet subscription using a username and

password such as the National Fire Protection Association (NFPA) to license servers hosted on

Global Brains' network like the National Building Code of Canada. As Web 2.0 technology

became more widely accepted codes and standards have become more widely available the

majority of commonly used documents is now available electronically to Buildings Engineering staff and can be shared with other practice areas when needed. This approach facilitates work sharing by allowing employees from multiple offices work on the same project and assuring they have access to local and/or client codes and standards. A similar approach has been instituted for software tools, which are now hosted centrally utilizing a concurrent licensing system that allows a specified number of users to run the software simultaneously thus providing a diversity factor to the users as not everyone needs access at the same time. This approach has several advantages. First it streamlines software management by ensuring everyone runs the same version on similar hardware without extensive local IT support. Second, by standardizing on a single "best of category" software program, training can be harmonized and users can share knowledge on how to effectively use the application. Finally data can be shared among users in different offices greatly increasing the capacity to do large projects and/or meet tight timelines. Building on the success of sharing codes and standards and software tools the next step was to capture the explicit knowledge found within the mechanical, electrical, and structural disciplines.
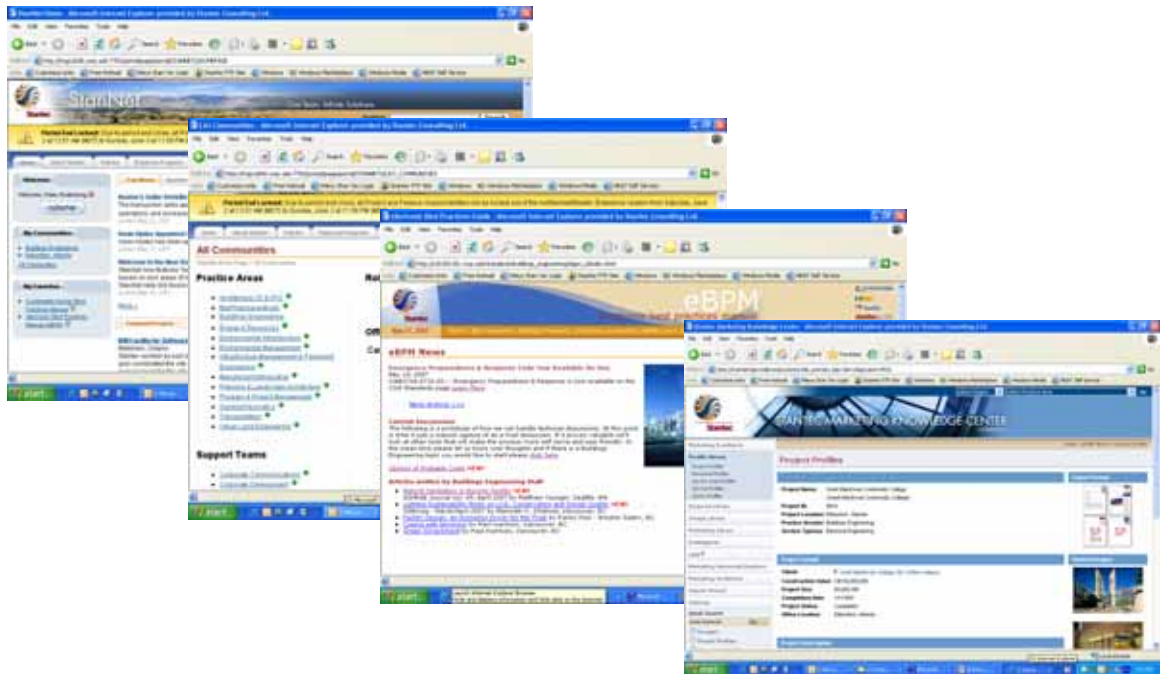
Illustration 3 - *screen captures of Global Brains knowledge repositories* shows the various internal systems available to Global Brains employees including GlobeNet, Global Brains Marketing Knowledge Center (MKC), and electronic Best Practices Manual (eBPM)

The eBPM was initially built as a simple Intranet site using Microsoft FrontPage software to develop the pages and links. The site was managed by the author who also reviewed the content that was collected primarily via e-mail attachments. The initial taxonomy used systems to organize the content to reflect the way design documents are created and published. In the first year 5 GB of documents including Computer Aided Drafting (CAD) standards, standard specifications, standard details, calculation forms and personal design notes were posted providing the foundation for the best practices manual and basis for future discussions and growth. In the summer of 2005 a summer student rebuild the site using straight HTML coding in order to eliminate issues caused between FrontPage coding and Global Brains' internal network. It also facilitated the use of cascading style sheets making it easier to standardize the text and page layouts and a further level of content taxonomy was added in the form of market sectors such as healthcare facilities, research laboratory facilities, hotels and resorts, airports, etc. in

order to integrate content from multiple disciplines into a single page. Employees working on a specific building type could now find design information from all engineering disciplines with a single click. At the same time these pages provided information about client needs and sector requirements, Global Brains experts and links to their profiles on the SMKC and showcase projects completed by Global Brains. The intent was to facilitate Global Brains's integrated services approach of "One Team. Infinite Solutions".

To keep the project manageable the initial site had been promoted only to the people that provided content and had an interest in sharing technical information. This was done mostly by sharing links to the site via e-mail. There was a reluctance to make the eBPM widely available pending a thorough review of the content to ensure it was correct. As awareness of the eBPM and its usefulness of the content spread a link was added to the Building Engineering page of GlobeNet so that everyone within the practice area could access the posted materials and contribute their own. This led to a further change in taxonomy by adding specialty services that crossed all disciplines such as security, energy, modeling, commissioning, etc. in order to further communicate the availability of those services throughout the practice area. This "folksonomy" allowed content to be posted once and linked multiple times to suit the perspective of the user at the time. The site was further expanded when a need arose for a central repository of sustainable design information being collected throughout the company. By using the same page templates and adding a green background, so that browsers know what section they are in, a new site was quickly built. The sustainable design site also incorporated content from the Architectural practice area thus proving the eBPM concept could be used enterprise wide. In the spring of 2007 StanNet was upgraded to provide better functionality and the eBPM was integrated into the new Intranet by allowing users to make the eBPM part of their favorite links. The next step will

be to fully integrate the eBPM content into the new GlobeNet and expanding the concept enterprise wide, which will further expand the management of explicit knowledge of the company. However capturing the tacit knowledge will remain a challenge for the communities of practice.

Communities of Practice – it became clear very early on in the process that just posting technical documents verbatim would be insufficient to capture and retain the knowledge required to successfully complete complex projects. At the same time there was a tremendous opportunity if the extensive and growing expertise could be identified and leveraged. "If only Global Brains knew, what Global Brains knows". Communities of Practice (CoP) seemed to provide a potential solution. By encouraging employees with similar interests and expertise to form a community they might be able to develop content for the eBPM while at the same time share leading edge information that ensures Global Brains services remain at the forefront of their industry. By allowing junior employees to join in the activities of individual CoPs knowledge would be shared much more rapidly than traditional channels. As part of the eBPM pilot project a number of CoPs comprised of passionate volunteers were established based on the initial taxonomy of the eBPM site. Because of the distributed nature of Global Brains' operations CoPs quickly became virtual CoPs (VCops) and the company supported their efforts with resources such as teleconference and web meeting accounts and time to meet.

One of the key challenges in a widely dispersed company the getting CoPs started. When people are located on the same floor or even the same building it is more likely that they will strike up a conversation that may ultimately lead to future collaboration in an informal CoP. When people work in the same building, chance encounters are much more likely. As jobs migrate from manufacturing to knowledge based work the physical workplace is changing to

accommodate the needs of the creative class. Research buildings , which stand at the vanguard of the knowledge economy are now designed to include open stairwells, wide corridors, atriums and common lounge areas in order to increase serendipitous encounters among workers in hopes that they will strike up a conversation, build a relationship and cross pollinate ideas in order to create new ones. But how do you spark relationships when people are hundreds even thousands of miles apart. Technology can play a role as people communicate via telephone, e-mail or discussion forums; however these are not very rich channels and are limited in the types of information they can effectively convey. It is difficult to build communities by electronic means. At Global Brains the challenge is even greater as the vast majority of the knowledge resides within employees that can best be described as digital migrants rather than natives. The baby boomers, the generation that has the knowledge and experience you want to capture before they retire are uncomfortable with technology, especially communication technologies. In order to plant the seeds for CoPs, Building Engineering's senior management decided to create a number of technical topics and the author was charged with facilitating the establishment of the communities by encouraging volunteers to join one or more groups in which they had an interest or needed for their jobs. A snapshot of these CoPs are shown in the table below.

Buildings Engineering Communities of Practice	
A = active **E** = emerging **F** = future	
Mechanical (A) Heating & Cooling (E) Ventilation (E) Controls (E) Fire Protection (A) Specialties (E) **Electrical (A)**	**Market Sectors** Research / Laboratories (A) Healthcare (A) Education (F) Retail / Commercial (F) Hospitality (E) Sports, Recreation & Leisure (F)

Lighting (A)	
Power & Distribution (A)	Airports & Aviation (F)
Motors (E)	Attractions, Art & Entertainment (F)
Communications (E)	Community Institutional (F)
	Cultural, Religious & Public Assembly (F)
Plumbing (E)	Justice (F)
	Multi-unit residential (F)
	Military facilities (F)
Structural (A)	Arctic & Northern Facilities (F)
Concrete (F)	
Steel (F)	
Masonry (F)	
Wood (F)	
Global Expertise	
Sustainable Design (A)	
ES^3 (A)	
Energy Solutions (A)	
Performance Engineering (F)	
Performance Modeling (E)	
Others as required (F)	

The initial Buildings Engineering CoPs were established to reflect the main topics with those found in the eBPM in order to have structure for the content and reflect the services provided to clients. Once the topics were selected the next step was to identify and recruit subject matter experts (SME), people that had extensive expertise and had shown a passion in the subject. The employees listed in client proposals because they will get you the job. Who are active in their local and national professional associations in order to stay current with the latest industry ideas and technologies and who take pleasure in sharing their knowledge. The next step was to recruit interested members from multiple offices. These employees were often referred to as "encouraged volunteers", that is employees recommended by their managers as people that had shown an aptitude and potential in the topic, and could benefit from building a relationship with the SME. The first meetings were typically done via teleconference set up by the author

where members could introduce themselves and present their personal skills and interests. The outcome of this teleconference usually resulted in follow-up e-mail correspondence, posting of materials on the eBPM and a schedule for regular teleconference calls and where necessary Web meeting component. CoPs were encouraged to define their own role, processes, deliverables and leadership. The author would often remain part of the CoP in order to provide resources needed and ensure the community is recognized within the Practice Area. During these formative stages organizations must be careful not to over manage the process and make participation seem like part of the job. Care must be taken not to overload CoPs with too many expectations. There is a tendency to develop ambitious action plans with short timelines so that progress becomes immediately apparent. This can lead to burn out of the membership as they juggle their day-to-day responsibilities with the requirements of the CoP that has no immediate pay-off. At the same time they must remain focused on the task at hand and not become a social club where people come to discuss personal issues. In this case expectations are that content will be added to the eBPM. Once the CoPs are firmly established and have developed their role and processes it makes sense to meet face-to-face in order to strengthen relationships and continue to build trust. Often at these meeting the social activities at these summits achieve more in long term value than the formal meetings as members get to know each other personally. The mechanical, electrical and structural CoPs now hold annual summits in addition to their monthly conference calls and e-mail correspondence. This has helped tremendously in maintaining the energy and momentum of the CoP which has resulted in significant increase in the quantity and quality of the content contributed to the eBPM. As of the end of 2007 the eBPM contained than 11.5 GB, 43,298 files, 2,694 folders (a snapshot taken by the author on 31 December 2007) more than double that of the end of 2005. An unintended outcome of the CoPs has been their ability to integrate new

acquisitions and staff by providing a forum for individuals to meet people with common interest, learn about Global Brains, and contribute their knowledge. It is impossible to predict growth and success or failure of individual CoPs but if the right environment is provided then the diversity of topics, groups, and individuals will strengthen the Buildings Engineering ecosystem and like a mature forest greatly enhance its chances of long term survival.

