

Collaboration for Sustainability in a Networked World

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Abstract: This research explores how the web's collaborative potential can be harnessed strategically towards sustainability. With the success of web-scale collaborations such as Wikipedia and Linux in mind, we sought to understand how web-enabled collaborations could be used strategically, particularly to support innovation for sustainability. Building on Peter Gloor of MIT's research into collaborative innovation networks (COINs), a framework for collaborative organizational networks supporting innovation, we evaluated COINs' strategic potential for sustainability utilizing the framework for strategic sustainable development and the approach of backcasting. We found that COINs can provide a strategic and effective way to work towards sustainability because they harness collective intelligence towards innovation and support distributed working styles. Additionally they provide an organizational framework that supports socially sustainable modes of working. However, COINs can amplify the impact of unsustainable innovations, so a strong systems perspective based on principles of sustainability is required to use COINs strategically. The final product of this research is a set of recommendations for people considering utilizing COINs for sustainability.

Keywords: Collaboration, Collaborative Innovation Networks (COINs), Strategic Sustainable Development, FSSD, Backcasting, Networks, Organizational Framework

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Statement of Collaboration

Our thesis was a crashing together of three diverse minds from three different continents. As east met west, engineer met economist, we somehow found a common language to come together and explore our shared excitement for the power of the collaborative web. Intrigued by the web's emerging, exciting technology all three of us were eager to explore the opportunities the web affords our global village for solving complex sustainability challenges. The opportunity to work and learn as part of such a diverse group was not only an honour and a unique opportunity, but essential for the success of our research. By collaborating together in self-organization, overcoming the barriers of our diversity, reflecting and learning from each other, we were able to understand the true opportunities and challenges of global web based collaboration as few other groups ever have the opportunity.

All three of us participated fully in the thesis process. Realizing our interdependence, it was important to support each other's diverse contributions, strengths and weaknesses, and to find a combination of our talents greater than each of us individually. All insights, theories and ideas were created together, and each of us stands behind this research and work with pride. We learned that one player does not make a team, each of us had to share the risks and the rewards of this thesis endeavour together.

We were privileged to work on this thesis as part of our own collaborative innovation network (COIN). Our fellow COIN members contributed to our thesis with dialogue, conversation, information, and feedback. These insights not only helped to evolve our understanding of a new, sizable and illusive field, but also helped to make this thesis tangible whilst spurring our deep enthusiasm for the subject.

We believe this collaborative process was essential for engaging our topic successfully. Collaborating afforded us the opportunity to amplify our learning, and then share that fresh perspective on the opportunities for collaboration with the world. We are certain this experience will inspire our work in the future, and we hope our findings and research results can inspire and help other collaborative innovation networks.

Executive Summary

This report provides an overview of how sustainability practitioners can harness the web's ever growing network to collaborate and innovate towards sustainability by using collaborative innovation networks. It was submitted as a masters' level thesis for the international programme *Strategic Leadership towards Sustainability* at Blekinge Institute of Technology, Sweden.

Background and Research Questions

The sustainability challenges facing the world today are complex and global in scale. One individual, organization or country working alone cannot solve concerns such as climate change and poverty. These challenges require mass collaboration and ingenuity on a global scale. At the same time we are seeing the success of many web enabled or web based collaborations such as Wikipedia and Linux, two collaborations over networks that go beyond our previous understanding of how and why different people from around the globe can work together. Peter Gloor and his colleagues at MIT have researched the phenomena of Collaborative Innovation Networks (COINs), documenting an organizational framework for successful web-enabled collaborative innovation. According to his research COINs are the greatest drivers of innovation ever, and COINs are at the heart of Wikipedia and Linux's mass collaborative success (Gloor 2006).

Seeking to explore the potential of this powerful innovative force for sustainability, we asked the question: *In what ways can collaborative innovation networks (COINs) be part of a movement towards a sustainable society?* In order to be strategic in our approach to answering this question we structured our research according to the technique of backcasting as outlined in the Framework for Strategic Sustainable Development. First we explored the potential of COINs in a future sustainable society, then established a baseline of their use today towards sustainability. We uncovered barriers and emerging factors affecting their use towards the sustainable vision, and finally made recommendations as to how to strategically and practically harness their potential for sustainability.

Methodology

The exploration into this research was designed according to a qualitative research design model. Results were gathered from a literature review, interviews with 18 individuals with relevant expertise, a survey of 38 sustainability practitioners, and a social action research project. The social action research involved a distributed, web-enabled collaboration between the thesis authors and seven other individuals, working together as a COIN to build a web resource on collaborative innovation for sustainability. This COIN was called the Collaboration Ninjas. Engaging in participant observation while working as part of this COIN allowed us to develop and test theories as we worked, making our findings more relevant and accurate.

Results

We began with a literature review and exploration of how COINs are being used today towards sustainability, juxtaposing this against the role of COINs in our vision of a sustainable society. We found that the greatest potential of COINs today for sustainability is their innovative capacity, as when used correctly COINs are powerful drivers of innovation. Additionally they provide an organizational framework supporting socially sustainable processes of relating such as openness, transparency, involvement and cooperation. Perhaps their greatest asset for sustainability today and in the future is their ability to support diversity in decision-making and consequentially organizations and societies built around diversity. A few sustainability practitioners are utilizing COINs successfully today, and our research found that most have the tools and ability to harness these networks (computers and web access). However there are concerns over the effects of the digital divide on the sustainable use of COINs, as well as the resource intense nature of all the technical components supporting COINs such as computers and information storage.

To collect data around the barriers to sustainability practitioners utilizing COINs for sustainability we administered a survey focusing on technical barriers and interviewed experts in the field. We also observed our own experience in the collaboration ninjas COIN. Our data revealed that many of the difficulties of web-enabled collaboration reflect struggles with collaboration in the physical world such as power struggles, miscommunications and over controlling leadership. Unique to web based working were concerns over data and Intellectual Property (IP) sharing over the web, difficulties communicating and building trust in text based mediums, and poor signal to noise ratios. These and other factors all provided significant barriers and de-motivating forces to the successful use

of COINs for sustainability. Our results also revealed cultural barriers to the flattening of hierarchies that occurs as we adopt more collaborative, chaordic models of working driven by COINs. Deeper barriers to COINs operating strategically towards sustainability are lack of trust, openness and shared vision, without any of which a COIN is doomed to failure.

Our research also uncovered a variety of emerging factors affecting the potential of COINs for sustainability. Beyond the new technologies that are changing the way we store information, communicate and share over the Internet, we observed that networked communication technologies are evolving and transforming how we organize and work. With many hierarchical giants crumbling under the pressure from more 'open' web-based competition, we are not able to hypothesize how they will be superseded. The implications of this complex uncertainty on the use of COINs for our societal organizations are massive. Results indicated that COINs need the future of the Internet to be open and democratizing rather than controlled in order for COINs to function in a networked world.

Based on all the information gathered from the interviews, surveys, literature review, action research, and utilizing the creative tension of backcasting from a vision of sustainability, we developed a handful of recommendations, both practical and strategic, for utilizing COINs towards sustainability. These included suggestions as to how to build trust, keep motivation high, and select the right web-tools for the collaboration in order to overcome barriers to web based collaboration. These results were stored on-line in an open resource, <http://www.collaborationninja.com> in order to ensure their relevance for a field that is changing so rapidly.

Discussion

Results indicated there is tremendous strategic potential for using COINs for sustainability. In the discussion we outline how COINs provide an organizational framework supporting self-organization and diversity, two essential characteristics for innovating around sustainability challenges. They also support socially sustainable modes of working and provide a more natural way of addressing many of the world's greatest sustainability challenges. By enabling people to achieve whilst constantly learning, affecting and resonating with one another, COINs can leverage our capacity as problem solvers. Used for the transmission of sustainability knowledge, COINs not only save basic resources, but also make it possible for a

problem to be put on a global platform for people from all around the world approach.

However there are many dangers to beware of in using COINs for sustainability. The web and current computing technologies are very wasteful, generating many contradictions to the scientific principles underpinning sustainability. Because of the unsustainable nature of computing technology, networked collaboration is still a long way from operating within sustainable limits. Additionally, COINs can be used for innovating and putting to market unsustainable products faster and more effectively, clearly a detriment to sustainability. Finally our research highlighted the reality that the web and technology will not save us, rather people adopting different patterns of behaviour and attitudes is what will save us. Our use of the Internet and web-based collaborative technology enables different ways of relating, but is still nothing more than a reflection of our physical society. Throughout society there is still a large gap in our knowledge and education around the know-how necessary to work collaboratively, erecting a large barrier to our ability to use COINs for sustainability.

In our results we expected to provide concrete recommendations to support sustainability change agents in using COINs. However we found that due to the emerging nature of this field, much of this practical advice is changing rapidly. To adapt to this realization, we contributed the results of our research to the Collaboration Ninjas web resource for further development. To ensure COINs are used strategically we recommend they adopt strategic sustainability planning into their operation and vision as we recognize a large potential when the framework for collaborative innovation networks is paired with a sound science based approach to sustainability planning, the Framework for Strategic Sustainable Development (FSSD). The FSSD can allow COINs to build a strong vision based on scientific principles of sustainability, as well as bring the systems perspective necessary for critical COIN use towards sustainability, while COINs can provide the organizational frame to launch our society rapidly towards a sustainable vision framed within the FSSD.

Glossary

Backcasting: A planning methodology in which a future desired outcome is envisioned, and then steps are planned and taken to work towards that future.

Blogs (short for weblogs): Web based journals, often hosted for free, authored by individuals, media outlets and companies alike as an on-line communication tool.

Cloud Computing: Refers to the practice of hosting, storing, and sharing your data online rather than on personal computers or personal servers: the ‘digital cloud’. This allows personal information to be accessed from anywhere in the globe and eliminates the need for personal computer and data storage. Cloud computing has yet to become mainstream, largely due to security and technology concerns. Some suspect cloud computing will be the next movement in the Web Revolution.

Collaboration: When more than one individual, group or organization actively decide to work together to achieve a shared goal or vision.

Collaborative Innovation Networks (COINs): Groups of highly motivated individuals operating together in web-enabled networks of trust, transparency and shared vision to innovate collaboratively towards a common goal (Gloor 2006).

Collective Intelligence: When the output of a coordinated group is greater than the sum of its individual contributions. The work of ants building an ant hill is an example of collective intelligence; where the outcome is more intelligent than the sum intelligence of the contribution. The popular Google search engine is generated through collective intelligence. Collaboration is an active means by which to achieve collective intelligence

The Commons: “A commons arises whenever a given community decides that it wishes to manage a resource in a collective manner, with special regard for equitable access, use, and sustainability. The commons is a means by which individuals can band together with like-minded souls and express a sovereignty of their own” (Bollier 2008, 4).

Crowdsourcing: “Crowdsourcing is the act of taking a job traditionally

performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call. It is the application of Open Source principles to fields outside of software” (Howe 2009, <http://crowdsourcing.typepad.com/>).

Disruptive Innovation: Innovation is finding a new, better way to solve a problem or perform a task, whereas disruptive innovation is a new idea, product or service that in the long run irrevocably changes social practices and the way we live and organize as humans.

Digital Natives: People who are comfortable interacting within the subculture of the Internet, typically having used it all their lives (see also Net-Generation).

Digital Immigrants: People who have come to know the Internet later in life, and are not completely comfortable interacting in the subculture of the Internet.

Emoticon: Typed text images that convey the emotions of the writer. Popular examples include :) to indicate happy, and :(to indicate sad.

Folksonomy: Combining folks, and taxonomy, folksonomy is a new means of organizing and categorizing information that is grass-roots, or user-generated. Considered the opposite of categorization by experts (taxonomy), folksonomy allows users to create their own logic and organization of information and content. Also known as social tagging, collaborative tagging, and social indexing.

Forum / Web Forum: Also referred to in certain countries as BBS: Bulletin Board Service. A space within a website where people can follow and contribute to various threads of conversation within a subject area.

Intellectual Property (IP): consists of novel ideas that are protected using the law: Examples include patented information, copyrighted concepts, trade secrets, and trademarks (Chesbrough 2003, 157).

Internet: Global network of interconnected computers allowing for the sharing of information.

Linux: A popular computer operating system whose success has come to symbolize the possibilities of collaborative production models. Linux was developed collaboratively using open-source principles and does not utilize

proprietary protections like other operating systems (Microsoft Windows, Mac OS), a strategy that has resulted in wide spread, unprecedented success.

Net-Generation: The generation of young people born from the 80's to present who have used the Internet since a young age. See also Digital Natives.

Open Source: Refers to a means of production where the output is open and free for others to use and improve upon, consequentially harnessing the power of the crowd to improve a product. While it originated with the open source software movement (LINUX is a famous example), the term has been extended to other fields including economics and innovation.

Peer Production: A socio-economic system of production that is emerging in the digitally networked environment. Facilitated by the technical infrastructure of the Internet, the hallmark of this socio-technical system is collaboration among large groups of individuals, sometimes in the order of tens or even hundreds of thousands, who cooperate effectively to provide information, knowledge or cultural goods (Benkler 2006).

SaaS (Software as a Service): A new model of software applications, whereby rather than individuals owning single copies of software, many individuals share the same software that is hosted on-line over the Internet. In this way the software is accessible from anywhere, is transferable, scalable, and reduces the needs for personal storage and organization.

Social Media: Media that is created by users rather than institutions. Social media tools include e-mail, blogs, wikis and other social computing applications that allow individuals to broadcast information to their peers, communicating effectively without the use of traditional media outlets.

Sustainablists: An individual who is working to move society towards a state of sustainability. More than environmentalists, sustainablists are equally concerned with social and environmental well being, working from a whole systems perspective.

Swarm Creativity: Based on the behaviour of swarming insects where through self-organization individual organisms work together to solve complex tasks, creating an output greater than the sum of each individually part. It is an example of collective intelligence.

VoIP: Voice over Internet Protocol is software that enables telephone conversations hosted over the web.

Web (World Wide Web / www): The web is a flexible network using the Internet that cheaply disseminates information based on a language of html code and utilizing web browsers. Although different than the physical Internet that connects global computers, the terms Internet, the web, and World Wide Web have come to represent the same phenomenon in most common usages.

Wiki: a technology that enables all users to contribute, change and edit the content of a web page. It is wiki technology that enables millions to participate in the writing of Wikipedia, the popular user-generated web based encyclopaedia.

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1 Introduction

23.5% of the world's population, approximately 1.6 Billion people, are now 'on-line' using the Internet to exchange information and connect. That number is growing every day (Miniwatts 2009). How will we harness that potential for sustainability?

1.1 The Sustainability Challenge

The rapid technological and scientific advancements of the last 50 years (cheap air travel, the personal computer, the mobile phone) have led scientists, academics, journalists and authors alike to declare that the world is growing smaller by the day (Friedman 2007; Barabasi 2005). By making our world more accessible, these advancements have also revealed the complexity and difficulty of our global challenges: millions lacking access to clean drinking water, top-soil depletion, peak oil, the growing prosperity gap between the global north and south. As we understand more intimately the difficulty of these challenges, many are searching to understand how on earth we can all live together and tackle these complex problems.

There is a growing realization that these problems are systemic and interrelated. The 1987 UN Brundtland report was the first major articulation of the link between our economic, environmental and social challenges, defining sustainability as meeting the needs of current generations without compromising those of future generations (Brundtland 1987). This systemic approach to our shared sustainability challenge has grown in the past 20 years. Today the ideas of economic well-being and social sustainability are often considered as a pre-requisite to physical environmental sustainability (Harrison et al 2004). However sustainability as a term and a movement is still unclear to many, leading to confusion as to how to work towards sustainability.

1.1.1 Strategic Sustainable Development

To cut through the confusion, this thesis uses the following basic principles for sustainability, describing the minimum conditions necessary for the system of human life on earth to operate sustainably:

In a sustainable society, nature is not subject to systematically increasing

- 1. concentrations of substances from the earth's crust**
- 2. concentrations of substances produced by society**
- 3. degradation by physical means**

And in that society...

- 4. people are not subject to conditions that systematically undermine their ability to meet their own needs**

Figure 1.1 Sustainability Principles. Adapted from Holmberg and Robert 2000; Ny et. al 2006.

Initially developed by Karl-Henrik Robèrt and John Holmberg along with many academic collaborators in the late 1980's, we consider these principles to be robust as they were developed collaboratively, peer reviewed and are based on a scientifically agreed upon world-view. They provide useful directional aid for planning towards sustainability as they are concrete enough to guide action, sufficient to achieve sustainability, yet general enough to be applied in a multiple of situations (Robèrt et al 2007).

Framework for Strategic Sustainable Development. Karl-Henrik Robèrt, John Holmberg, and Göran Broman, in affiliation with the Natural Step and multiple academic associates, went on to develop a Framework for Strategic Sustainable Development (FSSD) to guide decision making for sustainability. According to Broman, "The framework is built on the concept of simplicity without reduction. Out of respect for complexity we designed it to provide a compass, a guide for strategic direction" (Broman et al 2000, 3).

The FSSD consists of five levels. The first level underscores the importance of understanding the system: examining the system for sustainability by looking at society, within the biosphere and identifying characteristics and principles integral to the functioning of this system. These include the basic principles of thermodynamics, as well as the eco-system tenants for sustainable systems: diversity, interdependence, self-organization.

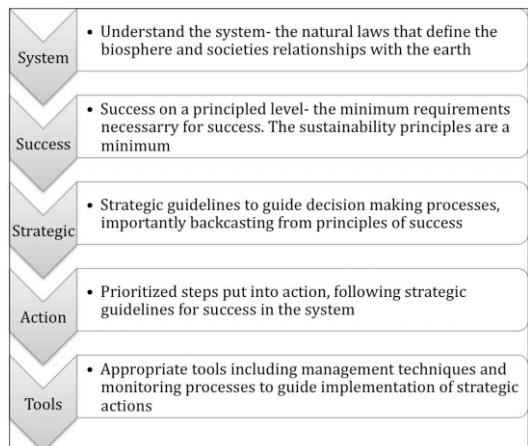


Figure 1.2 Framework for Strategic Sustainable Development

The second level involves defining what success means within that system. For sustainability, success is society operating within the constraints of the sustainability principles (fig 1.1). More specifically, the first three principles define success as no longer contributing to the systemic degradation of the earth's resources. Success in regards to the fourth principle means eliminating any barriers that inhibit others from meeting their needs. To define human needs, we use Chilean Economist Manfred Max-Neef's nine, (tenth has been proposed) human needs: participation, subsistence, freedom, leisure, affection, understanding, identity, creativity, and protection (Max-Neef 1991).

The FSSD includes guidelines to ensure any actions taken towards sustainability are strategic towards 'success.' The primary strategic guideline of backcasting from principles of success is particularly useful for making decisions where there is a high degree of uncertainty and complexity surrounding the issue as there is with sustainability. The process of backcasting involves envisioning success, the sustainable future we are working towards, and assessing today's operations against that vision. Then from today's current baseline, we can strategize dynamic measures towards that vision. In addition to backcasting, at the strategic level of the FSSD there are three strategic guidelines in the form of prioritizing questions:

- does this action move in the right direction, towards success?
- is the action a flexible platform?
- does it provide a return on investment?

Other strategic guidelines are geared specifically towards social sustainability. Benaim, Collins and Raftis (2008) developed specific guidelines to ensure actions do not systematically prevent the achievement of human needs, thus ensuring progress towards social sustainability. These strategic guidelines for socially sustainable processes of relating are: cooperation, transparency, openness, inclusiveness and involvement.

Once all actions are evaluated against strategic guidelines to ensure they will move towards success within the system, the final step when working with the FSSD is considering tools to help support and implement these actions. Given the scope and complexity of the sustainability challenge we face, the FSSD is a valuable tool to cut through the confusion regarding sustainability and help catalyze strategic actions in the right direction.

Moving through the five levels of this framework is a valuable addition to our societies' ability to plan for sustainability.

1.1.2 Collaboration for SSD

"Sustainable development simply calls for more collaboration since the changes needed exceed the capacity of individual actors." (DeBruijn and Tukker 2002, 11)

As with the FSSD, collaboration is extremely valuable in our societal efforts to shift towards sustainability, as there is growing concern that acting as individuals we do not possess the capacity to innovate the changes necessitated of us for sustainability, a concern labelled the 'ingenuity gap' (Homer-Dixon 2000). In response to the ingenuity gap, many within sustainable development are demanding more collaboration and greater cross-fertilization of ideas (DeBruijn and Tukker 2002). This research builds on the definition of collaboration put forth by Gray (1989) as a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions. Hartman et al. (1999) describes three reasons to collaborate for sustainability:

1. Because most sustainability challenges are complex and uncertain, collaboration offers an opportunity to bring together those with different viewpoints from different sectors and disciplines, thereby finding solutions that rise above our individually limiting perspectives.
2. Collaboration builds a network of stakeholders from different fields, allowing access to the various resources necessary for solutions.
3. Unlike traditional command and control structures, collaboration provides the flexibility necessary to build viable stakeholder networks working together in novel ways towards sustainability.

Clearly collaboration is needed to bridge the ingenuity gap and innovate the changes needed for sustainability, particularly as there is growing evidence that the greatest potential for break-through innovation and creativity comes through collaboration (Sawyer 2007; Paulus 2003; Chesbrough 2003). In the past the collaborative innovation process has led to the great disruptive innovations that transform our society forever, making it a compelling issue. Examples of such collaborative, disruptive innovation include the World Wide Web and airplanes (Sawyer 2007; Gloor 2006).

The process of collaborative innovation is related to the concepts of open innovation, which gained prominence in the Information Technology (IT) sector, and is now being explored by many other industries. Henry Chesbrough, the leader in this field of research, defines the term 'open innovation' as innovation where you openly share your ideas and innovations with others outside your personal, business or industrial sphere, thereby benefiting from others' insights and gaining improvement on your own (Chesbrough 2003). Collaborative innovation differs from Open innovation in that there is intent towards a shared vision. We use this 'intention' to draw the distinction between collaborative innovation for sustainability and the broader concept of open innovation.

1.2 Collaboration in a networked world

In 1992 our ability to collaboratively innovate towards sustainability changed forever with the successful launch of the World-Wide-Web: the realization of a vision to bring the interconnected, communicative power of the Internet to the world. Throughout the 1990s popular social communication tools such as e-mail, web forums and on-line chats provided the means to instantly communicate cheaply across the globe via 'the information super highway' (Gates 1996), transforming the way we communicate, socialize, organize and do business. More recently society has witnessed the rise of web 2.0: an evolution of the web enabling greater participation and co-creation through peer-to-peer social computing tools. In 2008 for the first time in the web's history its most popular usage was for participation in web 2.0 social media sites as opposed to viewing static media pages (Goldsmith 2008).

It is difficult to estimate or understand how quickly and dramatically web 2.0 has changed the communication landscape. The technology driving this transformation includes:

- Social networking sites such as Facebook, Myspace and Xiaonei where people communicate with and grow their social networks on-line.
- Blogs enabling self-publication including micro-blogging limited to 140 characters, the popular example being Twitter.
- Wiki technology, enabling people to collaborate and write content together, exemplified by Wikipedia.

- YouTube and bit torrent streaming sites that allow people to share files and videos across the globe in peer to peer sharing networks.
- Skype and other VoIp technologies that have transformed our audio-visual conferencing capabilities.
- The aggregation of information through tracking links, tagging, folksonomy or voting mechanisms has increased our ability to make sense of web communication and utilize user-generated content.

Before the rise of this new social media, traditional literature regarding collaboration discussed multi-stakeholder collaboration: supply-chains, government, corporations and NGO partnerships (Hartman et. al. 1999). With the rise of social computing the discussion now revolves around collaboration that transcends the barriers of time and space (Gloor 2006, Surowieki 2005, Tapscott and Williams 2006). Peer to peer, crowd-sourcing and collective intelligence are just a few synonyms appearing over recent years for the same concept: distributed collaboration where potentially millions can work together over the networked landscape of the globe thanks to new social computing technologies (Malone 2008).

1.2.1 Smart Mobs and Wise Crowds

However some are concerned that these new opportunities to communicate and collaborate do not actually make us more intelligent and increase our ability to innovate as a society, but rather just lead to a lot of noise and increasing instances of group think (Keen 2009). Leading researchers and thinkers such as Scott Page, Howard Rheingold, and Charles Leadbeater are exploring how networks allow for emergent wisdom from crowds. Leadbeater encourages us to consider what makes groups wise, a condition he calls ‘we-think’:

"We-Think emerges when diverse groups of independent individuals collaborate effectively. It is not group-think: submersion in a homogeneous, unthinking mass... It all depends on how the individual members combine participation and collaboration, diversity and shared values, independence of thought and community. When the mix is right... the outcome is a powerful shared intelligence. When the mix is wrong it leads to cacophony or conformity" (Leadbeater 2009, 23).

James Surowiecki outlined the conditions and circumstances that ensure collective intelligence, outlining four conditions for wise crowds: 1.

Diversity of opinion with a mix of knowledge and experience (you have to have some people who know something about the area of concern) 2. Independence 3. Decentralization 4. Aggregation: some mechanism for drawing out the collective decision (Surowiecki 2005). Peter Gloor at MIT also emphasises the need for diversity when he discusses the conditions for swarm creativity, the output of successful collaborations that simulates the collective intelligence of swarming insects such as bees and ants (Gloor 2006).

A variety of examples of intelligent, web-enabled collaborations do exist. When exploring these examples, a team of researchers in the UK outlined three categories for taxonomies of intelligent web-enabled collaboration, outlined below in figure 1.5.

- Unconscious aggregation and harvesting of information such as the strategies employed by Google. Usually the participants are simply doing their own thing and an unintended after affect is collaboration.
- Coordination of efforts of people working separately such as FlickrR's tagging folksonomy. Here participants know they are part of a sharing community or social network, and consciously aid in the aggregation and coordination of information that results in intelligent collaboration.
- Synergistic collaboration leading to certain aspects of Linux and certain content in Wikipedia. Here participants engage in rich dialogue with each other in order to make collective decisions. This is intentional, generative collaboration towards innovation.

Fig. 1.5 Taxonomy for Web-based Collaboration Adapted from Parekh 2009

This final, synergistic collaboration is where we focus our research, exploring how synergistic web-enabled collaboration can harness the wisdom of the crowd to innovate towards sustainability.

1.2.2 Collaborative Innovation Networks (COINs)

"Today, collaborating in an open and transparent flow of knowledge is key to successful innovation, and COINs are the most productive engines of innovation ever." (Gloor 2006, 10)

A team of researchers led by Peter Gloor at MIT have outlined a framework for the most efficient and effective organizations for innovation ever: Collaborative Innovation Networks (COINs) (Gloor 2006). A COIN is a "cyber-team of self-motivated people with a collective vision, enabled by the web to collaborate in achieving a common goal by sharing ideas, information, and work" (Gloor 2006, 3).

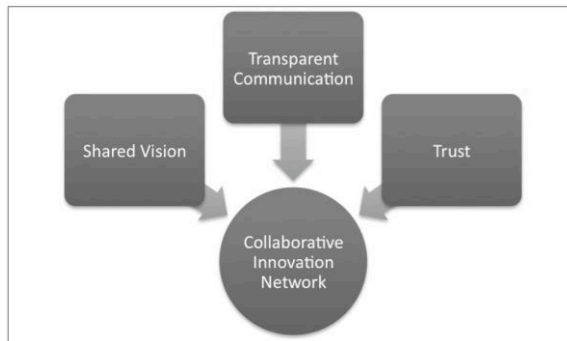


Figure 1.6 Framework for Collaborative Innovation Networks

Figure 1.6 outlines the core success characteristics of this synergistic collaboration: a shared guiding vision, a strong ethical code, and open communication towards collaboration. According to Gloor's research, COINs are often the driving force of innovation within corporations and industries, but also exist along the fringes of corporations and operate inter-disciplinarily. The later was the case with Linux and Wikipedia: two famous web-enabled collaborations driven at their heart by COINs.

Examples of COINs. To better understand the power of COINs we can look at examples of their use to date. Within corporate boundaries Daimler Chrysler made innovative use of a COIN back in 2000 with its project e3, an initiative with a vision to increase the efficiency of Daimler Chrysler's Global Procurement and Supply operations. Looking for an innovative way to achieve this goal faster and more effectively than their competitors, Chrysler opted for a COIN, gathering members from procurement, IT, business units, and external consultants from around the world to innovate a solution through a distributed network. Beyond achieving their vision, there were unexpected benefits: Chrysler was able to overcome cultural barriers between international partners and developed a collaborative corporate culture based on openness, trust and feedback that allowed for unexpected innovation and success in other areas (Gloor 2006). Peter Gloor and his

colleagues have investigated similar phenomenon in corporations across the world, including global innovation leader IBM, with equally successful results.

An innovative example of governments utilizing COINs comes out of the USA. There the Office of the Director of National Intelligence has established 'Intellipedia,' a wiki where analysts across 16 intelligence agencies can share information and connect the dots between their insights more easily (the Collaboration Project 2009). This has changed the culture of this community from one where good reputation is achieved by hoarding knowledge and secrets, to one where reputation comes through sharing the most information with the rest of the community. Intellipedia and collaborative tools have completely flipped the incentive structures and working styles of these agencies (Munz and Germaine 2009). The model was so successful that government agencies and areas of mutual interest across the USA have announced plans to launch similar wiki sites.

Within the design world there are specific COINs successfully bringing together consumers and producers to innovate more effective and efficient products. Eric Von Hippel (2005) calls this user-led innovation. Enabled by Design (EBD) is a UK based community of people “challenging the one size fits all approach to assistive equipment through the use of clever modern design” (Enabled By Design 2009). Stakeholders of the EBD COIN include producers of assistive equipment, the users, and fresh thinking designers. EBD brings the stakeholders together over the web to evaluate and innovate better assistive equipment. They have done so with such success that they were recently nominated for a MS society award (Enabled By Design 2009).

While exploring examples of collaborative innovation networks, Peter Gloor and his fellow researchers uncovered various layers and relationships that make up complete ecosystems of knowledge-sharing powering innovation. They found that COINs do not operate alone, but rather interact with a larger network of knowledge and information sharers, as depicted below in figure 1.7.

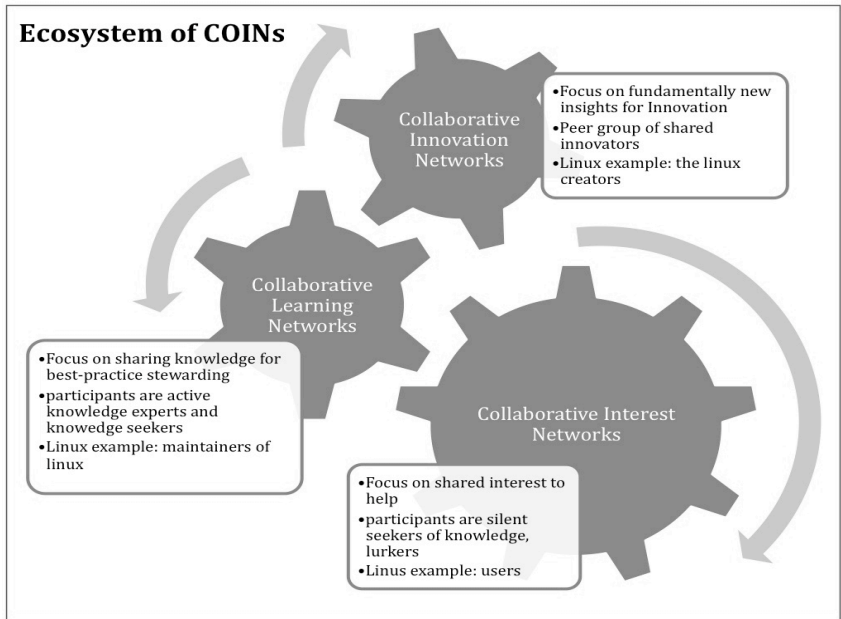


Fig. 1.7 Collaborative Knowledge Networks (Adapted from Gloor 2006, 128-130)

To understand how this knowledge sharing happens we can look to Wikipedia, a website inspiring distributed individuals from around the world to collaborate around the shared vision of: “Creating the greatest free encyclopaedia in your native language” (Klein 2009). Each Wikipedia page itself represents a COIN, with a core group of individuals writing, editing, gate-keeping and ensuring the content of the page stays accurate. The Collaborative Learning Network (CLN) consists of individuals sharing feedback, making comments and questions as to the accuracy of pages but not actively guarding them. The majority of Wikipedia users and participants passively use Wikipedia and benefit from its vision, without participating in its construction; they form the Collaborative Interest Network (CIN). Together these different components make up a dynamic, self-organizing diverse eco-system shaping one of the fastest innovations of our time - Wikipedia.