Social Networks – Organizational knowledge depends on the relationships forged between people – not technologies. Collaboration requires strong (trusting) relationships and strong relationships are based on effective communications and trust between people. Like many large organizations Global Brains understands the value of social capital but struggles to realize it in a way that adds value to the company's core business. As a way of controlling the multiple interactions between employees, disciplines, and business units spread out across North America, Global Brains developed a 3 dimensional organizational chart that divides the organization into hundreds of cells based on their geographic location, expertise (practice area), and market sector. The intent is to provide a flexible structure where each cell or profit center contributes t the success of the company in its own unique way. This is similar to the structure of a mature forest where multiple species provide the diversity needed to respond to changing environments. Mature trees, having survived and grown over many years, provide stability to the ecosystem, while the underbrush stabilizes the soil and provide habitat for animals. Fast growing species allow forests to respond quickly to disasters such as fires by quickly reclaiming the burned sections and starting the succession process. Succession also allows the forest to expand its boundaries by out competing neighboring ecosystems.
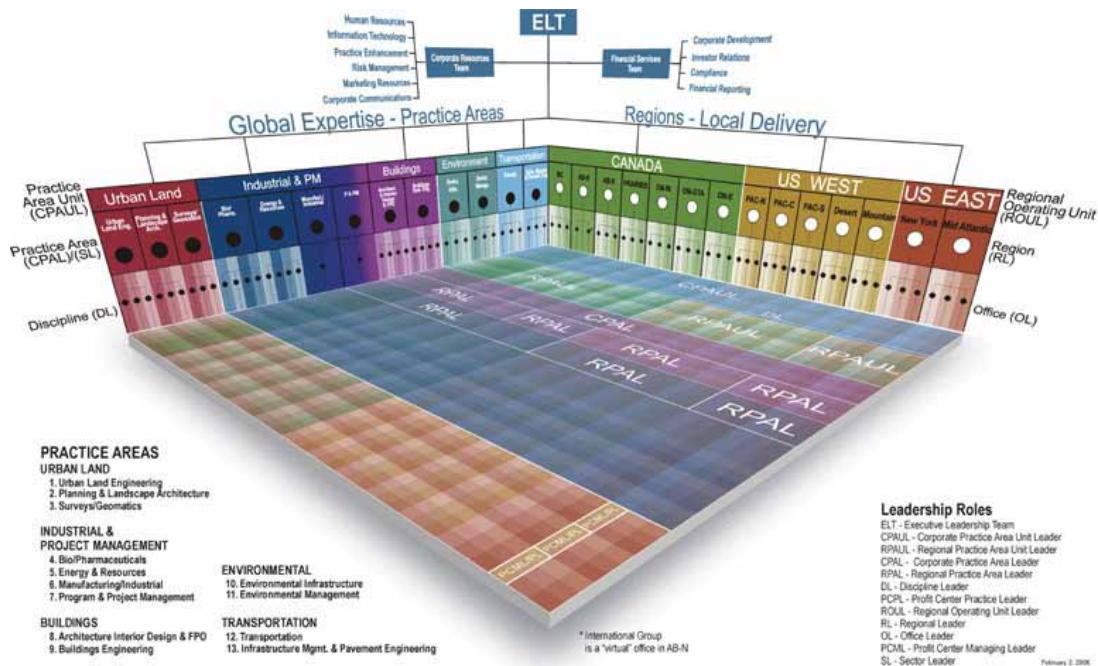
Illustration 4 – *downloaded from GlobeNet* - the Global Brains 3D organizational chart illustrates the relationships between practice areas, geographic locations and business units illustrating how the resulting profit centers contribute to the success of the corporate eco-system. The Executive Leadership Team (ELT) act as the stewards of the company by providing strategic direction and ensuring resources are made available where needed.

Although this organizational structure is very effective in structuring financial reporting relationships that facilitates the command and control organization the key challenge remains interpersonal communications. People rarely communicate along official channels. They tend to follow more organic personal social networks developed over time. These relationships are strongest within single locations where people interact face-to-face on a daily basis often forming clicks that are difficult for outsiders to penetrate. The cross pollination of ideas therefore requires external intervention. Innovation is rarely the result of a single insight formed in isolation. More often innovation is a result of a combination of two or more ideas that fuse to create a new idea. Often this is just an incremental advancement on the state of the art but every so often it results in an idea that will change the way we do things. Innovation is the currency of the knowledge economy and as such knowledge based organizations are continually searching

for ways in which they can encourage serendipitous encounters among knowledge workers in the hopes of sparking a new idea. This trend can be observed first in how these organizations design their physical space. At Bloomberg, a major business information provider, for example "offices have a central pantry, with free food for breakfast, snacks, or collegiate lunch, all have floors grouped around a single elevator stop, with intracompany movement by staircase and escalator; all have "break-out space", where chance encounter can turn into a quick business meeting" (Lange p. 91). Global Brains has a similar multi-purpose meeting space complete with coffee bar and Internet stations in it Edmonton head office in order to break down the barriers created by two multi-storey towers and organizational divisions and develop a "one team" culture. The next challenge is how you create a culture over distance. Global Brains has more than 10,000 employees located in more than 150 offices so serendipitous encounters are very unlikely for the average employee. In order to capture the knowledge found within the dispersed organization some form of communication technology must be deployed.
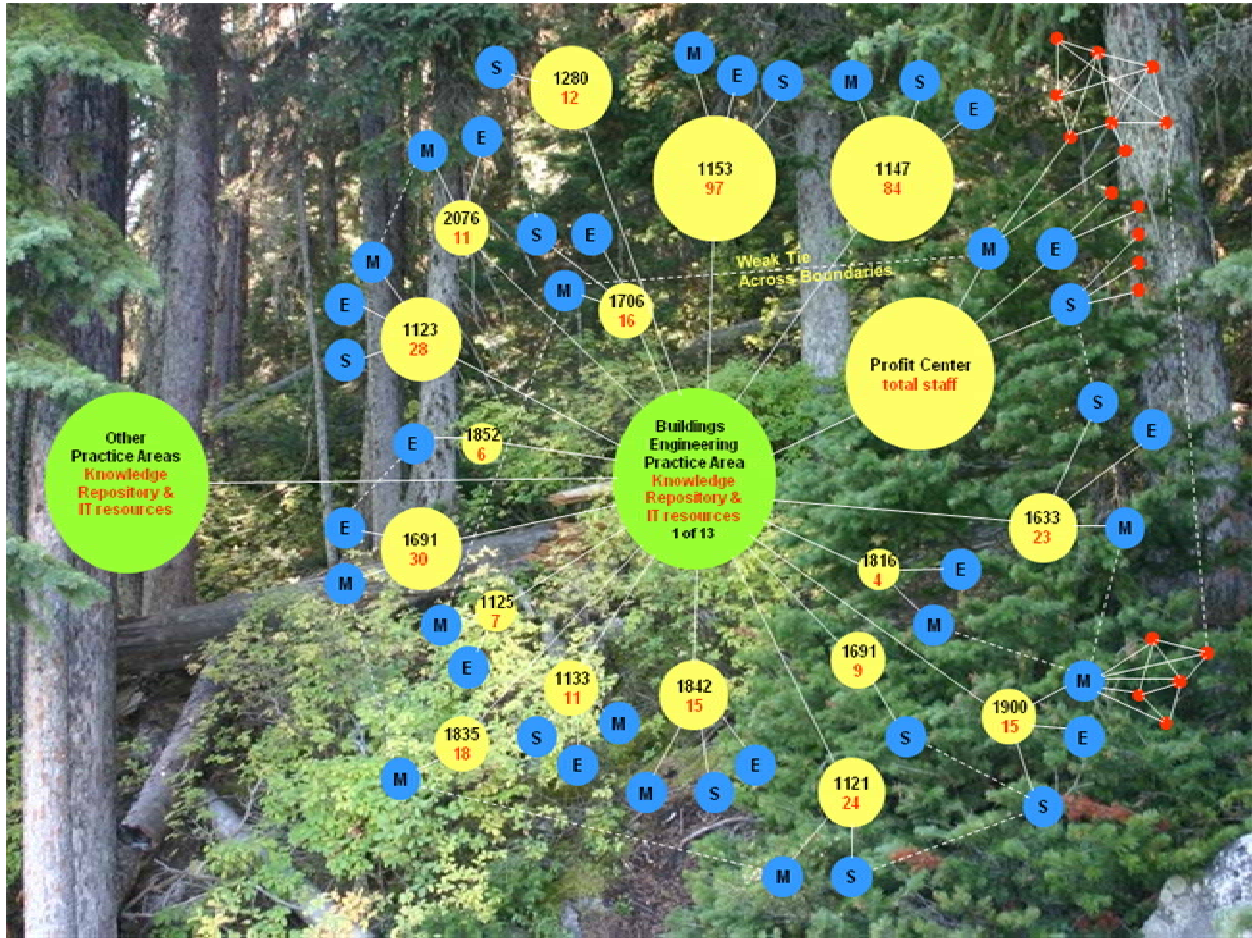
Illustration 5 – shows a simplified model of Global Brains' social network. The green circles indicate the Buildings Engineering Practice Area, 1 of 13 in currently established. The yellow circles indicate the profit centers that comprise the practice are, the size of the circle shows its relative size in terms of employees. The blue circles indicate the disciplines within each profit center (E = electrical, M = mechanical, S = structural) and the red dots indicate employees that work in local teams or clusters held together by strong ties created through rich face-to-face interactions. These clusters also have weak ties with other locations made possible through technology.

The challenge becomes selecting the most effective technologies for knowledge workers

who often deal in abstract ideas. There is no substitute for face-to-face interaction. People are

hardwired to communicate in person with small groups. There is no substitute for the richness

and immediacy this type of communication provides therefore any electronically mediated

experience must mimic the face-to-face experience as closely as possible.

McLuhan was almost alone in recognizing that the passivity associated with watching television is at the expense of activity in parts of the brain associated with abstract thought, logic and the reasoning process. Any new dominant communications medium leads to new information ecology in society that inevitably changes the way ideas, feeling, wealth, power and influence are distributed and the way collective decisions are made (Gore p. 25).

Electronic communication media extends peoples ability to communicate across space and time. The communication media deployed by Global Brains must reflect the needs of its employees so that they can build relationships, share knowledge and collaborate over geographical distances.

Global Brains now operates in different spaces and times simultaneously and uses varies processes and technologies to accomplish that feat. Appendix D provides a partial list of the growing number of technologies currently available to individuals and organizations. These technologies can be sorted into four categories based on time a place. The table below shows the various technologies that can be utilized by people communicating at the same time and place, same time and different place, same time and different place and different place and different time.