As these examples illustrate, COINs offer a powerful organizational framework supporting collaborative innovation, using the power of networks to bring diverse stakeholders to the table. Mark Klein, an expert in collective intelligence at MIT, points out that this could be exactly what

is necessitated by our society if we hope to develop strategically towards sustainability.

“A lot of sustainability issues we have can be traced to the fact that too small a number of people are making decisions that effect all of us, based on too narrow a set of concerns....collective intelligence [web-based collaborative] tools will help us make sure that the really critical decisions we face, about where we get our energy and how we get around and how we live, can be informed by a much broader set of concerns - such as the welfare of future generations, the welfare of the poor, environmental and social capital impacts - in a way they weren't before” (Klein 2009)

1.3 Our Research

1.3.1 Scope

This research focuses on the potential of web-enabled collaborative innovation to aid our societal movement towards sustainability. Building on the research of Gloor and his colleagues at MIT defining the organizational dynamic of COINs (Gloor 2006), we consider the systemic boundaries of our research to be: two or more individuals, within society, within the biosphere, sharing and innovating towards a common goal in line with shifting us towards sustainability. They must use web technology to enable the collaboration at some point, and we

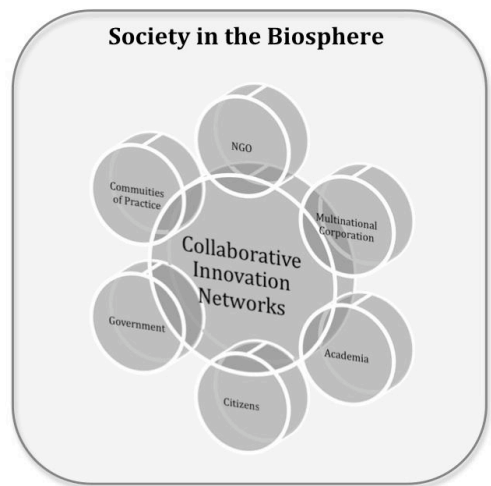


Figure 1.8 Research System

loosely define innovation as any attempt to find a new or better solution to a problem. The audience for this research is anyone actively trying to innovate towards a more socially and environmentally sustainable society.

1.3.2 Purpose

This thesis seeks to explore how we could harness the web's ever growing network to collaborate and innovate towards sustainability. We will explore

the concept of COINs, how they are used today, and how to strategically and practically harness their potential for sustainability. One of the main aims of this thesis is to uncover strategic guidelines for COINs or advice to ensure COINs support known strategic guidelines that support actions towards sustainability.

1.3.3 Research Question

In what ways can collaborative innovation networks be part of a movement towards a sustainable society?

To discover the answer to this primary question in a strategic manner, we utilized backcasting from a sustainable future to structure the supporting questions. Using backcasting to support the design of the research ensures its exploration into the potential of COINs for sustainability remains strategic (Holmberg and Rob ert 2000). In order to achieve this our first supporting question explores a vision of sustainable COINs, our next three questions establish the baseline of their use today in regards to sustainability, and our final supporting question utilizes the creative tension between that future vision and current baseline to make recommendations for the strategic use of COINs.

- RQ1: How could collaborative innovation networks be used in the future as part of a sustainable society?
- RQ2: What are the sustainability implications of COINs based on their use today?
- RQ3: What barriers confront the strategic use of COINs towards a sustainable future?
- RQ4: What emerging factors affect our ability to use COINs strategically towards sustainability?
- RQ5: What recommendations can we make to help both current and future COIN participants to effectively collaborate towards sustainability?

2 Methods

2.1 Research Design

The primary concerns of our research design were validity and relevance. We wanted to apply rigorous practices to ensure valid research, and to contribute practical knowledge useful in the context of every-day life, specifically for individuals working to undo the un-sustainable patterns of our society. Recognizing that the best research is iterative rather than linear, and that it is important to continuously re-evaluate your contextual framework (including assumptions, methodology, research questions and goals), we followed Joseph Maxwell’s qualitative research design process (Maxwell 2005). To support this systemic approach and ensure our work retained its practical social value, we engaged in social action research, developing theory through action, thus ensuring relevance for the problems of the field (Gustavsen 2001). The methodology presented below follows the chronology of the research design. However, as this research was designed iteratively all methods were undertaken in parallel.



Figure 2.1 Research Methodology

2.2 Literature Review

The first research stage involved surveying the field of relevant literature to better understand the functioning of COINs for sustainability today. The areas of inquiry included sustainable development, collaboration, network analysis, disruptive innovation, social media, network economics, and the societal implications of web-based technology. We accessed much of this initial research through academic search engines such as ELIN@blekinge and Google scholar, focusing our inquiry on peer-reviewed journal

publications. However as the nature of our topic is rapidly evolving, we also explored less traditional resources including weblogs, corporate white papers and conference proceedings. To discover these non-traditional resources we utilized the technique of 'snowballing': we started with acquaintances of the research team, using their extended networks and following their suggestions for additional subjects to stay immersed in the state-of-the-art. These less traditional resources laid the foundation for our field research, which bled into our social action research.

2.3 Social Action Research

For the social action research we partnered with a group of individuals based in the UK working under the banner of Brave New Collaboration. Brave New Collaboration was an exploratory partnership between Beyond Zero (UK based social innovation organization), NESTA UK (the National Endowment for Science, Technology and the Arts - with a mission of making the UK more innovative), and students at the Royal Design College. It sought to understand the challenges and opportunities of web based collaboration for social innovation. This thesis builds on many of the initial inquiries, findings and networks of the Brave New Collaboration team, providing an ideal collaboration for the social action research.

Our group of three researchers worked alongside this team in the UK as part of a distributed, web-enabled collaborative network innovating towards a shared vision. This created a COIN, the test subject for our social action research. The COIN vision was to build a dynamic, relevant resource on how to understand and utilize the ever increasing potential for web-enabled collaboration, intended to aid sustainablists in shifting society towards sustainability. This COIN operated under the name Collaboration Ninjas (www.collaborationninja.com), and the group was and still is completely open to any members who share this vision. Our participation as researchers in the Collaboration Ninjas COIN was maintained throughout the two-month period of study, beginning early February 2009 and ending mid-April. When the research period ended, there were 10 people from five different continents actively working on the Collaboration Ninjas project.

Beyond ensuring the relevance of our research, a primary goal of this social action project was to uncover barriers to successful COINs and suggestions for overcoming those barriers. Building on the science of social network analysis (Wasserman and Faust 1994) past researchers interested in the

performance of COINs utilized quantitative methodologies to identify important success characteristics (Cross and Cummings 2004; Gloor et al 2003). As researchers we considered using a quantitative methodology to study the success and barriers of our COIN, but previous research showed difficulty tracking the work of COINs when sub-groups are partaking in face-to-face collaboration in parallel to virtual collaboration (Gloor et al 2008). As this is true for the Collaboration Ninjas COIN, we opted for a qualitative methodology using participatory inquiry and observation to merge our action with theory and knowledge.

We engaged in first, second and third person observation of the success and failings of the group as a whole, and simultaneously reflected on our individual experiences, understanding how important reflection is to successful action research (Rudolph, Taylor and Gabrielle-Foldy 2001). The primary means of collecting this data was through personal journals where all three members of our research team recorded our experiences for the two-month period of study. We shared these reflections with each other on a weekly basis, and used positive inquiry to develop theories and seek improvements to our working as a COIN. We also discussed our reflections and new findings/theories with our interviewees and other members of the COIN, inviting feedback for further improvement via the Collaboration Ninjas online presence.

2.4 Interviews

We recognize that: "While observation is the most direct and immediate way of studying openly manifested behaviours, the only way we can explore motivation, attitudes, beliefs, feelings, perceptions and expectations is by asking" (Corbetta 2003, 117). The primary means of 'asking' was through qualitative, un-structured interviews with people discerned to have expertise in one of the many areas pertinent to our research. We undertook qualitative interviews using 'snowballing' to obtain subjects. We started with acquaintances of the Collaboration Ninjas COIN (including our own), used their extended networks and followed their suggestions for additional subjects. We asked subjects standardized questions (Appendix A), but also allowed them the freedom to talk about other ideas and concepts as we desired to "grasp the subject's perspective" (Corbetta 2003, 264) rather than constrain their responses. We interviewed 18 people including social activists, collaboration researchers, facilitators, social media experts, technology specialists and legal scholars to cover the interdisciplinary field

of expertise necessary to understand the usage of COINs for sustainability. A full list of interview participants is found in Appendix A.

2.5 Surveys

In order to ensure our recommendations and research were relevant for our thesis audience we administered a survey to subjects from this audience using the email list for alumni of the Masters in Strategic Leadership Towards Sustainability (MSLS) course. This survey was designed to identify barriers to understanding and using web-enabled collaborative innovation networks, focusing specifically on potential technological barriers faced by our audience. We had 38 respondents varying in age and technological experience; the survey including results can be found in appendix B.

2.6 Dialogue and Feedback

Dialogue was an essential tool to build our understanding, iterate and synthesize our research, particularly for building our vision (RQ1) and developing recommendations (RQ5) as a group. We utilized many organizational learning tools to facilitate true dialogue powered by deep listening and respect for diversity, as well as multi-media web based dialogue tools including a group blog, e-mail and VoIP services. This alternate means helped to maintain the dialogue over periods of separation, often offering a simpler way to communicate in the face of language barriers. We also engaged our interview participants and other members of the collaboration ninjas COIN in feedback and reflection on our initial findings including the outcomes of our dialogue through the Collaboration Ninja web presence, using this feedback to further our recommendations.

2.7 Validity

There is evidence that omission of detail and context when working with non-text based sources can limit the accuracy of findings in qualitative research (Mischler 1991). We assume this also to be the case for web-based multimedia research and have taken care to reference transparently and accurately. We also recognize that the snowballing technique used to secure interview participants will have limited our exposure to the field. As with any social action research we acknowledge the presence of bias.

3 Results

3.1 Vision COINs in sustainable society

What role might COINs play in a sustainable future that possesses the basic characteristics outlined at the success level of the FSSD (section 1.1.1)? Based on our literature review, and generative dialogue amongst the group, we identified the following vision for COINs in a sustainable future.

Our sustainable human society shows the emergent collective intelligence of the greatest living eco-systems, as it possesses diversity, self-organization and interdependence. This is made possible because all members of humanity are empowered and free, finding no barriers to meeting their nine fundamental human needs (Max-Neef 1991). There are no barriers because all organizations follow Benaim, Collins and Raftis (2008) sustainable processes of relating: transparency, inclusiveness, involvement, cooperation, and openness. These relations are supported by working as a COIN, an organizational framework dependent on sustainable processes of relating for its success. So in this sustainable future, all businesses and governments operate as part of collaborative ecosystems (figure 1.7), driven by COINs, working around shared vision.

A focus on service, facilitated by the instrument of COINs, allows more effective and involved working styles. Consequentially governments now exist to provide a platform and bring people together (Munz and Germaine 2009) empowering participation in the system at large. The diversity supported through this flattened, participatory, chaordic organizational structure contributes to the resilience of future organizations, as the resilience of each system is proportional to its diversity (Tovey 2008). The driving force behind this new structure is the network of the Internet and World Wide Web, the spread of which to all corners of the globe has brought greater societal tendencies towards openness, transparency and honesty.

The web technology and COIN organizational structure facilitates a new economic order where those who are the most open and share the most, gain the most (Leadbeater 2009, xxiv). This sustainable economy is driven by the endless possible connections of thoughts and ideas brought together towards innovation in COINs, a sustainable economic model as knowledge

is the only truly abundant resource. Through the networked knowledge economy, people connect and share in peer-production (Benkler 2006) driven by the desire to innovate towards a shared vision. All knowledge exists as part of the commons and people compete to find the best use of knowledge. Individuals as part of this new economic order are educated to understand “We think therefore we are” (Leadbeater 2009) learning at a young age the importance of critical thinking skills, individualism, diversity, openness and sharing within a successful society. We have a literate, well-educated citizenry using the knowledge of this networked world.

This organizational and economic structure also supports a low-impact, resource efficient mode of living. Because businesses and governments operate strategically towards a sustainable-shared vision, whilst in that process meeting needs and providing services, their physical waste is minimized. The networked knowledge economy allows us to build home spaces in harmony with natural eco-systems since we can participate in the economy from anywhere (Harrison et al 2004). With economic value based on putting knowledge together, people come out of isolation and begin to re-socialize. The new culture of creativity embraced in the knowledge economy allows cities to flourish as cooperative, self-organized, liveable, low-impact urban centres. Through this re-socialization we gain the cooperative benefits of sharing often found within family structures, allowing for further de-materialization.

COINs and the technology that drives them are inclusive, accessible and ubiquitous, reaching every corner of society through wireless, low-impact technology. We share ‘computers,’ Internet, and information storage. This technology is evolved in its design to be human and natural, allowing communication with presence. People are able to sense and feel the atmosphere of communication to truly learn and innovate from the social field enabling the sharing of self-transcending knowledge (Scharmer 2001).

With this deeper understanding of the unity and network that connects our society, people have re-gained the power to tell their own stories, and those who tell the stories control the world (Tovey 2008). Sitting down to generate the stories of our world together, we discover our common humanity. Re-localizing and humanizing our society through these new gatherings allows us to truly think globally, act locally.

3.2 Sustainability implications of COINs today

With our grounding in the FSSD we established a baseline for COINs by examining their current use towards sustainability, as well as their sustainability implications.

3.2.1 Examples of COINs for Sustainability

In order to understand how COINs are used today for sustainability we searched for examples that have social and environmental values very central to their mission statement, vision or core purpose. We uncovered these examples through our literature review and social action research.

Our first example of this type of COIN is from the USA where the Environmental Protection Agency (EPA) used a COIN to spearhead efforts to clean up Puget Sound, a waterway in the Pacific Northwest suffering from environmental degradation. In 2007 the EPA organised a virtual 'Mash-up' utilizing wiki technology to bring stakeholders from government, community, non-profits and corporations together over 48 hours to “identify and share the best information resources, tools, ideas, and contacts in their arsenal to inform the protection of the Puget Sound” (Puget Sound Mashup 2007). The project successfully established a better, more accurate library of information about Puget Sound. This also raised awareness and involvement from the community and stakeholders, improving efforts towards cleaning up the Sound (Munz 2009).

A similar example of a local environmental issue addressed through a COIN comes from a grass-roots initiative in the UK called Incredible Edible Todmorden (IET). IET has a vision to grow and eat more local food in Todmorden, a community of 17,000 residents. Started by just two ladies with a motivating vision, IET used a host of web 2.0 tools to connect, communicate and problem solve across their community. IET successfully linked growers, government, landowners and educators as a COIN to innovate a plan for a local, sustainable food system. In only one year they grew from two individuals to a community wide movement with such success that the BBC is currently filming a documentary on their story. Communities across the globe are looking to model IET's grassroots collaborative innovation network to 'go local, go green.' If this model succeeds, it could go a long way towards minimizing community environmental impacts (Artiuch 2009).