	Same Place	**Different Place**

Same Time	Face-to-face
	Presentations (PowerPoint)
		Telephone
		    VoIP
		      Conference Calling
		Video Conferencing
		Instant Messaging
		Web Casting

Different Time	Project Rooms File Sharing Wiki (virtual space) Collaboration Software On-line Knowledge Repositories	E-mail Voice Mail PodCasting Text Messaging ListServs

Although technologies extend a person's reach, elements of human face-to-face interactions are lost in the channel. "In a face-to-face conversation, our emotional brains are constantly

monitoring the reactions of the person to whom we're speaking. We discern what they like what they don't like" (Shipley p. 11). The telephone for example extends the human voice but loses the facial expressions and body language so important in understanding the context of the message. Similarly e-mail can convey our thoughts but are void of emotional cues and because it communicates over time as well as space "you cannot revise your message according to the reactions you're getting from the other party as you proceed" (Shipley p. 9) The experience at Global Brains has been that nothing replaces face-to-face communications as revealed in the constant requests to meet in-person. The technologies are ranked according to how well they mimic the richness of face-to-face encounters. Telephone is still by far the preferred method for communicating over distance, both as a one-on-one conversation and teleconferencing while e-mail is reserved mostly for asynchronous communications of factual information. Other technologies, although available, seem to be used sparingly by people uncomfortable with the technology. One of the key factors behind the relatively slow adoption of new communication technologies is the large number of older staff in senior positions that have not grown up with the technology like the junior staff who trust the technology without questioning its underlying assumptions. Junior staff that grew up with computer games will, as long as the program doesn't crash, trust the output without questioning if it makes sense in the real world. They are more likely to ask for wiki's rather than vetted knowledge bases.

Communities of Practice (CoP) are the tool adopted by the Buildings Engineering practice area to bridge the social and technological domains of knowledge management. By encouraging the formation of communities of people with similar interests and expertise they were able to identify who the most knowledgeable people were in various areas of expertise. Identifying these subject matter experts, facilitated the sharing of their knowledge and the

creation of multi-disciplined, multi-office project teams tailored to suit the needs of specific proposals. It allowed them to leverage the relationships built by local offices with clients and augment them with specialized experts drawn from throughout the company giving them an advantage over local competitors. This approach has proven itself especially well in the Research/Laboratory facility marketing sector where the design of these complex buildings requires the collaboration of many experts. The Research/Laboratory facility CoP holds bi-weekly teleconference calls where they discuss project opportunities, lessons learned from current projects and upcoming speaking engagements where they present at conferences across North America. A special page has been created on the electronic Best Practices Manual (eBPM) that captures the knowledge from the community including a skills matrix that captures the experience and knowledge of employees involved in Research/Laboratory facility design. This page allows more junior staff interested in designing these types of facilities to review what knowledge is available and who they can get in touch with to learn more. It also serves as a resource for acquired companies who can add their project experience and expert staff to the community. As the research CoP matures and grows it will become the vehicle for developing and attracting the best experts in the field, which in turn will attract the best clients and most interesting projects. CoPs for healthcare and post secondary facilities are emerging following the success of the research CoP and communities for hospitality, commercial and office buildings, and sporting facilities have been identified.

Discipline focused CoPs were also established in order to share knowledge and produce content for the eBPM. These CoPs were established shortly after the Buildings Engineering practice area was established in 2004 have grown to include at least one representative from each office, who in turn communicate this information to the local employees. These CoPs hold

monthly conference calls chaired by the discipline leaders, share knowledge and technical

discussions via e-mail and meet in person once a year to strengthen their relationships and set the

direction for the next year. Discipline CoPs also have smaller communities that focus on

specialty systems such as modeling, lighting design or fire protection. These CoPs have been

easy to establish but difficult to maintain the momentum. The Fire protection community for

example was one of the first to develop extensive content for the eBPM but has not met for more

than a year. This may be due to the fact that most designers design fire protection as part of an

integrated design and is very dependent on local codes and standards. The modeling

communities on the other hand remain very engaged mostly due to the constantly capabilities of

the software and emerging expertise that Global Brains wants to remain at the forefront of.

To date there have been no CoPs that have started on their own. All have been

encouraged by senior managers who have recruited volunteers and the process facilitated by the

author who established the conference calls, posted technical materials and discussions on the

eBPM and informed senior management on progress and resources needed. Although there is

lots of sophisticated technology available to employees it soon became clear that technology on

its own is not sufficient. The first experiment in using SharePoint software never worked as

hoped. The software is supposed to facilitate discussions between employees on various topics.

Employees can be invited to the discussion by the moderator or subscribe to discussion topics of

their choice. Several topics were started but none ever resulted in any significant discussions

even though people continue to ask for them. Share Point never had the participation it required

to sustain itself mostly due to fact that people do not have enough time to contribute answers to

posted questions and it has no direct benefit to the contributor. In fact one of the key challenges

of knowledge management within Global Brains is finding the time away from regular projects

to work on capturing the knowledge within the repositories. The Global Brains Marketing Knowledge Center for example is a repository of project profiles and resumes used in producing proposals to clients. Project managers can search for specific project types and filter them for geographic location, practice area, and discipline then output them as text or PDF files complete with images that can be inserted into the final document. Although this is a very useful technology a continuous challenge to ensure new projects are input on a consistent basis remains. This is a difficult process to automate and requires human intervention to ensure content is current and correct. The same applies to the eBPM where project managers find it difficult to find the time resources to add, review, and post now content that will increase productivity and improve quality assurance in the future. By using the social relationships fostered through CoPs supported by communication and information technologies the chances of success are increased. This is because CoPs can adapt quickly to people's current needs and technology reduces the resistance to effective information flow. The objective is to find the right blend of human interactions and multiple technologies.

Technology - can play a significant role when people are working in different locations and time zones. Global Brains currently has more than 150 offices, a number that grows every time a new company is acquired. Buildings engineering has a presence in 23 of these offices. This means that you must have some form of electronic infrastructure to facilitate effective communications. Global Brains has invested heavily in their information technology (IT) infrastructure over the last 25 or so years. The application of computer technology got started when the Computer Aided Drafting (CAD) systems became affordable enough to be used by provide companies. As costs came down and computing power increased the consulting industry quickly transformed from manual drafting to computer aided drafting and design. Soon desktop

computers were networked within an office allowed designers to collaborate on projects and reuse knowledge gained on one project to the next. Inter-office sharing of data was achieved by sending disk via couriers. When the internet arrived on the scene in the mid 90's drawings and other project data could be shared via e-mail attachments and as bandwidth grew files could be shared in real time by designers located in multiple offices. This sharing was easily accomplished within Global Brains offices but proved much more difficult to achieve with external organizations such as clients and other consultants working on the same project. This was due primarily to security issues and software incompatibility. As collaboration knowledge grew project management services such as Buzzsaw were developed to provide Internet based services that offered secure file storage accessible to anyone with an Internet connection. These services also provided some rudimentary file management services to facilitate communications among users. As Web 2.0 technologies become more ubiquitous new real time project information sharing becomes increasingly plausible. Building Information Modeling (BIM) provides a project knowledge repository where the information generated by all designers are collected in a single database that can be processed by powerful computers into multiple outputs such as design analysis, construction drawings, and precise material take-offs. In effect a multi-disciplined team creates a virtual building before a single shovel is put into the ground. Ultimately this database can be used to manage a facility through its entire lifecycle.

The amount of available technology is exploding, which makes it difficult for individuals to be proficient at everything. For a snapshot of the most common communications technology currently available refer to Appendix D. This rapid development of a disruptive technology has created a generation gap between digital natives and digital migrants.

Emerging Trends – "the ability to integrate the talents of dispersed individuals and organizations is becoming the defining competency for managers and firms" (Tapscott p. 18) "The new Web is about communities, participation and peering. As users and computing power multiply, and easy to use tools proliferate, the Internet is evolving into a global, living, networked computer that anyone can program" (Tapscott p. 19). As a knowledge based company Global Brains will continue to explore Web 2.0 technologies in conjunction with CoPs to manage the knowledge of the company. The objective will be to encourage mass collaboration among employees in order to provide our clients with the best solutions available for their projects. One of the emerging knowledge management tools for the buildings design industry is Building Information Modeling (BIM), which will transform vector based documents like CAD drawings and specifications into intelligent databases that create the building virtually within the computer from which the building can be constructed and operated over its life cycle. By hosting this database on the Internet designers from multiple Global Brains offices as well as client and other consultants can work on the project in real time. BIM has the potential to capture the integrated design solution derived at by the project team, however it does not resolve the interpersonal communications critical to producing a fully integrated design. Architects need to communicate their space plan to structural engineers who need to inform the HVAC engineers to ensure pipes and ducts will fit within the space provided. This can only be done through human communications either face-to-face or computer mediated. Social networking software pioneered by companies such as facebook can play a role within the context of a single project allowing team members to communicate by synchronous as well as asynchronous methods while at the same time capturing conversations and decisions. The knowledge created over the course of the project can be captured and re-used in the future by other design teams or individual designers.

As the Internet continues to grow and Web 2.0 applications proliferate and numbers of users

grows it will take on the characteristics of a natural eco-system where every element contributes

to its success while no single person or group can command or control it.

Findings

A focus group of six Global Brains leaders was convened to discuss the effectiveness of the Building Engineering approach to knowledge management and VCoPs. The challenge identified throughout the discussions revolved around the communication channels. "It [knowledge] was in my head more than it was documents" (Focus Group Transcript). A small company or office has limited need for a knowledge management process or knowledge repository because small tightly knit teams can draw upon the expertise company knowledge directly by talking to the person across the room. Although this is a very effective way of collectively creating, sharing and capturing knowledge it offers limited growth and diversity of knowledge. The challenge for large, diversified and geographically dispersed organizations such as Global Brains is to develop a way in which employees can share a broad range of knowledge across time and space. The protégé no longer works alongside the master. The knowledge repository in the form of an electronic Best Practices Manual (eBPM) created by the Building Engineering Practice Area was a place to start the collection and discussion of a broad range of knowledge. As the participants at the focus group put it "it's the right resource for people across the company to share…it is a good place to throw stuff…the information is very powerful" however "it is hard to find specific content" (Participant Focus Group). Effective knowledge management does not rely on technology, probably 80% of it depends on people and the relationships they have built over time. The eBPM is only the start for finding resources and building relationships between subject matter experts, "people who are willing to not only share information but act as a resource throughout the company" (Participant Focus Group).

Strengthening the concept that people share wisdom through stories is an example found within the focus group, a face-to-face encounter, was example of how the eBPM facilitated

became a virtual water cooler for a group of people from Alberta, British Columbia, Ontario and California. The story starts with an e-mail request to the fire protection CoP from one of our designers about an issue he had with a client that was challenging the requirements of a fire separation on a building:

> I go to this CoP [eBPM page] that lists with all the people I know have 200 years [of experience] and however number of projects…I had feedback from Alberta, what is required in Alberta, I had feedback from Ottawa, I had feedback from down California…here's what I have done…and then I can look at the info and then I can see what I want" (Participant Focus Group).

The information was captured as a discussion string and posted for future reuse. "It's the kind of information that you wouldn't get out of someone's cookbook" (Participant Focus Group). "You are analyzing and solving a problem in a group here, whether it is in person or electronic means" (Participant Focus Group). There are, however, limitations to an e-mail exchange. "some [discussions] get down to I need to talk to you face-to-face…I mean it might be a fairly complex thing involving inner relationships that e-mail doesn't readily allow itself" (Participant Focus Group). "It is so difficult for anybody who hasn't been involved in that dialog to go and find [it]. You know, you key through the pages and never find it" (Participant Focus Group). The effectiveness of sharing expertise and solving problems all depends upon the context of the discussion and context fades with time. The sprinkler example worked because the actors had met before and the researcher facilitated the process over the course of about week. It might not have worked using just technology such as e-mail, Wiki's, or social networking software and at this point in time we have no evidence that the content collected and posted will be reused in the future. Knowledge management works best through an active process engaged in by people rather that the passive process of finding relevant content on an electronic repository.

VCoPs are also effective in continuous learning. The senior members increase their personal knowledge by reading papers and attending, even presenting, at industry conferences and this knowledge is then shared by the rest of the community who share their own experiences. Communities can learn faster than individuals. At the same time each community offers junior staff with an interest the opportunity to develop relationships with the experts that will lead to accelerated learning and stronger engagement.

One of the key observations on communicating over distances is the importance of face-to-face communications. Every CoP that has been established has asked for a summit or in-person meeting where they can get to know each other. The same applies to the mentor program where participants are encouraged to make the first meeting in-person. Communication technologies are getting more sophisticated all the time the still lack the richness of human communications especially when that technology involves tacit knowledge or creative collaboration. People communicate best when they can monitor the reaction they get when speaking to ensure their message is being received and understood. It allows people to ask for clarification when they don't understand or can repeat the message to ensure they have understood correctly. "There are many, many, many subtleties in what we are doing and trying to explore all of those subtleties is extraordinarily difficult to do" (Participant Focus Group). "Body language and reactions" (Participant Focus Group). "There is also a certain way we collectively speak at the same time that's not facilitated a phone…there is a lot of engagement of active discussion in face-to-face where it is easy to interrupt and see how angry someone can be about something" (Participant Focus Group). Speakers can use flipcharts or props or just wave their arms in the air to augment their message. The greatest value of communicating in person however is the human interaction, the ability to develop relationships and build trust. If people

are going to work together in teams or collaborate when solving problems they must be familiar with the knowledge and skills each person brings to the team and trust that each will contribute more or less equally. To that end the most value provided by a summit, where a group of employees from different offices come together in person are the social activities outside of the official meeting. It is not unusual for a third of the people at a summit to have never met in person. Once people have met in person and established the beginning of a relationship further communications using various technologies becomes much more effective. The researcher has observed that almost every CoP that has been started by e-mail and telephone conference call has asked for a summit where they can meet face-to-face and get to know each other. The term most often used is "putting a face to the voice or e-mail signature."

The technologies most used by Global Brains employees are the telephone and e-mail. The telephone is the closest approximation to in-person communication, which is why this technology has endured for more than a century. The telephone can be used for real time one-on-one or many-to-many communications almost anywhere in the developed world. It can be used asynchronously using voice-mail or converting it into MP3 files that can be e-mailed to multiple recipients. Visual aids can be added through NetMeeting or Liv Meeting where people can view images on their desktop or at a meeting through LCD projector. The primary advantage of the telephone is in its ability to convey tone of voice and for people to ask questions of the speaker or the speaker ask for responses from the group. The telephone is also easy to use and people of all ages are comfortable with the technology.

> If it was an item I felt critical and I had to have an answer right away, I would have picked up the phone…the reason for using the phone is that it's closer to face-to-face because you get that immediate response, you don't have the body language but at least you have the voice intonation (Participant Focus Group).

All of the CoPs established by Building Engineering use monthly conference calls facilitated by the author to keep in touch and ensure tasks are on track and moving forward. "The goal of a conference call was to get to a point where you don't have to identify yourself…a conference call doesn't build a relationship …it maintains one" (Participant Focus Group). Like any form of collaboration conference calls take up valuable time resources so they must be used judicially and meet their objectives otherwise people will tune out. The larger the organization the more more complex and frequent communications will become. People from newly acquired companies experience a sharp increase in the number of meetings – face-to-face or virtual – they are required to attend. "They're one of the parasitic loads on my time" (Participant Focus Group).

Discussion

Mimicking mature forests, an organization like Global Brains "must do whatever is necessary to make themselves flexible, nimble, responsive, non-bureaucratic – adaptable" (Brown p. 38). Information overload and loss of knowledge can threaten an organization's future. Organizational knowledge is lost due to turnover and reassignments, poor documentation, restructurings and just plain forgetting (DeLong). Fast growing organizations such as Global Brains face a perfect storm for losing knowledge. Rapid growth through acquisition results in frequent restructuring of the organization, high turnover caused by the current talent shortage and impending retirement of an aging workforce and the difficulty of capturing new knowledge acquired by a geographically dispersed workforce into a consistent format all contribute to the knowledge management challenge.

There is a demographic gap between the boomers – age 50 to 65 – who have extensive experience and generation X – age 20 to 35 – who have little experience resulting in a shortage of prime workers with enough experience to succeed the retiring boomers. This shortage of talent forces organizations into promoting people too fast without adequate training or support, which in turn can result in a severe loss of organizational knowledge. As a consulting company Global Brains sells expertise, a fusion of knowledge and experience, to it clients. Losing its organizational knowledge puts the company's profitability and long term sustainability at risk. It takes time to develop credible expertise. In the past Global Brains was able to hire experts with 10 to 20 years of experience who could be integrated quickly and continue their lifelong learning as they honed their craft. However the lack of training provided by Global Brains as well as the consulting industry has resulted in a severe shortage of mid-career workers that can no longer be hired "off the street". This has resulted in what *The Economist* referred to as the "war for talent"

where companies need to compete with each other to attract the best talent at all levels. Employee attraction, development, retention and engagement are now defining the battlefield in this war. The Buildings Engineering Practice Area is now developing a mentorship program whereby junior staff are paired with senior staff to guide them on their career path. This combined with a greater focus on company supported lifelong learning programs will plant and nurture the seeds for the future by transferring the tacit knowledge from the mentor to the protégé but is unlikely solve the short term shortage.

Often technology is touted as the savior of knowledge management. By capturing people's knowledge in large company databases, it is argued, companies can reuse this knowledge in the future. Web based communication technology is becoming increasingly more powerful in collecting data and making decisions on our behalf and there is a general belief that computers are infallible when compared to humans. However as technologies become complex we are discovering that "glitches" are becoming more common as minor changes in one part of a program can have unanticipated results in other areas. This makes the human machine interface even more complex. "In an information-rich age, it appears that the ability to process information wisely and effectively is becoming far more valuable than the ability to gather information" (Brown p.38). As machines become increasingly adept at replicating information, human innovation is rapidly becoming the competitive advantage that allows organizations to be sustainable over the long run. Global Brains has invested heavily in a robust IT infrastructure that allows people to share data and information companywide. This includes an internal network that connects all employees to digital resources such as e-mail, intranet, project data, financial data, and latest software tools. The system can be securely accessed from anywhere inside the office or remotely through mobile devices such as blackberries or from home through the

Internet. This provides Global Brains with extensive structural and process capital and facilitates collaboration. However true collaboration is made possible by people not technology.

To leverage the value of communication technologies both inside an organization and externally through the Internet people build relationships in multiple social networks as they collaborate in finding solutions to what are often wicked problems. To encourage the collaboration of employees in the creation, documentation and re-use of knowledge Global Brains' Building Engineering Practice Area utilizes the concept of virtual communities of practice (VCoP) to build the social networks that are critical to problem solving process. Although CoPs are not a magic bullet solution they can play an important role in creating and managing an organization's knowledge. CoPs form a bridge between the technical and the social networks. In its pure form CoPs are small groups that get together informally or semi-formally within a single office. Interactions are mostly face-to-face and information is shared and applied by the participants. One of the most cited examples of this is the Xerox technicians that shared war stories by the proverbial water cooler that taught the technicians how to solve problems not in the manual. However, when an organization has multiple offices in geographically dispersed locations such as Global Brains you must use some form of technology to communicate. This is where the challenge for Global Brains begins. Although they have access to extensive technologies, employees are still learning how to use it effectively in a collaborative environment. Where is the virtual water cooler? How do you encourage serendipitous encounter on-line? How do CoPs meet in cyberspace?

Over the past three years Buildings Engineering has experimented with CoPs and their role in knowledge management. By developing multiple technical topics and encouraging employees to volunteer in forming a VCoP around a topic of interest several challenges could be

addressed. The topics were selected to coincide with the electrical, mechanical, and structural systems commonly found in commercial and institutional buildings. At its most basic a VCoP can start a discussion about the best practices used by designers in each office to design effective systems so that the best elements of each can be selected and documented in the eBPM repository so that it could be reused in the future. This approach has a better chance of capturing the tacit knowledge of the individuals that comprise the community than just posting the data from the manuals and text books. Furthermore it accounts for the differences in codes and standards found in individual jurisdictions and nuances found within various building types. As the VCops develop they become the keepers of the most current knowledge on the subject. This allows project teams or individual employees to tap into the knowledge of the community directly. When you have more than 10,000 employees, 5,000 of which joined over the last 2 years as part of acquisitions, in 13 Practice Areas, spread throughout more than 150 offices, finding a specific expert is like finding a needle in a haystack. VCoPs organized around systems are easily identified through the eBPM and where the implicit knowledge posted there is insufficient the CoP members are listed so they can be contacted directly and be assured of a reply because the CoP members are passionate about the subject. In fact they are the company's subject matter experts (SME). Experience by the researcher over the last couple of years has indicated that knowledge questions addressed to a CoP is much more likely to garner a response, and often spark a discussion, than posing a question through an all-staff e-mail or limiting the discussion to the finite knowledge found within a single office.

Web 2.0 applications offer potential new opportunities to improve communication within Global Brains. File sharing applications such as Flickr or YouTube could be used by employees to share documents. Social networking applications such as Facebook can be used by project

teams to keep everyone informed about a projects status and share the lessons learned. Blogs have great potential for technical discussions on a multitude of topics. One example of this is the book "*We are Smarter than me*" authored by an online community www.wearesmarter.org with more than 4,000 members, including the researcher. This site utilized hundreds of discussion forums posts, and wiki's to write this book on knowledge management collaboratively. The same features piloted here can be used to collaborate on a design project. At Global Brains building information management (BIM) is the next generation collaboration tool being developed for the building industry. By using a single database BIM allows multiple authors to provide input in the final project. However, even as the technology becomes increasingly powerful, they remain just tools to be used by people. Ultimately it is not the technology that provides organizations with a competitive advantage; it is the people that use the technology to collaborate with each other. VCoPs created within the Buildings Engineering practice area have proven to be effective tools for bringing employees together, build relationships and trust, and create, document, and reuse knowledge. After three years the concepts are starting to make an impact. A fact confirmed by the focus group. Staff is now re-using the information posted on the electronic Best Practices Manual and discussions in small focused groups are now capturing some of the tacit knowledge found within the brains of the experts. As new areas of knowledge requirements are identified people quickly ask for CoPs to be established. The key barrier however remains the time and energy people can effectively spend contributing to the CoPs in addition to their project related responsibilities. "I have this knowledge in my head, I know it, I need to share it but is non-chargeable, it affects my performance, my utilization if I'm sitting on the other end of the phone and [management] is looking at my utilization numbers" (Participant Focus Group). "It's finding that between non-billable work, non billable time and sharing the information…the client comes

first and everything else comes second" (Participant Focus Group). There is still room for CoPs to grow and become the centers of excellence recognized throughout the industry as leaders in their field, keepers of organizational knowledge and trainers of the next generation.