COINs for sustainability can also help mediate interdisciplinary working around complex challenges. With over-specialization rife and many academics, scientists and researchers deep down in their silos or ‘drill holes’, the Carbon Crucible project brings researchers together to approach the challenge of innovating for a Zero Carbon Society (Harwood 2009). “It’s a really simple model: they come together for three weekends over the course of a year and there’s a little social network that underpins that, so they interact online between those weekends. They build relationships, they spot opportunities and they come up with really good, new innovate idea for how to tackle some of these problems” (Harwood 2009). A few exciting projects to mediate working around complex challenges are still under development. Mark Klein is working on an argumentation tool, called the Deliberatorium, to aid researchers, experts and citizens to come together and innovate solutions to fight climate change (Klein 2007). Similarly Ali Wyne (2009) is working on a Global Challenges Wikipedia, which will allow experts and citizens to come together and uncover solutions to some of our greatest global challenges.

Virtual COINs are stepping out of the computer into our hands via the use of mobile technology, thus accessing participants without personal computers. PAMONet (the Pan-African Mobile Activists Network) consists of technical experts and inhabitants of different African regions using mobile technology and networks to work together and quickly for social change. Previous projects instigated through the PAMONet network include tackling gender violence in Democratic Republic of Congo, addressing environmental issues and tobacco control in Nigeria, as well as monitoring human rights activities in Zambia (Pamonet 2009). The collaboration involves cell phones and a web based entity, this simplicity providing a low barrier of entry and allowing for a more inclusive COIN. To imagine how these mobile collaborations work, Ali Wyne describes an African city where there is a lot of tension, assassinations and violence, and a ‘conflict portal’ is used to track these events. Suspecting violence is about to break out, one would send an SMS to a website, the conflict portal. NGOs on the ground receive a notification from the website and race to verify the account, resources are rallied and police are deployed to prevent that conflict from taking place. People and initiatives such as this are gathering successfully across Africa to tackle conflict and violence (Wyne 2009).

Web 2.0 tools are providing a means for activists and sustainablists, those working towards sustainability, to connect and form COINs in ways they

could not envisage just a few years before. An example illustrative of how many sustainablists use COINs is Collective X, a web platform that allows people to collaborate online via group-sites around the issues they care most about. Currently facilitators in Australia are using this platform to decide how to apply their craft to support the rebuilding of communities devastated in the 2009 Victoria brushfires. They are using things like blogging and podcasting to motivate the rebuild, finding innovate solutions together, from a distance (Brown 2009).

3.2.2 Sustainability baseline of COINs today.

From these examples and our experience working as a COIN, it was clear there are some ways COINs are realizing their potential for sustainability, and other areas of concern.

Concerns of COIN working. In order to achieve sustainability we must dematerialize resource use and substitute much of our consumption towards non-toxic, biodegradable substances abundant in the biosphere. However today the use of COINs may be having adverse effects on our ability to live within the earth's constraints as defined by the sustainability principles. The technology driving COINs is personal computers, broadband Internet connections, and energy intensive data storage. All three of these facets are un-sustainable with regards to the first three sustainability principles, and also with the fourth as computer manufacturing is very resource intensive, an inequitable use of scarce resources. Many are concerned by the rapid spread of this unsustainable technology (Moore 2009). In addition we found that data storage alone is unsustainable: "A single rack of storage enclosures [commonplace for small businesses] using 6 kW generates as much carbon dioxide as six 1999 Chevy Tahoe SUVs in one year (about 40 tons)" (the Collaboration Project 2009, 11).

Concerns arise as to how COIN working can erect barriers to people meeting their needs by limiting participation. COIN users suffer from the physical discomforts of today's computing technology, including eyestrain, back and wrist problems. The technology itself can be difficult to understand with users frustrated by counter-intuitive design and low accessibility (Brown 2009; Thorpe 2009). Our data overwhelmingly indicated that the digital divide between the global north and south, the have and have-nots, erects a large barrier to sustainable COINs; they cannot today be inclusive while 78% of the world's population still lacks Internet

access. This is particularly troubling when looking at COINs addressing sustainability challenges as many of the 78% without access are those worst afflicted by the challenges (Wyne 2009). Many are concerned that the spread of networked, knowledge working will only further segregate our world, erecting greater barriers to participation for those on the outskirts of society (Munz and Germaine 2009).

“The digital divide in terms of communities that are undeserved by Internet access is a real concern as you get this segment of society that is pulling out and pulling ahead. It’s the most visible segment of society because they’re the ones that are plugged in to popular media: it becomes even easier to forget about the folks that aren’t plugged in to that...If we expect to have a wired society we can’t have a big chunk of society that doesn’t have the wires.” (Munz 2009 47:00)

A major advantage of COINs for sustainability is the diversity, inclusivity, and involvement they afford, however our research showed that today web-based networks can suffer from balkanization where similar groups only network with each other. This can be a challenge to COINs working strategically as they lose diversity of perspectives and background (MingLi 2009).

Benefits of COINs for sustainability. Despite the resource intensive nature of COIN technology, COINs can aid dematerialization. They support distributed working which reduces fossil fuel consumption, a point brought up by almost all our interview respondents (Gloor 2009; Keen 2009). Beyond this obvious benefit, COINs bring us together in new and interesting ways. These new pattern of organisation effect our consumption and distribution in ways that show promise to reduce our ecological footprint, but are yet unexplored (Harwood 2009; Brown 2009). The biggest contribution to reduced resource consumption from COINs so far, however, has been through COINs innovating towards greater resource efficiency; to this end COINs have been very successful (Munz and Germaine 2009, Gloor 2006).

Perhaps the greatest contribution of COINs towards sustainability today is the democratizing social benefits of COIN working, a point that came across throughout our entire research process. Dominic Campbell (2009) of the Enabled by Design COIN pointed to how much more inclusive, natural and inviting this organizational structure can be. All COINs showed greater

involvement and cooperation compared with other working models, and it was clear that the openness and transparency facilitated by COIN working added tremendous value. One key to inclusivity and involvement is how COINs support communicating asynchronously, allowing greater flexibility in how individuals participate (Klein 2009). These findings highlight COINs' ability to support a social structure following sustainable processes of relating.

3.3 Barriers to successful COIN usage

“The biggest challenge to harnessing the collective intelligence of the world to help solve some of the very serious problems we have around sustainability....has to do with people knowing not only how to use the software, but ideas around critical thinking and collaboration.” (Rheingold 2009)

Our results so far indicate COINs have potential to contribute to a societal move towards sustainability, however there are various barriers that have and could in the future prevent this from happening. In order to understand existing barriers to individuals utilizing web-enabled collaborative networks for sustainability, our group participated in social action research as a COIN, surveyed members of our audience to discern their barriers, and discussed these with our experts in the interview process. Overwhelmingly our data emphasized sociological, psychological and cultural barriers, largely dismissing concerns about technology (software and hardware incompatibilities), pointing out that technology is advancing rapidly with user interfaces becoming simpler and more familiar. This was confirmed through our survey where respondents indicated that while they encountered technical difficulties when collaborating on-line, they did not view these as large or insurmountable barriers (for full survey results see Appendix B).

3.3.1 The Digital Divide

One of the greatest barriers to COINs for sustainability is the digital divide, as pointed out by all our interview respondents. As part of this phenomena The Collaboration Project encountered another element of the digital divide within the segment of the worlds population that *does* have access to the Internet, that of digital immigrants vs. digital natives. Digital natives (those who have been using computers on-line almost as long as they can

remember) use technology differently than digital immigrants. Reconciling the needs of digital immigrants with digital natives is complex and a barrier to successful COIN working (Munz and Germaine 2009).

Within our social action research we found it difficult to generalize digital immigrants and digital natives by age group, adding a complication as to how we anticipate and confront this digital barrier. Many of our co-collaborators were outside of the 'net generation' yet were quite comfortable with digital technologies. This was evidenced again in the survey results. Despite the variety of ages and nationalities, most of this group was very comfortable and experienced with the basic technologies driving collaborative innovation networks (e-mail, Skype, chats, web-sites, Google docs, blogs).

3.3.2 Intellectual Property Concerns

Our data uncovered a variety of barriers around Intellectual Property (IP):

- The legal constructs for collaborative, web-based working just do not exist. Most laws were created prior to this technology. People are operating outside of the law and hoping for the best (Munz and Germaine 2009; Moore 2009).
- Intellectual Property laws are biased towards large organizations with large amounts of capital, making it difficult for new innovation models to compete (Harwood 2009).
- IP laws are possessive, allowing the owner or inventor far too much control, stifling competition, and often killing needed innovations towards sustainability (Sawyer 2009; Gloor 2009).
- IP does not appropriately account for inter-cultural working, a reality not only brought out by interview respondents but our experience as an inter-cultural COIN as well. Where eastern cultures have a hard time conceptualizing and working with western definitions of commons, laws, and IP, western cultures have a difficult time conceptualizing the eastern culture of sharing (Bollier 2009; Ramchand 2009).
- The terms and conditions for many web-based collaborative projects are so confusing and unclear that people are afraid of how their IP will be used (Thorpe 2009; Gloor 2009).

3.3.3 Technological Barriers

“It’s very hard to separate culture and technology and ones own approach to how one uses a program because at the end of the day technology is integration, humans make of it what they will.” (Applegate 2009)

Status-Quo Bias. Our main methodology for uncovering technological barriers was surveys. Around one in ten respondents complained about the lack of ‘real communication’ and the feeling that emotions could be hard to convey, especially when working with only typed words and no voice or video. This implies that typing to communicate constitutes a technological barrier. Respondents also indicated frustrations encountered with hardware and software due to slow loading and formatting problems, particularly with one of the more popular collaborative tool Google documents. It is debatable as to whether these represent human or technological problems. The majority of our respondents concluded that the problem was ultimately user driven and that the technical problems would sooner or later be solved.

Dan Munz with the Collaboration Project pointed us towards a ‘status-quo bias.’ He observes that the complaints over 2.0 collaborative tools are not an accurate reflection of the technology’s usability as compared to our use of older tools like Windows and Microsoft office. All these tools have bugs, we are just more used to dealing with the older technology and the problems those present. That said, not all the technological barriers uncovered in our research relate to this status-quo-bias or human interpretation of technologies. Below we present technological barriers that emerged.

Systemic Security and Privacy Concerns. When sharing information and storing data on the web there are complications regarding security, confidentiality and identity (Thorpe 2009). These provide a barrier to people contributing information to a web-based collaboration as well as the sustainable, secure operation of a COIN. To deal with this insecurity, there are emerging technologies addressed in section 3.4.5. We experienced one such lack of security with our own COIN when Google’s mail server, Gmail, which we all used was not working for a few hours. Many people use Google Gears, a SaaS application to back-up all web data, however those who did not were unable to work. This reflects a large barrier to this type of working. The technological systems that support web-enabled collaboration are still a mystery to most of us and we are unaware of how

we are vulnerable to attack and weakness. This was a big learning of our social action COIN: most do not understand the system, which is a dangerous way to operate.

Signal to Noise Ratio

“By far the most commonly used technologies, including wikis like Wikipedia, media sharing sites like Youtube, Facebook and Flickr, open source efforts such as Linux, Mozilla and Apache, idea markets such as Innocentive, and web forums such as digg and Slashdot, fall into the sharing category. While such tools have been remarkably successful at enabling a global explosion of idea and knowledge sharing, they face serious shortcomings from the standpoint of enabling large-scale deliberation around complex and controversial topics (Klein 2007)”

The more people you get involved in a collaboration and the more complex an issue the more ‘noise’ (irrelevant information including tangential conversation) you get and less ‘signal’ (relevant, useful information). For example web-forums and e-mail lists tend to generate a lot of noise, without much signal, erecting a barrier to successful collaboration (Applegate 2009). It can be very difficult to design technology that draws out 'signal' from 'noise' (Klein 2009). Right now we do not have sufficient aggregation and folksonomy tools, either human or computer driven, to deal with the information on the web intelligently (Thorpe 2009).

Slow, clunky, badly designed technology. Much of the technology driving COINs is not designed with people in mind, leading it to seem as though we must rewire our brains to work within the systems of the technology (Campbell 2009; Harwood 2009). Accessibility of most web sites is very poor and sites are not designed for people with various disabilities, erecting a large barrier to the participation of many (Thorpe 2009).

Lack of transferable data, information, software; compatibility. In our COIN we had Macs, pc’s, English based operating systems and Chinese based operating systems, Microsoft word users and Open Office users. We found there are still glitches transferring between all these different systems. Lack of portability and transferability between proprietary systems remains a barrier.

With all these technological barriers, perhaps the largest barrier technology provides is as a distraction to our personal attention in the collaboration.

We cannot collaborate if we cannot listen and so much of this technology serves as a distraction. In general being an on-line citizen is time consuming, and sometimes painful in the face of the 'noise' overload. Pure exhaustion at the pain of being an on-line citizen can be a large barrier (Campbell 2009; Brown 2009).

3.3.4 External Cultural Barriers

There are various cultural wide tendencies and conditions that provide barriers to the successful functioning of COINs towards sustainability.

Complications with networked models of working. Many of these cultural barriers stem from difficulties working in networked structures:

- Older generations are much more comfortable with hierarchies, and often resist the flattening effect of COINs on their organization's hierarchy (Munz and Germaine 2009; Rheingold 2009).
- There is currently a culture of risk-aversion, of doing nothing without permission, and of not trying something new for fear of being wrong. This is antithetical to the work needed in collaborative networks (Munz and Germaine 2009).
- COINs interacting with the current power structures of our world, those dominant corporations and organizations often solicited for funding, have found difficulties communicating and reconciling their chaotic working style with the mainstream hierarchical models (Gloor 2009; Campbell 2009).
- It can be difficult to secure funding for collaborative web-based networks, as the return on investment is often different than those of traditional institutional endeavours (Munz and Germaine 2009).
- We are accustomed to hierarchical structures where responsibility is delegated with clear responsibility and fault rather than taking responsibility on an individual level, tending to pour reward and blame on 'heroic' leaders. This prevents individuals taking the responsibility necessitated for a shared risk shared reward culture of COINs (Moore 2009).

Culture of Competition and Fear. Western culture teaches the advantages of getting ahead as individuals by hoarding knowledge and being secretive in our working (Wyne 2009). This mindset of fear and possessiveness is destructive to collaborations (Munz and Germaine 2009). Sharing information on-line in transparent ways is still a psychological barrier,

particularly for digital immigrants who are yet to grasp the advantages of sharing (Campbell 2009). In much the same way, many organizations working towards identical visions do not want to collaborate (Wyne 2009).

Poor education and value systems. Most initial web-based collaborative projects had their roots in the values of Silicon Valley: a very liberal, hippy and egalitarian yet entrepreneurial value system. As we see this organizational working model spread into society at large with different value systems, we become more susceptible to phenomena such as on-line lynch mobs and fraud (Applegate 2009). If people do not have a strong sense of values and moral code when using the Internet, there is danger that this technology makes us more susceptible to fraudulent models of leadership and fake identities (Keen 2009). This lack of trust in the values of people using the Internet provides a barrier.

Finally if we do not educate the world in good critical thinking skills, the Internet will devolve into a cacophony (Rheingold 2009). It is not enough just to open up sustainability challenges to on-line deliberation; we need educated citizenship around these challenges (Klein 2009).

3.3.5 Barriers Internal to COINs

Beyond the technological and cultural barriers that exist throughout society at large, our results indicated various barriers to COINs being utilized successfully towards sustainability with regards to a COINs internal operation and organizational structure.