E-mail is used for routine, fact based messages in between conference calls. The conference calls are more effective right after an in-person summit, which results in raising the energy and engagement level of the individuals of the CoP. One of the limitations of telephone conference calls is that they are limited to about an hour to and hour and half before people lose focus and communication becomes ineffective. This seems to be due mostly to the concentration required to keep track of each voice in your head and knowing when you can speak without interrupting another speaker. "I don't think I am the only one sitting there with the mute button on and doing other stuff, this is like CBC radio in the background" (Participant Focus Group). Global Brains has attempted to use video conferencing multiple times over the past decade but each attempt has been short lived as the technology is still very expensive when compared to the telephone and connections tend to be unstable. The extra complexity of using video technology far outweighs any benefits gained by being able to see the people you are talking to especially when meetings comprise multiple people at multiple locations. New technologies such as Cisco's telepresence rooms that bring high definition video to conferencing of small groups offer some hope for future distance communications by making the media richer and thus ever closer to face-to-face meetings, although they are still unable to replicate the social activities during the breaks of face-to-face meetings.

E-mail is used extensively by all Global Brains employees to exchange information and keep people informed on routine tasks. The advantage of e-mail, used effectively, is its asynchronous nature that allows the receiver to deal with the massage on their own terms. This is

especially useful in communicating with people in different time zones. E-mail is also very effective in getting a consistent message to a large group. Sending a quick e-mail with an attachment or link to other documents can be much more effective than making multiple telephone calls or even organizing a conference call. That said e-mails can be used to have a one-to-one conversation in virtual real time. E-mail communication keeps a written record of the conversation that allows people to go back the conversation in the future. Telephone conversations require written meeting notes that need to be taken by someone and approved by the participants in order to keep an accurate record. The weakness of e-mail records are that they are stored on the computers of individuals where they are not available to anyone else and prone to loss when misfiled or computer crash. E-mail is also limited to fact based or implicit information. It is extremely difficult to have an effective multi-person conversation via e-mail a process that can take days, even weeks, to complete. As Global Brains grows, so does the volume of e-mail. One of the most heard complaints these days is the amount of time required to manage the volume of incoming e-mail, time that comes at a cost to project work.

Conclusions

There is a lot large knowledge based organizations can learn from mature ecosystems, which "self-organize into a diverse and integrated community of organisms with a common purpose--to maintain their presence in one place, make the most of what is available, and endure over the long haul" (Benyus p. 248). The depth, breadth and complexity of modern global organizations make it impossible for an individual to know everything. Managing these relatively new types of creative, knowledge based organizations requires the effective collaboration of many people and teams in pursuit of a common goal. Often, as is the case with Global Brains, these people are spread out geographically and cannot walk down the corridor to find an expert. Effective knowledge management is critical to an organization's sustainability. It is through culture and technology that modern organizations accumulate and retain the knowledge that will allow them to be successful. Global Brains is a knowledge based company that sells the expertise of their staff to clients in search of solutions to their problems. The company has few hard assets and manufactures no widgets. The company is only as good as its people because without them there is no company. As consulting projects become larger in scale and more complex in scope they require large, multi-disciplined and often dispersed teams of knowledge workers who resent being managed. To capture its knowledge Global Brains has embarked on an aggressive knowledge management strategy that blends technology with people.

Having started their knowledge management process by building a computer based knowledge repository that captured the existing paper based documents collected over the course of thousands of projects, it was soon recognized that a static database was not enough. A repository does not adequately capture the lessons learned by people. Recognizing that success depends on the skills and creativity of its people, the Buildings Engineering Practice Area

decided to leverage the concept of VCoPs to capture its implicit as well as tacit knowledge. As a naturally occurring part of any organization, VCoPs tap into "the flexibility of the brain's interactions with nature, through culture, has been the key to our success" (Wright p. 29). It is through culture that we share and retain our knowledge. Tools allow us to extend our reach but it is creativity that makes humans unique. Information Technology is just the latest in a long line tools that have allowed humans to overrun the planet. Electronic communication media extends people's ability to communicate across space and time changing the "way ideas, feeling, wealth, power and influence are distributed and the way collective decisions are made" (Gore p. 25). Everyday web-based toolkits emerge to manage talent, production, and knowledge however it is the human interactions that will determine an organization's success. An essential part of Global Brains' business is based on relationships with clients and colleagues and although technology can extend those relationships, success still depends on face-to-face interactions. VCoPs provide the cultural elements that facilitate the integration of face-to-face and electronic communications that allow sections of a large organization to act independently while contributing to the success of the whole organization like a mature forest.

At a company the size of Global Brains it is impossible for an individual to have a relationship, let alone a meaningful one, with more than even a small fraction of its employees. VCoPs allow small groups of people with similar passions to work together towards a common goal in a social context that is relevant to an individual. The experience at Global Brains has shown that VCoPs can be effective in breaking down the organizational boundaries created by the organizational chart as well as the geographic boundaries created by multiple offices. By organizing around topics of interest such as mechanical, electrical, or structural engineering or specialties such lighting, ventilation, or steel design or healthcare, post secondary, or laboratory

sectors VCoPs provide communications on a human scale. One of the lessons learned was that you cannot force a CoP into existence as they will quickly run out of steam and become another ineffective committee. CoPs provide a safe environment where people can engage their passion without the organizational constraints of the company while at the same time taking advantage of the resources a large company can offer. One of the most successful VCoPs at Global Brains was the one focusing on research and laboratory facilities, which was able to develop its own leadership and processes. This community was able to attract members from multiple disciplines and practice areas and formed a truly integrated approach that is recognized by Global Brains's senior leadership as well as employees needing their expertise to pursue project opportunities. Their work has been carried out mostly through a bi-weekly conference call facilitated by a strong leadership and e-mail correspondence. Face-to-face communications has taken place primarily through collaboration on projects and presentations made at conferences rather than official meetings. They have generated a list of people within Global Brains that have worked on laboratory projects and created a knowledge profile that includes the number of projects they have worked on, the types of facilities, their discipline and level of expertise ranging from limited experience to global expertise. This information is posted on the electronic Best Practices Manual where they have also posted a growing amount of technical content. As new people join Global Brains as either new hires or as part of an acquisition, they are added to the list and invited to join the community. This has all been accomplished outside of the official structure of the organizational chart with people volunteering their time and energy to the group without formal recognition from their home Profit Center. On the other end of the spectrum is the Computer Aided Drafting (CAD) committees organized to develop consistent drafting standards across the company for each of the electrical, mechanical and structural disciplines. Members of

these committees are selected by their managers based on their seniority and not interest. Their work has been done solely by telephone and e-mail and few of the members have ever met face-to-face. Work has been slow and results limited to symbols, layers and line types, all elements that can be easily documented in manuals and for the most part available through industry standards. There is little material here that provides Global Brains with a significant competitive advantage. Attendance at conference calls has been irregular and people are continually dropping out due to turnover or local workloads. This result is consistent with both mechanical and electrical disciplines and the structural discipline has not even been started after 3 years of trying. All of the other CoPs fall somewhere in between. The lesson learned is that once the seed is planted a CoP does its own growing, management cannot force it to grow faster, larger, or in a different direction. However they can ensure individual CoPs have sufficient resources to operate and protect them from bureaucratic interference. In the case of the research and laboratory CoP, members were all passionate about the topic and were given enough resources to attend conferences where they could meet face-to-face with each other as well as their existing and potential clients. The CAD committees however relied on "encouraged" volunteers or as they are often referred to "voluntold". There was no budget for them to meet in person and most of their contributions was unrecognized and often second guessed by senior colleagues.

The Communities of Practice pilot projects at Global Brains have not proven to be a magic bullet solution to the knowledge management challenges faced by a rapidly growing organization. However there have been enough success stories to recommend their continued use and refinement as a tool in the knowledge management process. When combined with ever improving information technologies in an ever increasing connected environment, VCoPs provide the human element of the equation. To operate effectively Global Brains must invest in

continually developing their staff with new knowledge acquired formally through schooling and training and informally by working on leading edge projects with internationally recognized experts. At the same time they need to support their staff with communication technologies that will allow them to collaborate in search of innovative solutions. Finding the right balance between people and technology is the key to success. Technologies will continue to change but success will continue to depend on how people apply these technologies to extend their knowledge, energy, and creativity.

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Appendix A – Transcript Focus Group – 28 April 2008

Researcher: What I would like to do to get started is go round table and then I have got some questions that I will just throw out to the group. The first question to get the discussion going, have you used the eBPM [electronic Best Practices Manual], are you aware of it, what are your impressions of it positive, negative that sort of thing.

Participant: I have used it quite a bit, I think it is great resource; always getting more info on, it may be a little bit hard sometime to track down the info, but I think there is just so much and how do you break it down into the right groups that a guy can know if I go here this is what I find, little things like that, but overall ----------- I use it and I make sure the guys in the office know it's there, it's a good thing to do

Participant: I use it regularly _____

Participant: I have used it extensively and I am promoting our guys, the rest of the people in the office to visit it. I think my biggest comment is a lot of the material; it is not terribly intuitive in terms of navigation. And it is fine in terms of navigation if you have been in it quite a bit however for people that use it very much they have difficulty navigating to a specific spot and anecdotally I have been told getting back to a spot maybe------- again the first couple times of use you can't the repeatability of finding information.

Participant: I haven't used it a lot. I am probably one of the lower users. As participant said that is probably something I would comment on that when I find the information it's very valuable but sometimes finding it is a bit of a challenge however the more you use it the more you are able to go back to find the information you are looking for.

Participant: I have heard of it, Haven't tried to find it because I am still getting used to the logic of the StanNet itself and its interesting I heard a common threat that the setup with StanNet its a bit arduous, once you've used it enough you have some facility of it. I only recently got into my dashboard and I have been trying since ever we got on in October or November. And I am working my way towards other things like this SMKC [Global Brains Marketing Knowledge Center] and best practices you know because I would likely do it, but the short answer is no so I can't comment. But I will.

Researcher: Can I ask you; was there something similar [your previous company] had?

Participant: In buildings no, because I brought Buildings Engineering to [my previous company] when I came so it was my own best practices if you will and I had standard details, standard spec ...... and the approach me and my staff used in our own quality control if you will .... it was in my head more than it was documented.

Time: 05:00

Participant: I've found the same here what basically standard .... it is a graceful tool, I use it quite a bit, I got around to bookmarking certain pages because it is difficult to navigate through. I find its very much and engineers tools in that it it has been designed and developed from an engineering perspective and not a usability perspective, a human factor type of ..... this is the type of interface you need that is user friendly for anybody trying the first time, the 100th time. So the result is if you get frustrated easily trying to navigate to the information you are looking for, it is taking too much time you get very discouraged and you are not going to go and get that so the result is you are going to see me in my office to ask where can I get this information, and I click this, click this, click this, go back here, click this, enter this, stand tall in your seat, turn around and he gets there. That's really the only bad feedback because once you get into it ...... I mean the information is very powerful. And it's the right kind of resource for people across the company to share that information it is just working on the interface. Just work on that.

Researcher: The second part, just to go around is the communities of practice part, now I am not going to define what a community of practice is, but just kind of what your understanding is of a community of Practice (CoP), whether you have been involved in any?

Participant: I was on the Buildings Engineering thing I was involved with the ventilation CoP however I didn't do very much on it other than donate information and part of the problem was that we had to go out and find people from other offices some of them lacked .... it's hard to communicate what needs to go in, it's just one of those onerous thing especially with [my office] being so busy it ends up on the bottom on list of things to do. But a CoP for my part as I said is just the ventilation and everything we know about ventilation design we would throw into that CoP, it would get vetted by the other members for everyone else to use.

Researcher: And based on that would you say if it was done a reasonably organized manner would it be useful?

Participant: Even the stuff that is in there now, there's other stuff imported there from other people. It is a resource for boilers, for heating and cooling, or architecture, or specs or the green stuff we have is a Cop or it is a good place to throw stuff in the guys have use the specs quite a bit, if I can't find one we have used in [my office], I'll go to one we've used in Saskatoon or I'll look at Tucson's all the master specs that people are there so .... but as a CoP my part was ventilation.......