Organizational Constraints. At a basic level COINs need the right mix of participants. Composition problems include diversity, expertise, competence, and numbers (MingLi 2009). Even if that mix is attained, organizations can struggle to manage collaborations as they can be expensive and time-consuming. Lack of basic resources to support and maintain a web-enabled collaborative project is actually a common barrier, as people do not realize how difficult it is (Munz and Germaine 2009). It is also complicated to schedule your organizational work when people are collaborating from across time zones, a common barrier that can slow down and create roadblocks when not intelligently anticipated (Husband 2009; Brown 2009).

Trust. It can be difficult to establish trust in on-line communications, especially at the beginning of the collaboration (Keen 2009; Gloor 2009; Moore 2009; Harwood 2009). A lack of transparency and the feeling that work is happening behind closed doors is one of the fastest ways to erode trust (Gloor 2008), so additionally being ‘closed’ is a barrier.

Dysfunctional Argumentation. Most respondents alluded to the difficulties and frustrations that go along with dysfunctional argumentation, a phenomenon often referred to as ‘flame-wars.’ Dysfunctional argumentation emerges when differing ideas brought together in the collaboration degenerate into un-productive fighting. This fighting is quite often tangential, and monopolizes the communication space, disrupting the entire collaboration. Many wiki pages (each page a COIN) have been turned off due to flame-wars emerging between participants of the collaboration. Dysfunctional argumentation is one of the largest barriers of current collaborative sharing communities (Wainfan 2005).

Communication. There are many internal barriers posed through difficulties in communicating:

- It is more difficult to communicate on-line as we lose non-verbal cues and a sense of presence. Emoticons and video conferencing technologies (Skype, Telepresence) are helping to overcome this barrier, but communication is still less effective without face-to-face presence (Gloor 2009; Moore 2009; Brown 2009).
- Chris Thorpe points out that most collaborations being in English is a barrier to global participation (Thorpe 2009).
- Being overly verbose can erect barriers to participation as it is difficult to keep up with and understand the content of the collaboration (Applegate 2009; COIN reflections).
- Most collaborative platforms adopt their own syntax, tone, style that can be difficult for outsiders to understand, providing a barrier to entry (Applegate 2009). For example outsiders could be confused by the use of acronyms or abbreviations ('r' for 'are', 'ttyl' for 'talk to you later').

Barriers within diverse, cross-cultural groups. While diversity is among the great benefits of collaborative working, the presence of diverse perspectives (culturally, linguistically, academically, professionally) can lead to greater conflict and tension (Gloor 2009; Harwood 2009). Peter Gloor points out that often this is because we have such different ways of communicating in different communities and cultures that we simply do not know the

meaning of cues, words, or signals that seem common place to others. Within our own COIN we encountered miscommunications where we had different understandings of the same phrase. There are a variety of ways to speak the English language, and the subtle differences can cause mix-ups.

Control and Possessiveness. For a collaboration to be successful, its participants need to let go of some control. Having a sense of singular ownership where ones individual contribution is thought of as final is very destructive to collaborative innovation, as in a true collaboration nothing is solely yours. Chris Applegate (2009) as a Wikipedia administrator saw this possessiveness time and time again as a large barrier to successful collaboration on Wikipedia. Possessiveness and ego are particularly destructive from leaders (Gloor 2009). Poorly structured governance that does not allow for self-organization, or is too hierarchical and controlling, can easily kill collaborations (Gloor 2006).

Vision. Vision came up as one of the most important tenants for a successful collaboration, with an overall sentiment that vision is everything. So a complicated, uninspiring, overly general, unattainable, or just plain boring vision are all barriers to successful collaborations (Wyne 2009; Campbell 2009; Harwood 2009; Gloor 2009; Thorpe 2009; Brown 2009).

Lack of Motivation. Ultimately all these barriers contribute to a lack of motivation. If people are not motivated, in a true collaborative innovation network, they will just walk away (Brown 2009). According to all our research as a COIN poor communication, vision, leadership, trust and technology are all de-motivating factors.

When considering motivations for COINs the value participants seek is often beyond simple financial rewards. COINs must consider motivation and rewards in a different way, something Mark Klein calls the value exchange. The largest de-motivation is when this value exchange is not realized. People need to get out of the collaboration what they were expecting, or at least see a clear possibility of this reward in the future (Klein 2009). Another factor effecting motivation of collaborators is the degree of risk that comes along with the reward involved. Roland Harwood (2009) points out that if collaborators do not operate under a shared risk shared reward model, they could quickly lose motivation.

3.4 Emerging Factors affecting COINs

When examining the baseline of COINs we uncovered a few emerging factors, what we consider as areas of knowledge that are new or evolving and critical to our understanding of how web-enabled collaborative innovation networks can be used strategically towards sustainability. While the primary method for uncovering emerging factors was the literature review, we also encountered these topics and areas of transition throughout our action research and interview process.

3.4.1 Open Source, Open Everything?

“A number of open initiatives are actively resisting the extension of intellectual property rights...open source software, open access to research and scholarship, and open science, share not only a commitment to the unrestricted exchange of information and ideas, but economic principles based on (1) the efficacy of free software and research; (2) the reputation-building afforded by public access and patronage; and, (3) the emergence of a free-or-subscribe access model.” (Willinsky 2005, 1)

A predominant trend and debate raging throughout communities of people interested in collaborative-innovation is the movement towards ‘open.’ According to the Open Knowledge Foundation, “A piece of knowledge is open if you are free to use, reuse, and redistribute it” (Open Knowledge Foundation 2009). This movement began with the success of open-source innovation in the software world where developers harnessed the power of millions to create new software (Bollier 2008), but “open” now is being considered in a variety of fields and industries.

The fundamental notion underlying this move towards open is organizations recognizing that there are better ideas, greater knowledge more intelligence outside their walls than inside (Leadbeater 2009; Ramchand 2009; Chesbrough 2003; Munz and Germaine 2009). This is largely because the Internet and the spread of open science and education have brought education and innovation to the masses; science has benefited greatly from this development (Chesbrough 2003; Bollier 2008). To many, this free sharing of academic and scientific knowledge is a huge advancement for the well-being of human society and a major success of the open Internet (Klein 2009; Bollier 2009).

Interview respondents pointed out that this need to 'open up' and 'look outwards' is more than a competitive strategy; rather it represents a fundamental shift brought on by the Internet. Likened to Entropy (everything spreads) a core tenant of the Internet is a tendency towards openness. Rather than struggle against this powerful current, it is essential to embrace this and move towards open-everything fuelled by sharing, transparency, and honesty. However there is not consensus as to the value of open knowledge, innovation and everything to our world. In fact Dominic Campbell of Enabled by Design sees a dogmatic fervour in the open everything movement. While he believes it is important, he also reminds us not to fall into 'being open for the sake of being open' and to keep our eyes on the target: innovating more effectively and building a more democratic, sustainable society (Campbell 2009).

The general consensus from our field research and Interviews was that openness has offered our society tremendous benefit, and “radically new and powerful possibilities that we didn’t have ten or twenty years ago” (Klein 2009). However there is still a lot of hype and confusion as to *when* and *how* it is beneficial. How open is too open? In what direction will this new openness lead our society? We’re seeing many organizations struggling to understand how to incorporate open into their way of working, and what value it could bring. This uncertainty greatly affects the functioning of COINs.

3.4.2 Intellectual Property

"What we have is a system of law around copyright that made sense for the technology of 100 years ago...The existing system defects are so huge...its almost unenforceable...technology has trumped the law in effect." (Moore, 2009, 17:60)

The future of open-source, open science, open innovation, and open in general is constrained by our current Intellectual Property (IP) Regime. Overly controlling IP has proved restrictive on our ability to collaboratively innovate, often to the detriment of society at large (Sawyer 2009; Klein 2009; Moore 2009; Harwood 2009; Gloor 2009). Consequentially there is growing discussion and movement towards a virtual commons. In the virtual commons, knowledge and information on the Internet is part of a pool of knowledge that is managed for the public good. Knowledge managed in this way is known as free knowledge for the commons, a

categorization beyond simply ‘open.’ ‘Free’ does not imply it is always available without cost and does not preclude monetization, but rather implies that a product is made by the commons, for the commons (Bollier 2008).

New ways and degrees of classifying intellectual property have emerged as a result, with Creative Commons licenses being the most popular (Bollier 2008). There are currently over 18 distinct Creative Commons licenses, and a host of other commons licenses (from Free Software Foundation and European Art Libre License) being chosen all over the Internet today (Bollier 2008, 203). No one knows which intellectual property regime will dominate, and all our respondents pointed out that currently there is no 'cure all' solution. The reality is we are in the midst of a phase change. The Creative Commons is easing the transition by opening doors in terms of the ways people can share their IP, however for many this is not quite the answer (Campbell 2009). Its constructs are yet to be challenged in court, and many are not convinced of its merits. What comes next for IP management is yet to be seen.

3.4.3 The Networked Knowledge Economy

“The change brought about by the networked information environment is deep. It is structural. It goes to the very foundations of how liberal markets and liberal democracies have co-evolved for almost two centuries.”
(Benkler 2006, 1)

Through all these new opportunities to collaborate and innovate together over networks, the need for classic institutional structures has been thrown into question, affecting our entire economic landscape (Shirkey 2008). This has brought about "new models of production based on community, collaboration, and self-organization rather than on hierarchy and control" (Tapscott 2006). New collaborative initiatives, such as the free-software projects and Wikipedia, where mass collaborative efforts are extraordinarily successful and based on little besides volunteer energy, have no economic precedent and according to our current economic narrative are completely ‘non-sensical’ (Applegate 2009; Benkler 2006; Leadbeater 2009; Masum and Tovey 2006; Bollier 2008). Many believe it is too early to predict the implications for our economic order of these new, web-enabled collaborative efforts with motivations that disprove classic economic theories (Bollier 2008; Sawyer 2009). However as Yochai Benkler points

out, it would be dangerous and unwise to write these instances off as fads, sub-culture, or a curious phenomenon. Rather they represent “a new mode of production emerging in the middle of the most advanced economies in the world” (Benkler 2006, 6): a new networked knowledge economy.

Yochai Benkler has defined this economy in his seminal work 'the Wealth of Networks' as an economy driven by 'peer-production.' As developed economies become more knowledge driven, and communication technology becomes cheaper and more ubiquitous, we are witnessing a new economic landscape where decentralized cooperative and coordinated efforts independent of proprietary strategies have greater influence and power within our society (Benkler 2006). If this transition towards peer-production continues, the opportunities for COIN working will be even greater in the future than they are today.

Democratization and Liberalization of Economic Structures. Benkler is not alone in his observation of the Internet's transformational affect on our systems of organizing. To many, web-based collaboration represents a transition to a liberating way of life with far greater opportunities for democracy (Benkler 2006, Leadbeater 2009, Tovey 2008). As Benkler points out, “This new freedom holds great practical promise: as a dimension of individual freedom; as a platform for better democratic participation; as a medium to foster a more critical and self-reflective culture” (Benkler 2006, 2).

One of the great uncertainties is how our economy will respond to this spread of opportunity and democratization. Charles Leadbeater, along with most of our interviewees, believes this will lead to an environment where 'we are what we share' (Leadbeater 2009); a move away from the traditional mentality of 'we are what we know'. However there are many institutions that thrived in the old economic order, so there is a tremendous amount of institutional and cultural resistance to the new networked knowledge economy. There is no guarantee that this new economic order will realize its democratizing and liberalizing potential (Benkler 2006).

Networked Business Models. A few different businesses are successfully exploiting the opportunities of the networked knowledge economy, however most of our interviewees were unsure as to how the effects of the networked information environment would ripple out to other industries beyond software, especially with the ongoing demise of so many industries, most notably journalism and the music industry (Applegate 2009, Shirkey 2008).

“No one knows the rules for the new economy business modes. But as a basic principle it’s about adding value to things that people do and need to do.” - Jon Husband 2009

Jon Husband thinks Kevin Kelly has the best answer with his 'new rules for a new economy' (Husband 2009). Kelly predicts that in an economic world defined by networks, or where our networked nature is truly realized, companies will have their current structures so stretched they will become pure networks themselves. They will have to operate distributed, decentralized, collaboratively, and adaptively (Kelly 1994). However many industries are resisting; both the newspaper and music industry are looking to tighten control, regulate the flow of information, and utilize legal systems to maintain dominance in the new economy without decentralizing or bowing to the ability to collaborate. Whichever permutation it takes, the new foundations for the networked knowledge economy will have huge implications for our ability to operate successfully as COINs.

3.4.4 Web-enabled tribalism

“We’re so used in the 20th century, in the age of globalization and mass media of being told what to think by organisations... What’s happening now is it’s reverting to a slightly more democratic, user-centric society. It’s starting to become in everyone’s hands” (Thorpe 2009. 40:20).

An exciting side effect of new social computing and social media tools that drive COINs and the networked knowledge economy is how they allow us to connect to each other in ways never before possible (Husband 2005). For the first time citizens and users outside of organizations are bypassing traditional structures in their innovation, communication and collaboration capabilities, building networks and groups independent of organizations at an unprecedented rate (Ramchand 2009; Munz and Germaine 2009; Shirkey 2008). To many of our interview participants, this new ability has revealed who we really are as humans, how interconnected we are and the true role of networks in our success and existence (Brown 2009).

“We are a ‘we’ species, labouring under the illusion of ‘I.’” (Earls 2003, 313)

What all this indicates (social media, mass-collaborations, COINs, networked knowledge economy) is that our motivations are not what they were once perceived to be. Many are theorizing that in reality we are far more tribal than has been researched or discussed in western academic

traditions over the last few hundred years (Godin 2008; Earls 2003). If this is true, then COINs are working with a herd species, and we thus must move away from our western traditional stories of individualism when engaging collaborators. This is still such a new way to consider motivation. Social science, marketers, and academia in general are yet to grasp the full implications for how we work together to find our tribes.

3.4.5 Emerging Technology

The technology driving web-enabled collaboration networks is young and rapidly evolving, with many developing areas affecting the strategic opportunity of COINs.

Identity. In order to participate in most web-based collaborations, you must sign in and provide personal information, a process that creates a variety of barriers (section 3.3.5). For that reason many people are pushing for Open IDs, a way to make just one, secure portable ID that follow us everywhere on the Internet. To Chris Thorpe, this could have a dramatic effect on our ability to participate and engage more people for sustainability on-line (Thorpe 2009).

Hardware. The growing use of mobile technology for cheap, wireless Internet access without broadband is closing the digital divide (Rheingold 2009). Some believe that if this trend in mobile technology continues the whole world will be wired very shortly. There remains no guarantee that the 78% of people without Internet access will all gain access to this technology, but this is the frontline of the battle for inclusive, diverse COINs. As the hardware becomes cheaper and more portable, and the software more compatible, our opportunities to truly collaborate across the globe increase (Thorpe 2009).

Cloud Computing. Many believe that cloud computing, if it lives up to its potential future, could revolutionize the way we share, work and participate on-line. The essence of cloud computing is portability, the ability to access your data and information from anywhere at any time. This relates to the concept of Software as a Service (SaaS), a “new model for accessing application or processing capabilities: applications that live on the Internet, are accessible from anywhere, and scale easily to meet the needs of a diverse workforce” (Collaboration Project 2009, 10). Perhaps the best known example of this is Google documents and other popular Google applications. Vivek Kundra, an IT guru revolutionizing the U.S.

governments use of information technology, reports “a 90 percent increase in speed to deployment, along with an 80 percent drop in costs through not having infrastructure to manage” (Collaboration Project 2009, 11) by switching to cloud computing and SaaS applications. If cloud computing lives up to its potential, it could eliminate the need for vast and wasteful servers for many organizations, as they could store information on the 'cloud' and would be able to access it from any machine. In this way, cloud computing offers the opportunity to dramatically reduce the ecological footprint of computing. However there is still uncertainty as to the security of utilizing cloud computing and SaaS. Once all the contents of your computer are stored with on-line servers, is that content secure and safe?