Time: 08:04

Researcher: We'll get into that a bit further later on.

Participant: So you want me to talk about communities....

Researcher: Yes do you, first of all know what a community of practice is, because I think it's a bit of a bit of a jargon and I am not sure if everyone is aware of it so I guess I want to see are you aware of them and have you been involved with one.

Participant: Yes I have been involved in a few.....I think it's useful in building connections and relationships with people from elsewhere.

Participant: My understanding of a CoP is it's a group of people with like interests or specific knowledge or expertise and the CoP site is supposed to be a repository of that knowledge and the focal point for interactions around that particular community. That's how I understood it. I participated in the Fire Protection CoP.

Researcher: And did you find it useful? Or is there better ways to approach that?

Participant: Again I think it always comes down to two aspects in terms of the workings of the community the huge feeling is as [name] alluded to is the workload and the size of tasks were unmanageable they were trying to eat the whole elephant at once so progress on any specific initiative within that CoP were stalled just by having too large a pot to carry or ..... or in some sense some people did not see the collective good that could come out of it. The people that might have had some time didn't do this through ill will or anything but maybe a lack of knowledge, they didn't understand how the information could be fixed. On the flip side I also don't know that people below the CoP really understand that it exists. Trying to explain that concept to a CAD guy wasn't always being done and they didn't always get the concept of it.

Participant: I have not contributed to a CoP or to be honest checked into any of that. So any idea or concept I would have right now would be similar to it being people with similar interests or expertise wherever they can exchange information on whatever project they may be working on.

Participant: I have heard of it as a matter of fact a lot of people I have used as resources are sitting in the other room. My impression of it is essentially its and area of expertise or a resource where you have a concentration of people who are willing to not only share information but act as a resource to people throughout the company for various projects so I've used, I have gone to the plumbing group, the architecture group, just throwing questions at them related to design, primarily because it has involved work and working in other jurisdictions where it may not be clear what the requirements are so and from that aspect I have gotten very positive feedback from the leaders of the CoP or the group heads. They were very timely in getting back to me with that kind of information so from that aspect I find it's valuable. As ----- alluded to the value that you get out of it is primarily based on what you are willing to put into it so if we all contribute it is more value for everyone and if we don't contribute then it's just another spot on the web taking up space. I am not sure what the focal point is for that group if it is intended to entry level engineers, CAD technicians, or primarily for your senior designers, P. Eng's and so on who go there as part of the design so.... that's one aspect that could be better defined. Who it's for?

Researcher: Finally, very quickly how did you find out about the best practices manual?

Participant: Because you and I started it. We were going to do our own, well everyone has their own design manual right, and you all keep your cheat sheet and notes and everything else. So how do we take that that, capture it, and put it into a manual? It was going to be a book manual not a computer manual and Klaas came back from marketing

and said I can do this on the computer and we thought this was great because to all the young guys you say this is how you pick a unit heater and here is your cheat sheet on pipe sizing and things like that and its developed to pretty well network wide so that's how I got started.

Participant: I don't remember hearing about it.

Researcher: That is one of the things I am trying to find out whether there is a real knowledge there or if people don't know about it and sounds like there is some of that.

Participant: That is something I do Klaas I tell all my new hires and everyone I deal with, I do tell them about the site, we mention it in our meetings every now and then and tell the guys here it is, save it as a book mark if it is hard to find, all the codes and standards are in there it is an excellent resource.

Participant: I would love to read it.

Participant: I was only one step behind ------ I think I got started when we decided to move it to an electronic form, soon after we had a meeting where a motion was put forward by you and Greg that this be put forward a BE initiative and cast the sub committees

Participant: I can't recall if its part of the information presented to new hires I don't recall if its included in there or I must have just got it from someone.

Researcher: Word of mouth?

Participant: I vaguely remember hearing about it on those teleconferences and sort of not really knowing but I have heard about it.

Researcher: So you have probably been working with it, without knowing it because those teleconferences are part of the CoP.

Participant: I heard it in discussion, but I didn't use anything from it.

Participant: I got a note from yourself or from [name] saying we were starting up a database so if I had any information, or if I had anything I wanted to contribute send it through so we could send it through the vetting process getting set up. That's how I recall hearing about it.

Participant: I have a question for you Klaas, on the best practices site, the LEED and the sustainable design, geothermal sites are they part of the buildings or they a separate entity upon themselves?

Researcher: They are part of the buildings only because we are the only ones doing anything right now. So we like to ultimately make it much more widely available so when we started with the BE one were just going to do the

engineering then when sustainability came along we realized it needs to go beyond that, you know to get it wider. So right now you can link to it from both the BE and Architecture and I guess that is part of what we are trying to do here is should that be broader should it be another thing and maybe that leads right into the next question. I am just going to throw it open for the group.

What would you see if we define a CoP as to what we are doing here today or as a sub-group, what would you see its role would be in capturing the technical or the general knowledge and whether that goes into the best practices manual or in some other way. What would you see the role would be? There is two ways you can look at this, one is that you use the CoP, which is what we have been trying to do and the other way is other methods that might be better or not. You could accomplish the same thing, collecting the company's knowledge.

Time: 18:40

Participant: I am almost seeing your question could you repeat it again just ...... what are you trying to get at?

Researcher: What I am trying to get at is.......how would you see...based on what have defined Communities of practice, which is a group of people with a common interest to do that would you see...what would you see that role would be to collect that information, that company knowledge so that ...it would be the standard details the specs the different things we have been collecting would you see that that is a good way to do it as opposed to other ways that you could do it which would be ...you know we could just e-mail each other or we could just randomly ...

Participant: ....I think there is two things to address there what I think the benefit of a community of practice is, is that all the information doesn't reside with one sole resource ... they walk out the door they get hit by a bus they are on vacation whatever it is, the brains don't leave. So from that perspective a community of practice that is spearheaded by a ...... that community has a benefit to the office and that office to the company. That said it has to have strong leadership, you know to say that you're a member of the community practice for the sake of saying that I am on the community of practice check that satisfied my requirements for professional development is one thing but as someone was saying earlier if there is no contributions to the community of or it is not active that benefits so it just ends up being nothing ...her is my information so just throw it in there and we'll see happens to it that sort of thing. It has to be active in order for it to truly serve its purpose.

Participant: It is vague, there are some vagaries in here that .... like the community of practice you are still keeping it all theoretical like what it is and what it intended to do and what you are trying to do it is like I am missing something.....if you would more clearly define or do you want us to help you define what it is you want to do?

Participant: First the CoP is not the information it's the group of people so its a group of people with like interest or like expertise...a group of practitioners is a good way to put it. And what is the role of that community of practice? It has been to sample and in some ways capture that information, the collective knowledge in the binder that you have on the top of your desk, you know that talks about all your ventilation and also to be in certain cases

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push stuff out an more commonly used as a collective resource for people with questions. [Name] has used the fire protection community of practice of which there is a page that has the members listed with hot links to all their e-mail, that's one way and a code issue comes up and he can he can push a question out to the community of practice and then the community of practice can, well the individuals will respond and what Klaas has taken to doing is that if its any more than a simple basic question like where can a code be found if it's something that needs debate or information sharing he captures those e-mail strings in a spot and creates a discussion group. There was one a little while ago about someone in Calgary was looking for archival storage, this doesn't fall into a community of practice but basically falls under HVAC types of things and so lots of good information so Klaas just captured a half a dozen or so e-mails.

Participant: So it's a way of capturing when we sit together as a group of practitioners and talk about a problem we get the collective input, which enriches everybody and you're trying to capture that.

Researcher: That's right.

Participant: It is almost like an internal blog.

Participant: About a month ago I had to deal with window sprinklers and it was in a jurisdiction where any job I have ever worked on window sprinklers if its an A2 separation, done deal, well the architect was challenging it and the architect had managed to get the local authority to buy in, you have to have the global insurance agency to buy in and the plans examiner to buy in that you don't need window sprinklers regardless of what the code says so I threw the question out because [name] was the engineer of record and I said I can ask [name] whose got maybe 30 years of experience, I go to this community of practice list with all the people I now have 200 years and however number of projects and I said look who has come across this? It may come back with wow you are the first one go get him or it may come with...I had feedback from Alberta what is required in Alberta, I had feedback from Ottawa, I had feedback from down California....here what I have done, here is what I have, etc. And then I can look at the info and then I can see what I want as [participant] said Klaas captured this, it's a string so if it ever comes up again so you can all the discussion on window sprinklers, what's happened.

Participant: Here's the collective knowledge that came from that discussion.

Participant: It's the kind of information that you wouldn't get out of someone's cookbook.

Participant: You are analyzing and solving a problem in a group here whether it is in person or electronic means.

Participant: And some things can get solved in that group e-mail situation, but some of them get down to I need to talk to you face-to-face about... I mean it might be a fairly complex thing involving inner relationships that e-mail doesn't readily allow itself.....

Participant: From that aspect this is where my own criticism of the whole system in general being standard general practice manual is we share this information but it's so difficult for anybody who hasn't been involved in that dialog to go and find that. You know you key through the pages and never find it.

Participant: In some sense the gathering of all this wonderful information and distilling years and years of experience but we've lost that here, being that experience, for some of us. You can assemble all that but I don't think you can replace the mentoring that a senior engineer gives to a junior engineer. This compendium of knowledge is very useful for the junior practitioner as well as the senior practitioner. To me seems that that manual still needs the senior practitioner to guide the junior practitioner through his instruction.

Participant: That's what it was always meant to be. It was not meant to be a place where any Dick or Tom goes to the pump selection page and pick it. It is more like, you're going to pick a pump, go read up on it and then we'll talk about it. So it's like a giant reference book.

Participant: The question is in the design process for the young...

Participant: And that gets back to the whole human interaction and thats where you start to see the difference between the people that rely on the computer and the database versus the people that pick up the phone.

Participant: I am working in the [name] office and think there is only one job being done in Toronto. I am working with [name] in Saskatoon, I am working with [name] down in the US, I'm working guys out in Alberta so I have to be able to communicate with these people. You can't rely on e-mail so from that aspect it is very similar if you want the information you need to be able to interact.

Participant: And this is the best form of communication.

Time: 27:23

Researcher: That is a good segway because that is one of my questions how do you most often communicate with people and what I've got is face-to-face, telephone which can be one-on-ne or conference call, e-mail or others? And from what I hear you say is face-to-face, there is no replacement for face-to-face.

Participant: No because what we do is not new ... there are many, many, many subtleties in what we are doing and trying to explore all of those subtleties its extraordinarily difficult to do.

Participant: Body language and reactions.

Participant: Yeah and there is also a certain way we collectively speak at the same time thats not facilitated by a phone you know like there is a lot of engagement of active discussion in face-to-face where it's easy to interrupt and see how angry someone can be about something. Certainly I try to minimize my e-mail its good for certain things but then you kind of stamp out stuff if you really want to be driven to the details.

Participant: I have gotten to the point where with clients you'll get a phone call saying "I sent you an e-mail "when did you send it?" "about 5 minutes ago." "oh why didn't you just wait to talk to me?" You know so I'll tell him I check my e-mail once, maybe twice a day and that's it early in the morning and later in the day because I don't have time, if I sat there and tried to navigate through all the e-mail then that would be my job and you can't be productive doing that so.

Participant: There are people that will treat it as a chat line.

Participant: Oh yeah for sure.

Participant: how come you haven't responded back? You know.

Participant: I look upon it which tool is most appropriate for that communication and there are times when e-mail is the most appropriate for things that do not require the human unspoken conversation of actions and this sort of thing. You could call a meeting face-to-face and have the potential of a very effective meeting but it would be completely useless because the topic at hand is not...it isn't exactly worth it .... I would offer caution while ...on ignoring e-mails while you may think this is a sensible pragmatic approach to batch them once a day and go through them or only go through the ones you think are important there's enough clients out there that ... you know "I sent you an e-mail and why the hell didn't you respond 72 seconds I've sent it ....to say take a number and I'll get to you, you know he's going to go to the next office down the street, you have to be careful with that but in a bigger sense with all the forms and tools of communication we have I think we should be looking at the parasitic loads on our time and coming from a .... my world is not the way the whole world should be coming from a port main office through this huge shift I was like this fishing boat all of a sudden joining this big luxury liner ... I see it more as parasitic loads of wasted time and it's like you are wasting my time and your money and it's a shame and without questioning it becomes the norm and away you go so I was trying to say too many things at once there but I have been dying to get that point across......

Researcher: aAd that was the of the things I'm looking for because one of the things I want to dig into a little bit deeper is that I think at least from what I see around the table we can agree that face-to-face is best but that is not always possible just putting this meeting together has been a huge thing so what so what would be you're second preference.

Participant: I would suggest that if this was for sharing internal resources like [name] said, I don't see there being a problem if can send someone a link to how to pick a fan or for a concept that they can go to there to review that and then discuss it later. That would be a very efficient way to do that. You do it once or twice and then the individual will probably know, they'll check this first see what information I can find and then if there's questions that I still have after that I can go and review that with him or her after that.

Researcher: Is there an advantage to sort of the time shift thing part of e-mail you don't need to reply to it that day, you can look at it the next day or something like that. The types of things we are doing, does not have to be done

instantly, it is not like talking to clients. Is there some use to like you said send links or e-mail discussions over a couple of days.

Participant: I'll go back to Chris' point about the window sprinklers I forget who it was I think it was [name] who was the first to respond to reply all and he wrote probably two pages on it. What he did was, first of all negated the need for a lot of us to repeat that information, we could endorse it or pick a line item out so that was a very effective use of e-mail. Because he had the time and the inclination he responded right away and that took the need or urgency off the rest of us replying, took it off the table, so I would argue that was a good use.

Participant: And that was because he did that right away, I mean we could have had four guys all writing the same 2 pages at the same time.

Participant: [name] response came within a couple of hours and I just said good response I have nothing to add and some other stuff followed. If it was an item I felt was critical and I had to have an answer right away I would have picked up the phone, "Tom are you there? No!" click next and you just work your way through the list.

Participant: And the reason for the phone is that its closer to a face-to-face because you get that immediate response, you don't have the body language but at least you have the voice intonation.

Participant: The e-mails that you get and I get them, and just pick up the phone right away because I'm not going to respond the whole direction.

Participant: Right it's too complex.

Participant: Not understanding so this is what I meant and you give him a call right away and away you go. If I have to write something out, an e-mail doesn't always get that across, if he's not very good at his English or he took it the wrong way.

Researcher: And a conference call? When you get this many people on a conference call does that still have a place in terms of how we communicate?

Participant: When I am part of the mechanical discipline calls or whatever you couldn't involve people by e-mail and if you couldn't put them together in one room.

Participant: I find it helps and it doesn't help there's 25 guys on there and you don't know whose really talking now you see some face faces hopefully you'll remember.

Participant: I heard someone say that the goal of a conference call was to get to a point where you don't have to identify yourself. You know its [name] talking....

Participant: We probably all know [name] because of the Scottish accent.

Participant: A conference call doesn't build the relationship.

Participant: It maintains one.

Participant: It could maintain one.

Participant: Having attended 7 or 8 or 9 conference calls since we've been acquired they're one of the parasitic loads on my time. I don't think I'm the only one sitting there with the mute button on and doing other stuff, this is like CBC radio in the background. The first meeting was pure novelty and all that stuff the second meeting I had enough but I felt obliged that I had to listen but somewhere between the second and third meeting it became clear that to me that there was absolutely nothing that goes on in any of those conference calls that couldn't have been handled by an e-mail and it really comes down to are you busy or are you not busy and do you need help or can you help me or not? Hopefully everybody's day is so busy that you would rather not sit down at a conference call and the one's I've missed I have truly missed because I have had meetings, somebody was going to pay me $150 an hour to be there so I wasn't going to sit there and listen to telephone calls way out there.

Participant: I am so disappointed.

Participant: It is not that I don't like hearing your voice [participant].

Participant: I think a I got brave enough to tell my dear friend [name] that people should really respect each other's time much more and meetings should be very infrequent and very short no matter what the form electronic or in person.

Participant: It is interesting that you say that because I had a similar point than what you did, my opinion has somewhat changed since I've had to use lot of the people on the calls and that was a result of, as [participant] said, I'm not doing work out of my own office and its sometimes good to just touch base because now I came from an organization where this kind of a meeting, where all of us got together happened twice a year and I imagine that the same type of thing that happened at those meetings will happen at these meetings. There will be a flurry of communication amongst us all because we all just seen each other and everyone says we can do this we can do that and then you fall back to your tendencies I haven't got time to deal with this call or that sort of thing. What I find is a benefit for something like a discipline lead call is it's a forced communication regardless of how busy you are getting everybody still gets together once a month and has the discussion. We are doing the same thing in our office now, we just changed the format up slightly but once a month everyone gets together and we do a technical review. And what's happening initially is that was always the same people giving the presentations you get up there and talk and would show up there for their free lunch like you said people felt they really didn't need to be there, I'm here because I was told to show up ..... we flipped it up now, what we've done is we've made it presentations with the staff and everybody on staff is expected to once a year do a 15 minute presentation on a project they're doing we then take the project do a half an hour QA and QC and then do a question period at the end, now everybody is involved and so by getting everybody involved in the discussion we now have buy-in. It's something that you have

to look at you're asking is there buy-in at the conference call, there is buy-in in the conference call provided everybody has an involvement. It's like I said earlier if the conference call is basically being run by two or three people and everybody starts saying yes we have work, no we have work, yes we have work, you are right you can deal with that through e-mail. The forced communication amongst the group hopefully fosters that development of that relationship because we can't get together every week every other week, every other month or twice a year whatever it is.

Participant: There may be another structure we have to look at it's a discussion outside of Klaas'.

Participant: You are getting more information than you want Klaas.

Researcher: No this is exactly what I want.

Participant: To come back to the conference call I would say yes, providing it has the appropriate structure.

Participant: And that the topic at hand is necessary and useful.

Participant: If it is focused.

Participant: Often my complaint or observation on how they have gone they've come to be a lot of repetition because we can't get any traction for our progress on things that should have been done already like there's things on the agenda's that have been on the agenda's for 12 months. Now if that had been a project and something had been on an agenda repeatedly for a project meeting for 12 months you would probably get fired off the next job because it's not evolving because of a lack of progress on the issues.

Participant: The things that are on there, the items on the list what are they? Are they actually worthy of action?

Participant: [name] did a presentation six months ago I gave her one and I probably owe her a couple more .....whoever is present we should say to them all this is a great idea, who's going to volunteer, its Wednesday by Friday everybody should send a note to [name] saying I'm going to do this one. It gets back to that thing that you need buy-in from the community.

Participant: How important are the bulletins? And I am not demeaning you or anything like that but just an example of what will that do for the people in this room and all of the people in all of the offices that may need them.

Participant: I was talking to some people after/during lunch and sounds like they will be very useful to a lot of people to explain to their clients things like using ground source heat pumps and the client wants an overview they can give them perhaps a one pager that just summarizes it. Maybe that can go in the back of the proposals and I think they will be very valuable.

Participant: Knowledge transfer, knowledge collection and transfer.

Participant: But they are not necessarily time critical?

Participant: No.

Researcher: But I guess that is one of the questions that I have, we are focusing on knowledge management within the company and realizing it is not time critical but is there also an issue that they just get stagnant because everything else is more important so at some point do you need to move forward and that is part of the thing I am trying to study is that why does it become stagnant? What are the barriers to doing that?

Participant: I know in my case you get busy and its similar to what [participant] said I got one person that wants something deadline driven I have to maintain a utilization over whatever percentage it is at that point with a paying client and at the other end I have this knowledge in my head, I know it, I need to share it but its non ... it effects my performance, my utilization if I'm sitting on the other end of the phone and [name] is looking at my numbers in [accounting] or whoever is looking at them and says [name] utilization is 60% he calls up ML [Managing Leader] and says you know what you've got a guy there that is not carrying his weight get him in the office and find out what is going on meanwhile everyone who is the room here is saying oh he is giving us this great stuff, he's good he's sharing the information so its finding that balance between non-billable work, non-billable time and sharing the information unfortunately the client comes first.

Participant: And everything else is second.

Participant: It gets to what [participant] was saying earlier things are lagging on that agenda because we are pushing things aside. If the agenda progressed we say we are going to get this done by a certain date and we going to get done by a certain date and we treated it like a job the agenda would change over and the involvement would change over.

Participant: I truly believe that the short term financial pressures trump everything else.

Researcher: So is there an issue here in terms of what the company values? Is it an issue that the company doesn't necessarily value this knowledge?

Participant: There is an issue of competing interests between practice and operations.

Participant: Yes.

Participant: Very well put.

Participant: Sums it up quite well.

Participant: You get a different focus, a different direction when you talk to the PL [Practice Leader] versus if you talk to the ML.

Participant: We view it; we view it from the practice side as an advantage in growing the top line. In the short term though, the short term pain is a lack of revenue generation and since we are a short term revenue generating beast, being publically traded, and you would never get Tony [Franceschini] saying that but it's the reality or that's the perception that trumps everything.

Participant: It's going to be harder for smaller offices to find that time.

Participant: Yeah and in the cases where we have had some progress it has probably been the bigger offices and they can afford to take the 30 hours out of Vancouver's 120 mechanical people, like 30 hours is just a piece of grain in the ....

Participant: 30 hours out of a 3 month span ... and as you saw in the room there are only 3 arguably 5 offices that have any mass to them that can actually sustain contributing to ....

Researcher: So that could be a potential barrier in that we have these large offices and a whole bunch of smaller offices almost satellite offices.

Participant: There are great pools of knowledge in every office.

Participant: But they do not have the ability to disseminate this knowledge.

Participant: One aspect we had to deal with in my former life one way had to deal with that the issue we had was that we were all very young we all started off where it was pretty much our first job, not married and things like that so there was this youth contingent in the office and there still is to a certain extend you'll see when you walk through the office tomorrow our engineering side its a very young office and so what we had to do is we didn't have that issue, we had to learn on the job so the result was you got a lot of welcome information there but you documented it and that became the standard so to speak. It wasn't my guy saying here's a design for a ground source it was here's the ground source details for this project, see you learned on the project so what you do is you don't have the utilization non-utilization issue by giving it actual project info. I think that is the only way to come to [participant] point the smaller offices can survive if we were to say [name] we need to get a bulletin from you about pumps, just to keep it simple He says OK I have a project I am starting now and I will have that bulletin ready for you in 2 months because in two months I'll be ready to size the pumps and I'll do it the proper way and we'll bill the project. It's just a different strategy to get around.

Participant: I think these are very good use of time and relative cost so I am wearing a couple different hats so I get to say this we do not have a .... because of the financial heads a spot where people can charge to for these collectively good things and so I believe that if we had something like a budget. If we had a budget for doing

technical bulletins if we had of budget of say 150 man-hours and you could charge your time to it. It is still and admin time but it is not as burdensome as.