The Naturalization of Technology. The humanization of technology has huge implications for our ability to collaborate using COINs, as currently there are still many physical barriers to using the technology. Where the introduction of the 'mouse' and 'bluetooth technology' vastly naturalized the use of computers and cell phones in the past, Mingli (2009) sees this trend continuing, and believes that in the end human beings and computers will be tied together seamlessly. Some of the most exciting steps towards humanization were recently demonstrated by Pattie Maes and Pranav Mistry when they presented a computer you wear on your person as an accessory that can then be used to project information onto any surface, and interacts with the movement of your fingers (Maes 2009). This demonstration allowed a glimpse into the unknown future of technology, and into what Chris Thorpe sees as an increase in user-centric design that will hopefully make all of our experience with this technology far more human (Thorpe 2009).

“An intelligent group, especially when confronted with cognition problems, does not ask its members to modify their positions in order to reach a decision everyone can be happy with. Instead it figures out how to use mechanisms - like market prices, or intelligent voting systems - to aggregate and produce collective judgements that represent not what any one person in a group thinks, but rather in some sense, what they all think.”
(Surowiecki 2005, XIX)

Collective Intelligence. Many hold high hopes for emerging technologies that better harness collective intelligence, catapulting our ability as COINs to move towards sustainability. Mark Klein and his colleagues at the MIT Centre for Collective Intelligence are working hard to “develop a new class

of web-mediated technology that transcends the limitations of existing deliberation-support systems” (Klein 2007) and has made great strides with the Deliberatorium, a tool that supports web-based argumentation towards productivity rather than dysfunction, noise, and flame wars (injurious online text based arguments).

While we wait to see what the next collective intelligence tool could look like, some are researching and lending their hope to the future of the Semantic Web (an intelligent, thinking web), especially in advancing scientific collective wisdom (Bollier 2009). Stephen Wolfram is in the process of creating a search engine that can work with human language (Wolfram 2009). He has invented a symbolic language (Mathematica) that can represent anything and has the algorithmic power to do any kind of computation, supporting the definitive future of the web that Tim Berners-Lee, the creator of the web himself, is working towards:

“I have a dream for the Web [in which computers] become capable of analyzing all the data on the Web – the content, links, and transactions between people and computers. A ‘Semantic Web’, which should make this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The ‘intelligent agents’ people have touted for ages will finally materialize.” – Tim Berners-Lee, 1999

3.5 Recommendations for using COINs

Understanding the role of COINs in a sustainable future, their baseline operation (including barriers and emerging factors affecting their use), we utilized the creative tension from backcasting to develop recommendations as to the best use of COINs towards sustainability. These recommendations were also informed by knowledge from experts gathered in the interview process and feedback from our social action research. When considering these suggestions it is important to understand that as discussed in section 1.1.3, web-based collaboration can cover a variety of ideas (see fig. 1.5). We tailored our suggestions around COINs, the heart of almost all mass-collaborative, collective intelligence efforts through the collaborative knowledge ecosystem (see fig. 1.7). These recommendations are for any sustainabilist interested in working as part of a COIN to make their work towards sustainability more successful and strategic.

3.5.1 How to use COINs Strategically

Use COINs to solve complex challenges. Collaborative working is time consuming and takes a tremendous amount of effort, particularly because we are not taught many of the skills necessary to work collaboratively (Rheingold 2009). For this reason it is not strategic to set up web-enabled collaborations for small tasks where a solution is already known. COINs are better employed where ‘out of the box’ innovative, new ways of thinking are sought.

Use COINs for increased efficiency. COIN working can be strategic towards reducing your carbon footprint and resource consumption if used thoughtfully. We recommend sustainablits use COINs for distributed working to reduce their carbon footprint and make work and living more natural, but strategically utilize travel and face-to-face time to build up trust- something that is needed more intensively early on in collaborations.

To ensure maximum resource efficiency in the technologies supporting COINs, use cloud computing and software as a service applications whenever possible to host the information and data at the heart of your COIN. This is far less resource intensive than hosting your data on more traditional organization-specific servers, as cloud computing used a load-sharing system that maximises the efficiency of the servers online (Thorpe 2009). However this is a new field so be sure to consider the security of the system when choosing the best way to host your information. And when choosing your hardware, remember the first three sustainability principles (fig. 1.1) and look into manufacturers that are recycling and keeping hazardous materials in a closed loop.

Choose Open-Source. As outlined in section 2.1, the great opportunities for COINs come in their ability to function as part of the networked knowledge economy, promoting diversity, involvement, transparency, inclusiveness, cooperation and openness. As revealed throughout the emerging factors, there is no guarantee that COINs and our organizational structures will have this effect. In order to utilize COINs strategically we recommend, whenever possible, that you chose to work as part of the commons. Use open-source platforms and software and utilize servers that promote openness, involvement and transparency. However you cannot be open to the detriment of financial sustainability. You must consider return on investment of this working, but when possible chose to share, chose to be

open. Our research demonstrated that this decision often pays back (Moore 2009, Brown 2009).

Support Diversity. The greatest strategic benefit of COINs is their ability to support diversity, bringing in insights from more people thinking in different ways, all of whom have a large stake in our sustainability challenges. However research revealed the many barriers to working in diverse groups (section 3.3.5). In order to overcome these your COIN needs to acknowledge, discuss, and truly believe in the value of that diversity. Seek out gatekeepers (people who are comfortable in multiple cultures, working styles and academic fields, wherever your diversity lies) to help mediate those differences and aid the communication within a diverse COIN (Gloor 2006). When selecting your technology, make it as simple and accessible as possible to allow for a diverse crowd of users (Thorpe 2009).

Use known frameworks. It is important to follow the guidelines outlined by Peter Gloor for successful COINs. This framework calls for a strong unifying vision, clear transparent communication, and a firm ethical code allowing for trust within your group of collaborative innovators (Gloor 2006). Our personal experience through social action research and discussion with experts made it clear that these three elements are indispensable. In order to ensure that your COINs vision is strategic towards sustainability and all participants have a shared language for sustainability to communicate around, we recommend COINs for sustainability utilize the FSSD to help understand what sustainability and success means for their COIN and society.

Finally COINs will not promote openness, involvement, transparency, cooperation, or inclusiveness if they are used incorrectly. Below we continue with recommendations on how to use COINs effectively, in order to ensure they can be used strategically towards sustainability.

3.5.2 How to use COINs Successfully

This is a new field that is rapidly emerging, so the bulk of this advice is living and improving itself on-line. You will find the latest advances in this research at <http://www.collaborationninja.com>. We published our initial findings, the draft of a how-to guide, on a weblog at the end of March 2009, allowing two weeks for feedback from the participants of our COIN and the people we interviewed. After this initial period we incorporated feedback,

and the COIN worked together to rebuild the site and transfer information over to a more permanent location. At the time of publishing, this transfer was still in process. The overarching goal of this resource guide and site is to help us all understand how to be ninjas at collaboration. Why Ninjas you ask?

In Japanese history the Ninja (忍者) is a warrior; one whose skills and dedication, so it is said, could not be matched by normal men. The Ninja must study, practice and teach the many arts of war; stealth and life on the path to ultimate skill. Along the way, earning both respect and legend — both powerful tools in their quest for victory.

Like the Ninja, we too are warriors - but of the digital age. Using our combined skills, we strive to stand out and overcome the many barriers to a better world. Join us on the path, pass on the skills you already have; study and gain new ones along the way. Together we too will taste victory as we change the world — who knows, we may even see legend.

Figure 3.1 Ninja Legend Courtesy PG, Collaboration Ninja COIN member, UK

The recommendations in this guide follow the timeline and logical ordering sustainablists would follow when deciding to set up a collaborative innovation network for sustainability.

- **When to collaborate.** Know when to collaborate, or not (logic of going down this route).
- **Perfect Invitation.** How to engage the right crowd to participate in a collaboration (vision, rewards / motivations, value-exchange).
- **Collaborator experience design.** Design a compelling experience for the participants of the collaboration (web tools, culture, governance, legal).
- **Lead by example.** Be a great collaborator yourself (spontaneity, listening, story-telling, letting go).

These results are synthesized below.

When to collaborate. The most important point to consider is whether or not the people you need to collaborate with are on-line. If so it seems that having a well-structured collaborative innovation network is almost always

beneficial in our efforts to innovate for sustainability. However there are a few reasons to be cautious: if you have reason to doubt the Internet literacy of your audience, their ability to critically think, or their ability to act individually. Also be cautious if the problem you are innovating around requires a high degree of implicit communication, as the web does not currently offer the presence needed to deal with complex emotional challenges. That is not to say it cannot play a role, just make sure the web-enabled collaboration is supported by face-to-face time to sort through any issues needing more presence.

How to motivate participation. The first step in motivation is to have a simple, clear, compelling and tangible vision. Multi-media can often help communicate that vision, especially if you are embarking on a collaboration that is solely web-based (Campbell 2009; Brown 2009). It is important to make it clear not only how you will work towards that vision, but how people will be rewarded for their work and participation. Mark Klein and the collaboration project discuss the value exchange: how will people realize value in exchange for their participation. Make sure that whatever value exchange you use it is clear and participants can see how they will receive value at some point, even if it is not immediate.

The complicated aspect of designing this value exchange is to know what motivates participation. Common motivations are trying to ‘be a hero’ or ‘find your tribe’ (desire to connect) (Klein 2009). A strong motivation is ego. Try and reward people’s egos by acknowledging them! Acknowledgement can go a long way towards motivating successful collaborations. Also consider games. People enjoy competition and solving problems and game type motivations can be wildly successful (Thorpe 2009; Massum and Tovey 2006). As collaborations offer a great opportunity to connect and find our tribe, often a large motivation is people seeking the enjoyment of connections. Make sure you leave room for that enjoyment.

Because the motivation for web-based collaboration is often more about vision, ego, finding your tribe or being a hero than it is about making money, it can be tricky to understand how to design financially for a collaboration; money can actually be de-motivating (Bollier 2009; Gloor 2009). At the least it is important to be clear about whether you are inviting people to an open collaboration (free to participate but privately controlled and owned), or a free project (control and ownership is part of an

established commons) (Bollier 2009). Which design is appropriate depends on your innovation goal, so it is impossible to say a project should always be established under a commons structure. If it is a free project, do not forget a general rule of thumb: “That which is created in the commons must stay in the commons, unless the commons decides that certain things are acceptable for being privately appropriated” (Bollier 2009).

A few other recommendations for dealing with monetization include the following. Consider the tenet of ‘shared risk=shared reward’ when deciding how to design financial rewards (Harwood 2009). Concentrate on creating value for the stakeholders (i.e. all members of your COIN) rather than on making money, as research reveals this is the best way to ensure success (Gloor 2007). And perhaps most importantly, be transparent about all motivations for designing a COIN and all potential rewards, as nothing will de-motivate participation faster than a fear of being taken advantage of. This is easily mitigated by transparency, honesty and openness.

Once a vision is established and you have motivated participation, the question becomes how should we structure the collaboration? What governance is needed, what web tools to use, and what legal structures are among the primary considerations.

Governance. It is important for a successful COIN to be self-organizing, however that does not mean total chaos and anarchy. Along the spectrum of possible governance (from command and control at one end to anarchy at the other) we recommend you aim for more decentralized structures, as collaboration research reveals decentralization is an important facet in empowering participation (Gloor 2009; Sawyer 2009). As opposed to traditional hierarchies, it is useful to consider wirearchies: "a dynamic two-way flow of power and authority based on information, knowledge, trust and credibility, enabled by interconnected people and technology" (Husband 2005). In a wirearchy, our structures are our agreements. State up front what you are expecting, what roles, risks, and responsibilities everyone will take. Those agreements become your structure and people are accountable to those agreements.

In reality most of the successful web scale collaborative efforts to date have exhibited hybrid governance models with balances of anarchy, democracy, consensus, meritocracy, aristocracy and monarchy (Applegate 2009; Harwood 2009). These hybridizations should emerge through self-

organization when and if your collaboration grows beyond the smaller driving force of a COIN. This evolution will likely come through social capital, where the leaders with more ‘power’ are those who have earned more standing in the collaborative community (Applegate 2009). To support an environment with healthy social capital it is important to have accountability and integrity in the structure of your agreements.

In order to facilitate this self-governance you also must engage people of all different levels in the design of the collaboration and empower different levels of users. If all someone does is correct a spelling mistake that is beneficial. Make room for those small contributions, as well as space for idleness, randomness, creativity and risk to allow for true self-organization, while never forgetting the structures of your agreements. But how do randomness, idleness and creativity emerge over the web when we are no longer collaborating face-to-face? What is that creative space? Used correctly there are a multitude of web tools available to help hold that creative space. Twitter has been described as the water cooler of on-line collaborations, where there is space for random conversations and insights (Moore 2009; Campbell 2009; Applegate 2009). Below we will explore more of what to consider when choosing web tools for collaboration.

Choose the Right Web Tools for the Job. When it comes to picking the right tools for a collaboration it is difficult to provide overarching guidance as every collaboration is unique, and the tools needed are unique to the task and participants. However from speaking with experts and experienced web collaborators we’ve developed a list of questions to ask when picking your web-tools to help make an informed choice. These questions can be found at the Collaboration Ninjas site along with some guidelines to consider when selecting a tool.

In general it is important to consider the technical sophistication of your co-collaborators and play to that. There is no reason to use overly complicated tools or wikis if it will turn off or scare your co-collaborators. Engage people using the technology they are already comfortable with, and from there you can add in features or move to more complicated tools as a group. In short: Keep it Simple Stupid. It is also important to keep any web-based interface clean and clear, playing to how the brain works not the computer (Thorpe 2009). Consider accessibility for people with disabilities if you want an inclusive COIN. Perhaps most importantly, consider the signal to noise ratio. It is critical to find a tool that helps you cut through all the noisy

information and allows you to get at the signal. For some collaboration the signal is so strong that e-mail lists are sufficient. For others where there is greater noise, you need something more sophisticated to cut through the noise such as the Deliberatorium Mark Klein has developed.

Whatever tool (or likely tools) you decide on, do not let bugs in the machine put you off. Choosing open-source tools can help in dealing with bugs as they have a quick response to problems (Applegate 2009), but ultimately software will always be buggy, as it is not human so cannot do exactly what you want it to (Munz 2009).

Protect everyone and the idea legally. There is no cure all answer as to the best intellectual property regime for your collaboration. For tips in considering IP, please see the Collaboration Ninjas resource. As a rule of thumb we encourage everyone to err towards sharing more, not less as the more you share the more opportunities for creativity and collaboration emerge. When thinking of legal structures consider if the entire collaboration should exist under the same IP regime, or if it would be best for each participant to state their own level of control. While its simplest to have one regime for the whole collaboration, in larger collaborations allowing users the choice could motivate greater participation. A good compromise is to chose the most open creative commons license for the collaboration, and allow different participants to take on IP restrictions if they choose. One of the simplest legal constructs available is to open up all your ideas to the commons, just require attribution. New software and creative commons licenses can give people the piece of mind to participate - so feel out your stakeholders and chose the IP regime that will best ease their fears and encourage their participation.

Communication tips. Once your structure, IP and web tools are in place, it is worth considering how you maintain clear, motivating communication that helps build your community. It is important to use shared language that everyone understands. For example if you have many digital immigrants in your group, it is not a good idea to use abbreviations and common web-acronyms as this is not shared. In cross-cultural working this is even more difficult. We recommend communicating through stories, not processes, as stories represent more of a shared language (Gloor 2009).

It is also important to be clear and transparent in your communication, especially with distributed contributors who are often left behind when

communication is happening face-to-face. Record face-to-face meetings and share all communication transparently (Gloor 2009). Perhaps the best advice is to do whatever possible to pass along implicit communication. Use emoticons, as “;-)” goes a long way towards communicating sarcasm or playfulness that would otherwise be lost (Moore 2009, Gloor 2009). Use video conferencing and multi-media to harness more senses than a text box, and in the name of transparent communication, encourage everyone to use their full name and be open and honest about who they are (if dealing with on-line only collaborators). This allows for trusting, productive relationships, as does meeting face to face at the beginning of collaborations to establish trust and good communication patterns.