Participant: Those kinds of budgets do exist.

Participant: We have a budget for mechanical engineering that pays for me and the room and stuff like that, but it's not, it has not yet been refined to fill time for these functions, specific functions, a collective initiative per-se.

Researcher: I am conscious of the time here I think we have gone through most of the stuff that I wanted to say, just one quick question and again feel free to send me something later on if you think of something else that can go in or I can give you a call later to clarify something .... Are there some other ways that we should be looking at for communication and the second one that is related I guess is in an ideal world what should this look like what should a community of practice, specifically to capture this look like? Are we getting close? Are there things we can do to improve?

Participant: If I could offer that the question you pose deserves to be sent to us as e-mails we can think about it, I am sure you'll get some input.

Researcher: Thank you!

Time: 54:19

Appendix B – Focus Group Participant Brief

Date: March 25, 2008

Re: An invitation to participate in graduate research on The Role of Communities of Practice in Knowledge Management.

Dear Colleague

I am a master's student in the MACT program at the Faculty of Extension at the University of Alberta. My research focuses on knowledge management in large and complex organizations such as Global Brains and I am conducting research dealing with the effectiveness of communities of practice in capturing, storing and re-using knowledge in organizations. The title of my study is "The Role of Communities of Practice in Knowledge Management". I am asking for your assistance in this study to gain some insight on your experiences with communities of practice at Global Brains. What worked, what didn't, what can be improved.

The study takes the form of a one hour session attended by yourself and half a dozen of your colleagues who have also volunteered to take part. Your participation in this research would be greatly appreciated but is voluntary. Your confidentiality and anonymity are ensured. You are free to discontinue participation at any time during the study. Your identifiable information contained in the survey will only be used during the data collection phase of this study. During the analysis portion of the study, you will not be individually identified with your questionnaire or responses. All collected data will be aggregated and grouped.

There are no known risks associated with participation in this study. Your responses to the survey will contribute to the improvement of knowledge management within Global Brains and the establishment and support of communities of practice. The knowledge gained from your responses will also help those individuals and disciplines who will create technical knowledge in the future. By participating in the focus group or interview you are agreeing to participate in the study. If you have any questions or comments concerning this study feel free to contact us using the information provided.

To participate in the research project please fill out the attached Consent Form, and email it to klaas.rodenburg@Global Brains.com.

The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Faculties of Education, Extension and Augustana Research Ethics Board (EEA REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EEA REB at (780) 492-3751.

Thank you for your interest and participation in this research.

Klaas Rodenburg - Graduate Student

Advisor:
Dr. Marco Adria
Research Supervisor
Faculty of Extension, University of Alberta
Telephone: (780) 492-2254
Email: marco.adria@ualberta.com

Appendix C – Focus Group Participant Consent Form

The Role of Communities of Practice (CoP) in Knowledge Management

Invitation to Participate	My name is **Klaas Rodenburg** and I am a Master of Arts in Communication Technology (MACT) Student at the University of Alberta, Faculty of Extension. My research focuses on *The Role of Communities of Practice in Knowledge management,* and you are invited to participate. This research study is in partial fulfillment of the MACT degree requirements
	The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Faculties of Education, Extension and Augustana Research Ethics Board (EEA REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EEA REB at (780) 492-3751.
Purpose of Research	The purpose of this research is to develop best practices, tools and recommendations to improve the use and development of Communities of Practice within large and complex organizations.
Research Method	If you decide to participate, you will be asked to participate in a one hour focus group and/or one hour individual interview and follow-up discussions via e-mail or telephone
Your Professional Opinion	You will be asked for your professional opinion according to your past Community of Practice experience. Research findings and results will be gathered and presented generically without any of your personal information or indication of individual responses.
Confidentiality Anonymity Security of Data	Your identity as a participant in this study and/or any other personal information gathered about you during the study will be kept strictly confidential and will not be made public at any point in time. All data containing personal information from which you could be identified will be stored in a locked file cabinet in my office during the study. It will only be available to me and to my supervisor (Dr. Marco Adria). Electronic data will be password protected. All published results of the study will contain only statistical or group data from which no individual participant can be identified. Raw data will be retained in a secure location for up to five years after which it will then be destroyed.
The Right to Say No	You are being asked to make a voluntary decision as to whether you wish to participate in this study. Your decision to participate (or not) in the study will in no way affect your relations with me or the company you are employed, and participation is not a condition of employment. Please read and consider the information given above. If there is any part of the information you do not understand or where clarification is needed, please feel free to ask me to explain it. If you would like to consult with someone not associated with this study concerning the research process, feel free to do so. If you decide not to participate, or if you later decide to discontinue your participation, your decision will not affect your present or future relations with the University of Alberta. Upon request, a copy of the information, data, and results will be made available to you. You will always be free to discontinue participation at any time up to four weeks after the focus group session, after that the data collected to the point of your withdrawal will be retained/used for the study. If you decide to participate, please provide your signature as indicated below.

What Your Signature Means   Your signature below on this Consent Form indicates that you have read, considered, and understood to your satisfaction the information regarding participation in this research project and agree to take part as a participant. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. If you have any further questions or concerning matters related to this research, please contact:

Contact Information   **Klaas Rodenburg**
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If you have any concerns about the way you have been treated as a participant, please contact **Greg McPhee**, VP Buildings Engineering greg.mcphee@Global Brains.com (780) 917-7130

Appendix D - Summary of Communication Technologies

The information within the table below is an incomplete high-level survey of the myriad of e-media tools available to global organizations. The intent is not to provide a definitive listing but rather show the challenge in selecting a single product capable of doing it all.

ST = Same Time   **DT** = Different Time   **SS** = Same Space   **DS** = Different Space

Technology	ST	DT	SS	DS	Description
Telephone	●			●	One of the first electronic technologies used for communicating over distances in real time. The most widely used one-on-one communication tool within Global Brains Consulting.
Voice Mail		●		●	A feature added to telephones that allow callers to leave messages when the recipient is not available. Can be used for time shifting.
Conference Calling	●			●	A feature that allows more than two people to share a conversation in real time.
Voice over Internet Protocol (VoIP)	●			●	Mimics the functionality of a telephone through digital means, which allows it to be connected to the Internet. As a digital file it can be managed using a computer in a similar way that e-mail is managed. Commercial products such as Skype provide no cost long distance voice communications. Early adoption within global corporations to reduce long distance telephone costs. Some issues such as security and server reliability require solutions.
Video Conferencing	●			●	Adds visual images to the telephone. Requires meeting rooms equipped with cameras, microphones and monitors to connect groups in real time. Can also use the Internet through a web cam, which can in turn be combined with VoIP technology to provide sound. Not widely adopted within most companies due to cost and complexity of use. Increased bandwidth and reduced hardware costs will make this technology more prevalent in the future. The new Bloomberg headquarters has several meeting rooms especially equipped and permanently connected to their London and Tokyo offices. TelePresence by Cisco http://www.cisco.com/en/US/netsol/ns669/networking_solutions_solution_segment_home.html Is an emerging technology providing high definition displays making the experience richer and more lifelike.
Desktop Computer	●		●	●	Primary tool used by knowledge workers to run software and access the Internet. The desktop environment has great possibility for collaboration by allowing users to customize their desktop with a series of "dashboard" tools or apps.
Laptops	●		●	●	A portable version of the desktop computer. Its role in the corporation is changing with the advent of PDA's and improved remote access through technologies such as VPN's. Expensive to maintain and support compared to desktops.
Personal Digital Assistant (PDA)	●	●	●	●	Electronic handheld information device be used to store information from your desktop computer or access information from the Internet. (Blackberry, Palm)

PowerPoint (presentations)	●		●		Software used to create and deliver presentations to provide information to a group of people. Can be used to present to multiple people in a single room or over the Internet to multiple audiences worldwide. Can be integrated with conference calling or VoIP technology to provide sound.
Web casts	●			●	Telephone conference calling with presentation images in real time, can be one-on-one or one-on-many - WebEx, NetMeeting
Internet	●	●	●	●	A worldwide system of interconnected computers and computer based devices. Information is transmitted by packet switching using the standardized Internet Protocol (IP). the Internet is held together by bi- or multi-lateral commercial contracts (for example peering agreements) and by technical specifications or protocols that describe how to exchange data over the network. Source http://en.wikipedia.org/wiki/Internet Widely used by Global Brains Consulting and other to connect their staff and offices using a variety of applications.
Intranet	●	●	●	●	A private network application using Internet Protocols used primarily for internal communications. Used by Global Brains Consulting to exchange data, information, ideas and files.
Virtual Private Network (VPN)	●	●	●	●	A private communication network used for remote access. Used by Global Brains Consulting staff to provide access to the Global Brains Consulting server and personal files. Can be used as a platform for sharing files and collaboration with internal and external CoP members.
E-mail & Listservs	●			●	A means of exchanging text messages among computers over the Internet. With attachments can be used send other digital files such as pictures, audio, audio-visual, word files, spreadsheets, drawings, etc. Listserv is just a commercial version of an e-mail distribution list. The most common used application within Global Brains Consulting and the Internet. Concern over the increasing volume of e-mail reducing productivity and reducing its value.
Wiki		●		●	A type of website that allows users to add and edit content and is especially suited for collaborative authoring. Sometimes refered to as "What I know, is…." Source http://en.wikipedia.org/wiki/Wiki Has great potential for use as a content creation tool for Global Brains Consulting CoPs by allowing for continual refinement of posted information. Has potential for abuse and vandalism.
PodCasting		●	●	●	Sound files that are sent to individual computers (primarily on a subscription basis) rather than a broadcast, which is available with anyone with a receiver. Has great potential for "pushing" company information to a selected group of recipients. Also provides potential for listening to the messages while traveling i.e. car.
Text Messaging		●		●	A service available on PDA's used to send short text messages. Abbreviated version of e-mail. Currently used primarily for individual messages and has not been widely used for formal communications within Global Brains Consulting.
On-line knowledge		●	●	●	The Internet makes large amounts information available to employees both internally and externally. Having closed its libraries in most offices Global Brains Consulting now has a number of corporate subscriptions or licenses to post materials on their WAN server so that this information is available to its entire staff 24/7. This includes items such as magazines, codes & standards, technical databases, and concurrent licenses for software tools. The rationale for accessing third party information is that is the most current, scalable, and more economical than an in-house service of a non-

					core task.
On-line training	●	●		●	The Intranet, as well as Internet, open up the possibilities of providing learning resources on-line. This can be an internally developed set of how-to instructions, a self study course, a web-delivered presentation/lecture or resource reading materials. Commercially available courses are also appearing on the market. An example is the "essentials of LEED Professional Accreditation" offered by the USGBC to prepare people for their exam. Source: http://www.usgbc.org/DisplayPage.aspx?CMSPageID=286&
Collaboration Software	●	●		●	There are an increasing number of commercially available software tools that assist companies and individuals in collaboration. Companies like Microsoft and Adobe are adding these features in the office products while other products such as Buzzsaw and CAISNET provide web-based services. Most of these products provide services already available within the Global Brains Consulting network but provide extra functionality or tracking capabilities worth exploring.
Speech-to-Text					Software designed to convert speech to text so that it can be used inside a text document.
Text-to-Speech					Software designed to convert text to speech so that the written word can be understood verbally.
Portable Document Format (PDF)					A common format for exchanging a variety of file types and information formats over the Internet. Used a free viewer to view information. Can be used to scan handwritten documents so they can be attached to e-mail (replaces fax)