Be a leader for a collaborative community. The final piece of the puzzle is to understand good leadership to maintain a successful collaboration. Traditional ideas surrounding leaders as heroes and commanders do not fit with the networked organizational model and reality of COINs. Instead you should consider leadership more as facilitation. The best leaders bring people and resources together, facilitate the coming together of passions around a vision and simply exercise their natural influence within networks (Thorpe 2009; Brown 2009).

Both Mark Klein and Jon Husband articulate a new way to consider leadership for collaborative networks. Their advice (and ours) is to begin as the champion: champion the vision, the cause, the platform, build excitement and make connections. Then once that critical mass is reached you step back and simply make sure resources are channelled to the right place. Champion, and channel. Evangelize, then maintain. Some stages within a collaboration will require more control from leaders, the most important thing is that when you do need to exercise more control you are transparent and it is clearly desired and organized by the swarm (your collaborators). The most important role as a leader is to empower participation, so empower your participants by enabling them to operate with self-determination.

Leadership as facilitation encourages us to hold the space, allowing for creativity (Moore 2009; Brown 2009). Facilitation is an art form, on or offline. It can be helpful to draw on the wisdom of improv comedy where the rule of thumb is ‘yes and.’ Every conversation that is brought to the table is an invitation. Say yes to that invitation, and... (Moore 2009, Brown 2009). Ultimately the best way to encourage good participation is to lead by

example. As a participating leader, we have the responsibility to “set a tone that embraces diverse opinion...a practiced invitation to a way of being in the world” (Moore 2009) as well as the moral standards and values of the collaboration. A few guidelines for good participation include:

- Be nice! - Don't behave online as you wouldn't in the flesh.
- Communicate clearly, with stories and shared language.
- Do not be possessive as nothing has a better chance of killing a collaboration.
- Support explorative risk-taking and let go of control.
- Be aware of information overload; filter what comes to you.
- Be altruistic to support the 'swarm' – the collective interest of the stakeholders of your COIN (Gloor 2007).
- Be patient and understanding of different technical sophistications.
- Know-Thyself, admitting strengths and weaknesses. Only by truly understanding your own strengths, weaknesses and contributions can you support diversity and contribute effectively to a COIN.
- And remember: “Ego is like fire, it can be brilliant, illuminate, warm-up; it can also just destroy everything” (Applegate 2009).

4 Discussion

This discussion pulls together the results of our research and addresses their implications for the overarching research question: In what ways can collaborative innovation networks be part of a movement towards a sustainable society.

4.1 How can COINs move us towards sustainability?

One of the greatest insights from our research was an understanding of the uncertainty and complexity that drives the future of the Internet, and consequentially all web-enabled technology and collaborations. The more we experienced, talked and read about the potential of the collaborative web, the clearer it became that the web's future, along with its potential for collaboration, is still uncertain. As its vast power and communication technology transforms how we organize and work as a society, there is a silent battle to determine which institutions and power structures may survive the transition. In the midst of this transition it is hard to trust or understand the security of these new technologies and know if the future will be one of open-source democratization or just another new hegemonic power. By immersing ourselves in discussions about the potential of the collaborative web, we were entering into the trenches of a battle for the future of the Internet, although we still are not quite sure who was fighting.

After researching different philosophies surrounding the Internet, Charles Leadbeater identified 5 distinct camps ranging from those who predict our imminent demise at the hands of the Internet to those who believe it will be a liberating, democratizing force and the saviour of the human race. In order for COINs to reach their full potential, this thesis falls in the camp of those “who believe the net will be mainly good for us as a possibility of community and collaboration, commons-based, peer-to-peer production, which will establish non-market and non-hierarchical organisations. It is not opening a new state of capitalism and the market but laying the seeds for alternatives to both” (Leadbeater 2009, xxviii).

As a group born and raised as digital natives, we are likely biased to accept the realities of networked living, the compromises it could entail (greater

transparency, less privacy), and celebrate its opportunities. As we discuss how collaborative innovation networks can be used strategically towards sustainability, it is important to keep this uncertainty, and our position as researchers raised digital natives in mind. For the purposes of this discussion, our thesis is assuming that the future of the Internet will continue to have a democratizing effect, more people will gain access, Internet surfing will be allowed, unmonitored, and access unfettered. To ensure COINs are part of an Internet future that is democratizing and moving us towards sustainability, we recommend COIN participants, whenever possible, open up and contribute the findings of their collaborations to the digital commons, pick computer programs and tools developed for the commons, and work to keep access to the Internet open and un-fettered.

4.1.1 Strategic Opportunities of COINs

Reduced Resource Consumption. If COINs are used to their full potential with regards to providing a new, less wasteful, more effective and efficient way to organize around a service and vision, they can support a business, company or institution to reduce its resource consumption. The beginnings of this potential were witnessed in the U.S. Government. By simply switching to software as a service (SaaS) word-processing applications utilizing cloud computing, U.S. governmental agencies increased both worker and resource productivity (the Collaboration Project 2009).

This resource saving was achieved through a very small organizational change towards software that is more collaborative in its style, thus enhancing its portability, reducing time and resource waste in information storage and knowledge development. This is just the tip of the iceberg in terms of the potential for collaborative working technologies helping us to make working environments and knowledge processes more effective. The more focused our organizations become in providing a product or service, by working towards a vision of success as a COIN, the more able they are to focus on reducing their waste and redundancy, particularly if they adopt a strategic vision of sustainability. Sustainablists can ensure a COIN's vision is strategic towards reducing resource consumption and shifting towards sustainability by engaging with the FSSD - a framework that supports visions based on a principled, science-based definition of sustainability.

Almost 100% of our interview respondents also pointed to an obvious benefit of increased web-enabled working as part of virtual communities. COIN members do not have to travel as often, allowing for reduced resource consumption through decreased transportation. Not to say that COINs eliminate our need for face-to-face working, they simply give us greater flexibility to choose NOT to travel on a daily basis. Beyond that, there are some indications that the possibilities of distributed working styles enabled by the Internet could allow us to redesign entire industrial cities, making them more liveable and sustainable, reducing the resource consumption within the boundaries of cities themselves (Harrison et al 2008). However the rise in distributed models of working are so new, it is difficult to ascertain the full resource implications of this shift.

Perhaps the best way to reduce resource consumption through the use of COINs is using them to explore the challenge of dematerializing our society. A few have started to put this to test, as documented in section 3.1. However our research indicates that there is untapped greater potential to harvest COIN's innovative capacity towards a vision of decreased resource use. We could be using COINs to leverage our capacity as problem solvers by enabling people to achieve whilst constantly learning from, affecting and resonating with one another in terms of intellects and experience. COINs, if used for the transmission of sustainability knowledge, do not only save money, time or basic resources, but also make it possible for a problem to be put on a global platform for people from all around the world to come and learn, solve and learn to solve.

Self-organization, Diversity, Interdependence. One of the greatest roles of COINs towards sustainability is their ability to promote an organizational structure that is both self-organizing and diverse. Our interviews, experience and literature review revealed that self-organization and diversity are essential characteristics for successful COINs. In order to achieve swarm creativity (the output of a COIN) you must have the ability to act as an interconnected, intelligent group with diverse contributions that are self-organizing, building off each others ideas to create an emergent whole that is greater than each individual contribution. This was a critical learning for us as a group: to embrace our own diversity and recognize the importance of looking out and bringing in more diverse talents and ways of thinking to achieve our ambitious vision. That diversity could not realize its full potential without everyone stepping up and helping to co-create the organization, guiding the process in a way that works for each individual

involved. The glue that holds COINs together is not command and control, but a shared commitment to a vision. That glue holds greater potential than traditional hierarchy to support self-organization and diversity, those very basic characteristics our society needs in order to achieve systemic sustainability.

Sustainable Processes of Relating. Successful COINs provide an opportunity to support most of the strategic guidelines for organizational processes that underlie social sustainability. This is because by their nature COINs must be cooperative, transparent, open and involving in order to succeed. While COINs do not need to be inclusive, the more inclusive they are, the more diverse the knowledge they hold, consequentially the more successful they will be in harnessing the wisdom of their network. Below is a visualization of the organizational dynamic and boundaries of a COIN. COINs, working as part of larger ecosystems of knowledge sharing, operate with self-organization, diversity, vision, communication and trust. Because of this, members of the COIN relate to each other with transparency, openness, involvement, and cooperation.

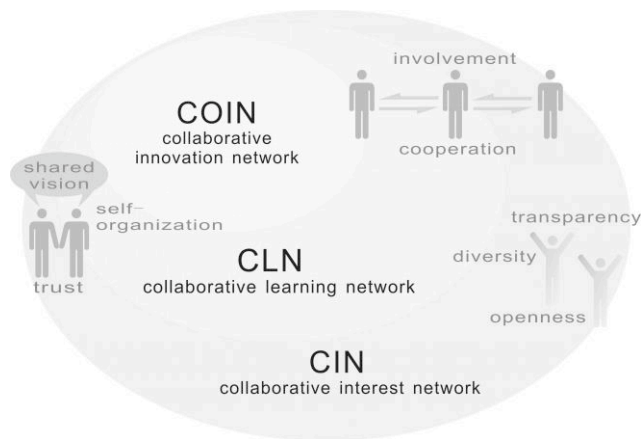


Figure 4.1 Strategic, Sustainable COINs. This image represents how shared vision, trust, and transparent communication are a centrifugal force holding together a self-organized, diverse system that operates with openness, involvement, cooperation and transparency, supporting strategic guidelines for a sustainable organizational and social system.

Bridging the ingenuity gap. One fact was undeniably clear throughout our research: collaborative innovation networks hold the greatest potential for disruptive innovation. Our society is in need of disruptive innovations if we

are going to achieve the dramatic re-organization necessary to live sustainably within the earth's limits. Today, because of the networked world, we have greater potential to collaborate together than ever before. If we can promote greater use of collaborative innovation networks, we have a chance of achieving the break-through innovation necessary for sustainability.

Almost all of our interview respondents pointed to COIN's capacity to bring new and different people to the table to solve problems as the greatest benefit of this way of working. As Albert Einstein famously said: "we can not solve problems using the same kind of thinking we used when we created them." With collaborative networks, we finally have the ability to bring new ways of thinking, diverse perspectives and people from different backgrounds outside the paradigm that created the problems to the table to innovate new solutions (Ramchand 2009). For the first time many of the people worst afflicted by our global challenges can be involved in innovating a solution. These are the type of collaborative innovation networks that visionaries such as Ali Wyne (Global Challenges Wikipedia), Mark Klein (the Deliberatorium) and others at the MIT Center for Collective Intelligence are working hard to establish (Wyne 2009; Klein 2009).

There is another less obvious benefit to this type of innovation: it is fun. As we network, meet and connect with different people to solve these challenges, many working using COINs have found the innovative process creative, fun and engaging (Massum and Tovey 2009; Applegate 2009; Campbell 2009). COINs have brought a life to some of these challenges, helped connect people in new ways, and granted us a productive organizational opportunity to have some fun and make a difference all at the same time.

Geoff Brown and others suspect all this 'fun' is because it is easier to find our tribe, others throughout the world who connect with our own sustainability concerns and that as humans we enjoy finding places we fit in (Brown 2009). Ali Wyne goes even further in ascribing the power of these networks to help us find others with similar concerns and work together on those challenges. He believes that the issue of global climate change is so complex, we could never have made it the well understood and talked about issue it is today, without the power of the Internet (Wyne 2009). Now Mark

Klein and others are working to set up systems to help us go the next step, working together to find greater solutions.

Beyond this enjoyment, perhaps the greatest opportunity to address our global sustainability challenges is via these networks providing for true ingenuity around decentralized solutions to centralized global problems. Globalization is a blessing to many as it allows us to see the truly complex nature of our world, however is also a beast in the way it has allowed a few people to impose their solutions on the masses. Of the many lessons of globalization, one of the most damning is the conundrum that all the great challenges we face are shared, yet our world is so diverse there is no one solution that will work in all the different corners of the globe.

Sustainability, this global-scale issue, cannot be resolved by globalization. A more natural way of working is emerging, that of working as an ecosystem of COINs towards a centralization shared vision, through local, regional and national decentralized solutions: one body, with many organs.

4.1.2 Sustainability Risks of COINs

Resource Use. As we mentioned, the future of the Internet is uncertain, in particular as we scale up our use of the Internet, just how many resources will it take to store all our information on-line? Servers that store information and data from the web are energy intensive, and every misappropriated website just sitting around is an awful waste of energy (Thorpe 2009). If we switch to cloud computing and Software as a Service model, we have a far better chance of finding a means of storing information on-line in an affordable way, as cloud computing and utilizing global data centres effectively distributes the energy load and dramatically cuts down on waste (Thorpe 2009; the Collaboration Project 2009). However with no clear solutions today due to security and server concerns, the heavy resource cost of storing information has led many to doubt our ability to achieve sustainability in a networked information environment (Odum and Odum 2001).

Additionally many doubt if providing every person a computer is possible in a sustainable future due to the resource costs of these machines (Moore 2009). Once again cloud computing and the move to wireless technologies provide a solution where whole communities can share more resource efficient hardware such as cell phones, but we still have a long way to go before information storage and the whole resource chain necessary for

utilizing networked collaboration is operating within sustainable limits. Cradle to cradle design (where products are designed to be completely reusable or biodegradable), as well as a switch towards dematerialized mobile technology are both important moves.

COINs for UNSustainable initiatives. The wonder of COINs is their amazing innovative potential. We can achieve great things at a surprising pace when we work collaboratively. But not all disruptive innovation is in favour of sustainability. What if a group of people start innovating using COINs at a rapid pace towards an end that is fundamentally unsustainable? Collaborative Innovation at a networked scale is so effective, it is dangerous.

The web won't save us, People will save us. This speaks to the largest reality/danger of this technology. Our use of the Internet and web-based collaborative technology is nothing more than a reflection of ourselves and our society. It is dangerous to believe the collaborative potential of the World Wide Web is going to save us (Keen 2009). It is important to remember that the real power lies in the people using the technology. If we believe in the potential of collaborative innovation networks and want to use their potential for sustainability, we need to invest in the people using the technology. We need to educate around the critical thinking skills and values that support good communities, otherwise these systems will devolve to emulate many of the great atrocities of our off-line world (Rheingold 2009; Applegate 2009).

One intriguing human habit is that of balkanization: we have a tendency to talk to the same people and create reinforcing beliefs without ever bringing true diversity to the conversation. This is a dangerous habit if we expect COINs to be used for sustainability as their true value lies in a diversity of perspectives. If we chose to collaborate only with others with similar beliefs, tendencies, reactions, strengths and weaknesses, the group will lose its intelligent characteristic. The resulting collaboration runs the risk of establishing group thinking and mob mentality, rather than the advantages of we-think and smart mobs.

Poor Collaboration Skills. Which brings us to perhaps the most important point of all. Collaboration is difficult. It is not something most of us are encouraged or taught to do from a young age. This reality was verified by our own experiences as a COIN as well as the responses of almost every single interviewee. If people are bad at collaborating in real life, they will

likely be bad at collaborating in on-line networks. Bring in the added complication of miss-communication and misuse of web-based technology and we realize that while collaborative innovation holds huge potential, there is still a large gap in our education as to how to operate collaboratively (Rheingold 2009).

In our opinion, the largest risk to COINs being a strategic way to organize and innovate for sustainability is our own inability to collaborate. If we just create a lot of web-sites and say, 'let's innovate our way out of this mess' without a proper understanding of the difficulties and problems associated with collaboration in general, and web-enabled collaboration specifically, we will only waste more resources, time, energy and further discourage sustainablists in their work.

Overcoming Sustainability Risks. To address our inability to collaborate, we believe the most valuable outcome of our research is a collection of tips, guidance and suggestions on how to consider collaborative innovation, how to design it, how to lead it, and how to participate. When we entered into our research we expected to find suggestions, practical guidelines, clear concrete answers as to the best way to utilize COINs towards sustainability. However the reality of this topic (it's breadth, interdisciplinary nature, it's newness, the emerging factors) made that impossible in this research period. Instead we have areas to consider, topic threads, advice when working with COINs, and are looking forward to discovering more answers as we all go forward exploring this field.

Finally we'd like to re-emphasize the importance of utilizing the FSSD to help ensure COINs are used strategically. Not only can the FSSD provide directional guidance to help make resource choices in line with a sustainable future, it can also help to unify a group around a shared language. Sustainability can mean a variety of things, and it can be difficult to unite a diverse group around a shared definition, especially when people in diverse parts of the world feel the impacts of the sustainability challenge so differently. If sustainability is part of a COINs core values, it is important in order to be successful as a COIN to find a shared language to communicate around that value. The FSSD can provide that shared language, as its grounding in accepted scientific principles allows for consensus amongst diverse participants. The FSSD supports vision led working, and COINs need strong, well-communicated visions in order to succeed. Combined, we believe COINs guided towards a sustainable future

by the directional aid of the FSSD will play a transformational role in our society's necessary movement towards sustainability.

4.2 Limitations and Suggestions for further research

The main limitations involve time and experience. This research crossed a variety of disciplines including economics, organizational learning, open innovation, social media, and IT. Besides strategic sustainable development, the authors did not possess expertise in any of these fields, necessitating a large amount of preliminary research in a short period of time. The research period for this masters' level thesis was 2.5 months long.

Due to these limits, this research remained a fairly high level overview of the considerations when utilizing COINs for sustainability. We are pleased with the variety of responses and data we were able to collect in this period, and feel that this research has provided a valuable overview of the issues and considerations when engaging with web-enabled collaborative innovation for sustainability. We know this would not have been possible to achieve were we not collaborating as a group and working with our compatriots in the U.S, UK, Africa and China.

In the meanwhile, there are a few points to consider when evaluating the usefulness of this work. Our most successful learning came from our action research as a COIN. We needed the experience of working, and reflecting together in true distributed collaboration to understand the real barriers and opportunities of this working style. We feel our research gained validity due to our ability to engage in dialogue with the field, receiving feedback throughout the process allowing for an evolution of our theories.

Our interviews were successful bearing lots of interesting data and insights, however it is important to consider the implications of having such an interdisciplinary interviewee basis. Each one brought a different perspective to the field, which effected their interpretations of our research questions and responses. Many of the terms littered throughout our research questions (Collaborative Innovation Networks, web 2.0, social media) hold different connotations and meanings to different people. At the start of every interview we would set the context and explain the relevance of these concepts to our research. However there remained different interpretations or biases present in the use of each word. We attribute this confusion to the

lack of accepted taxonomy for this new field, a concern David Bollier pointed out. He, Yochai Benkler and others have worked hard to set new taxonomies for the networked, collaborative working world, but as a new field there is still no definitive text to point to with the answers (Bollier 2009).

For all our interview questions, this confusion was most apparent in the first question, 'How can we know when web-enabled collaboration is appropriate or not.' About half of our interviewees answered the question: how do you know when to collaborate or not (with or without the Internet). The other half answered the question: how do you know when to use the web to collaborate vs. face-to-face. The results were still quite fruitful, but these two different interpretations reflected the confusion both we as researchers and many experts in this field still hold regarding the clearest way to think, consider and discuss all these new concepts. A shared language is still evolving.

One possible solution would be to focus more specifically on a particular field, examine case studies relevant to that field, and build taxonomies. In this research we talked with creativity experts, designers, computer programmers, social scientists, legal experts and entrepreneurs. Across all these disciplines there are different understandings of the collaborative web and networked innovation. This was important for our research as we were interested in building an interdisciplinary foundation to understand the potential of web-enabled collaboration, however to lend validity and depth to the research, it would be helpful to spend time, rigor and research exploring each field in more depth.

Future topics to be researched by masters students at the Blekinge Institute of Technology and further afield may include:

- A study of the resource implications of distributed working in COINs.
- Establishing Gatekeepers: investigating communication for multi-cultural COINs.
- Developing a training scheme for teams desiring to form a sustainability COIN.
- Developing an education programme for web enabled collaborative innovation and critical thinking for school children.
- Further research in to the qualities needed to communicate and work effectively as a COIN

- Case study of web-scale COINs integrating the FSSD to understand how these two frameworks interact together.

This study concludes with strong recommendations for the advancement of this resource via further research into the strategic use of COINs for sustainability. We are excited and committed to the continued evolution of this research and to supporting the use of COINs by sustainablits worldwide.

5 Conclusion

The emergence of social media and social computing tools has dramatically changed our societal ability to organize and work together. These changes are evidenced in projects such as Wikipedia and Linux, where millions of volunteers successfully collaborate together despite being distributed across the globe. According to research at MIT led by Peter Gloor, these collaborative successes were driven by Collaborative Innovation Networks (COINs), an organizational framework describing the collaboration of distributed participants, innovating as a network around a shared vision. By harnessing the power of networked collaboration, COINs are the most effective mode of organization for innovation ever (Gloor 2006). This is a reality that has many sustainablits contemplating their potential use for sustainability. In response to this need, our research explored how COINs can be used strategically towards sustainability.

Results indicate that COINs hold tremendous opportunity for sustainablits in their endeavour to bridge the ingenuity gap and create the disruptive innovations necessitated to move us towards sustainability. To succeed, COINs must be both self-organizing and diverse, essential characteristics for innovating around sustainability challenges. The fundamental premise of a COIN, a shared commitment to a vision, is the glue, the interdependence of its components. Supporting this, successful COINs are cooperative, transparent, open and involving, in line with the strategic guidelines for organizational processes that underlie social sustainability.

However, results pointed to some concerns regarding the sustainability implications of using COINs. Despite the opportunity distributed working provides to reduce the carbon emissions of travel, the technology driving COINs is very resource intensive, from the heavy metals that compose a computer to the energy intensive needs of data storage. Additionally, in being so effective, COINs can be highly problematic if used to innovate towards an unsustainable goal.

Research results highlighted that our society is not accustomed to collaborative working and we do not universally possess many of the critical thinking skills and education necessary to work effectively together, especially with the additional complications of using web-based technologies. Our ability to collaborate for sustainability using web networks is further constrained by the realities of the digital divide. With

78% of the world's population still off-line, COINs are inherently limited in their ability to harness the wider collective intelligence of the world for sustainability.

Our research provides sound advice for sustainablits as to how to best harness COIN's innovative potential for sustainability: practical guidelines and suggestions as well as strategic considerations. However throughout our research process, it was clear that this is an emerging field. As the web continues to spread and the technology that drives it continues to evolve, it is impossible to predict exactly what our networked future as a society will look like. This uncertainty, along with the relative newness of this field limits our ability to make concrete suggestions as these could rapidly decline into irrelevancy, particularly those at the level of detail. For this reason our resultant recommendations for the utilization of COINs are stored on-line at <http://www.collaborationninja.com>, where they are open for re-iteration in hopes that we can continue as a group and society to develop our understanding of this field and support each other towards making this new mode of working effective and strategic.

For now the greatest stride sustainablits can take when engaging COINs for sustainability is to adopt a strategic approach by pairing the Framework for Strategic Sustainable Development with the framework of COINs. The FSSD helps us create visions we can be confident are moving our society and organizations towards success and sustainability. Its greatest asset is an ability to support vision-led working focusing on a principled definition of sustainability. COINs provided a powerful organizational construct to drive innovation towards that vision more effectively and efficiently than has ever been possible before. Together, these two frameworks provide a powerful force towards sustainability.

In the end the results of this thesis should help sustainablits make a conscious decision as to whether or not to work as COINs, understand the benefits and risks, and utilize COINs to improve their collaborative innovation process towards sustainability.

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Appendix A: Interview questions and respondents

1. How can we know when web-based collaboration is appropriate or not?
2. In your experience, what are the barriers to web based collaboration?
3. How can the collaborations be designed to incentivize participation and break-down barriers; ie what governance structures work best for collaborative projects in your experience?
4. What is the role of motivation, vision and trust in successful collaboration- and what kind of leadership is needed?
5. What are your recommendations for designing a business model around successful web based collaboration? What is the value added for participants of collaboration, and how is that value realized?
6. What are your recommendations regarding legalities for web-collaborators?
7. What is the role of open in collaborative innovation?
8. What does your ideal e-collaboration tool look like? Do you have any favourite collaboration tools that exist? How can we overcome the limitations of current collaboration technology?
9. How do you see the future of e-collaboration? Do you think the web is the best tool to facilitate collaborative innovation for sustainability? Do we need something else? What real world mechanisms do you foresee necessary, running in parallel / supporting e-collaboration.

Name	Profile	Date
Chris Applegate	Wikipedia administrator, social media marketer, masters in computer science.	13/03/2009
Anand Ramchand	PhD in Information Systems at the National University of Singapore	05/04/2009
David Bollier	Legal expert, leading scholar regarding 'the commons', author Viral Spiral.	17/03/2009
Dominic Campbell	Social Media policy advisor; Entrepreneur	13/03/2009

Geof Brown	Professional facilitator, blogger, comm. organizer	16/03/2009
Danielle Germaine Dan Munz	Director and lead researcher at the Collaboration Project, leading research into collaborative organizational structures for U.S. government	10/03/2009
Peter Gloor	MIT Scientist at Center for Collective Intelligence; leading research into Collaborative Innovation Networks (COINs)	04/03/2009
Roland Harwood	Head of Nesta Connect, expert on collaborative innovation.	06/03/2009
Jon Husband	Organizational change consultant, professional blogger, leading thinker on the collaborative web.	09/03/2009
Andrew Keen	Entrepreneur, author, leading critic and expert into the negative effects of the Internet on community and culture.	06/03/2009
Mark Klein	Computer Scientist at MIT Center for Collective Intelligence. Developed argumentation tool for complex challenges: the Deliberatorium.	05/03/2009
Mingli Yuan	Wiki administrator and the first translated wiki into Chinese	14/03/2009
Johnnie Moore	Open space facilitator, We20 facilitator, Improve Comedian	03/03/2009
Rheingold Howard	Leading thinker and writer about The Virtual Community and Smart Mobs	17/03/2009
Keith Sawyer	Author, professor, leading expert on creativity and collaborative innovation	03/03/2009
Chris Thorpe	Computer Programmer, social media consultant, Entrepreneur.	12/03/2009

Ali Wyne	MIT Graduate, Global Challenges Wikipedia developer	07/03/2009
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Appendix B: Survey Questions and Results

Our survey focused on how web-enabled collaborative innovation networks can help us move towards sustainability. The purpose of this survey was to involve the envisioned 'audience' of our research, the survey was sent out to the MSLS Alumni Network email list via SurveyMonkey and the surveying period was from 16/03 to 23/03, and in total collected 38 responses.

The survey consisted of eight questions gathering the following results:

Q1: Personal Information

Field of work: For the most part respondents consider themselves to work in sustainability, in consultancy and management, and some also in education and engineering.

sustainability	14	36.84%
consultant & management	8	21.05%
education & student	5	13.16%
engineering	4	10.53%
design	2	5.26%
others	5	13.16%

Age: Respondents ages ranged from 24 to 50 years old, with the most (33) in the 24-37 years age bracket: 86.84%.

Country of residence: Of our respondents, the biggest representation (18 people) was from North America, including, eleven from the USA and seven from Canada. The second biggest group was from Europe, with three people from the UK, two from Sweden, two from France, and one from the Netherlands. The third largest group consisted of representatives of Middle and South America, including one person from Mexico, one from Costa Rica, and three from Brazil. There were four people from Australia, two from Asia including China and Japan, and one from Africa.

Q2: Have you been using computers on-line most of your life?

Consistent with the age of respondents, most 24-29 years olds chose 'yes' in this section. Of those who answered 'No' in this section (34.2%), most started to surf the Internet in mid/late 90s, with just two starting before 1995.

Q3. When working collaboratively with peers or co-workers, have you communicated using the Internet at any point to help enable, support, continue the collaboration. (for example: e-mailed to keep absent group members involved, used skype for meetings, used google docs to group write)

37 people (97.4%) answered 'yes' to this question. One person answered that they were not sure, the reason being that in Costa Rica and Latin America not everyone has a computer or is computer literate.

Q4: Please indicate any technology you used and provide details of how.

In this section we observed that e-mail and skype are a component of the daily lives of our respondents, with all indicating that they use these two for interpersonal communication with friends, family and people from school or work. It is notable that some of them use e-mail services as their planner (e.g. Outlook) while others log onto Skype for online meetings. A majority of respondents use web-based meeting software for either academic or work-related purposes, e.g. presentations or webinars. 84.2% of respondents use IM, indicating this is mostly for trivial communication e.g. to 'ask quick questions', to 'tell others to log on Skype' or that 'an e-mail is coming'. As for information-sharing software and websites, Google documents and Wiki pages seem to play a dominant role. 93% of respondents use the former for web-based collaboration when they have no 'private' server and approximately the same percentage use the more public-oriented Wiki's, although few are 'active users'. Most used wiki technology as an internal website for a company or to get institutional knowledge. As for personal lives, an overwhelming 92% of people use SNS like Facebook or myspace and almost all claim these to be 'totally personal' using these services to keep in touch with friends and share photos. However, in terms of blogs, almost half of the 73.7% who keep blogs do so for more work-

related purposes. In addition to these tools, people filling in this survey also reported using other web-based tools like Google Picassa and personal websites.

Q5: What kinds of problems did you experience when utilizing these web based tools to assist your collaborative project?

There were a variety of responses. Around one in ten complained about the lack of 'real communication' and the feeling that emotions could be hard to get across, especially when working only with typed words and no voice or video. Many of our interviewees were concerned with technical problems relating to either hardware or software, among which the low load speed and formatting problems of Google docs were the most significant. Respondents reported embarrassing situations occurring when talking over Skype becomes unsatisfactory due to limited or low quality Internet access. Another barrier was the difficulty to send large files via e-mail and the inability to show everybody's image when using on-line meeting software. One respondent raised the concern that sending e-mail may be not so efficient because the sender might assume that the recipient would read it immediately while this may not be the case, causing awkward postponements at work. Still, the majority of interviewees concluded that the choice is ultimately made by the users and the technical problems would sooner or later be solved.

Q6: Based on the challenges you described above, did you find any ways to overcome them?

Talking about the successful ways to solve the above-mentioned problems, one in ten interviewees said they had yet to find a solution. For those who have found the way to solve their problems, approximately half turn to the belief that the technology itself is bound to improve, be it the Internet server, the software or the website. One respondent believed that the technology will ultimately be more satisfactory but as for now actually we are already perfectly capable to work with these tools. Some also suggested that we should teach more people how to use these tools properly and we should always have a back-up plan to deal with the situations when there is an Internet failure or problem with the tools. Almost all said it was always nice to have a little more patience. Still, around one third of all those surveyed reckoned that essentially we should meet in person more to ensure more efficient collaboration.

Q7 : What were the benefits of utilizing web-based technologies as part of your collaboration?

Our respondents saw almost identical benefits to using web-based collaboration: it's cheap, fast and enables long-distance communication with almost zero delay. Some noted that collaboration of this kind could get everybody involved and informed, and that cooperation like co-writing and brain-storming is made possible. One respondent mentioned SNS like Facebook made it possible to get information to and from many people at a time.

Q8 : In what situations would you recommend using web-based tools to enable collaboration?

The overwhelming majority agreed that web-based collaboration should come into play whenever people from different time zones or living far away needed to work together, or when in-person meetings were inconvenient. Some even answered 'always' explaining that the exchange of information and ideas is quicker when collaborating online. They believed that the technology is well-developed and it is our place to utilize it whenever possible. However, a few held the opinion that web-based tools were not appropriate for kick-off meetings because the technology was overwhelming when the participants should focus more on the content of the meeting, indicating however that for check-in meetings these tools were good to use. Two respondents highlighted that web-based communication was not appropriate when highly classified information is involved.