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Knowledge Management

In Renewable Energy Innovation

A Carbon Trust Offshore Wind Accelerator Case Study

By Heather Louise Madsen

Knowledge Management
In Renewable Energy Innovation

A Carbon Trust Offshore Wind Accelerator Case Study

PhD Dissertation

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International Business Center

Department of Business and Management

Aalborg University

For my first teachers
Susan Berry Baca & Gary Francis Greif
You are a constant source of love and wisdom

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Chapter 1: Introduction

The scholar Mats Alvesson describes knowledge as "replacing capital and labor as most significant in the economy and in companies." (2004, p.233) Although this statement is nothing fancy, it is to my mind poignant, and most literature concerning organizational learning and knowledge management reiterates it in one form or another. One reason for this may be that it raises two important questions, the first one being: *why* is knowledge so significant for today's organizations?

Answering this question requires a bit of context. The industrial age, beginning in the mid-1700s with the industrial revolution, propelled society into a time of increased labor and capital. Living standards rose steadily and affected almost every aspect of daily life through changes in manufacturing, agriculture, transportation and technology. Then, around 1980, the advent of the personal computer, along with the internet, changed society once again. Suddenly, information that was once only available to very few individuals became widely accessible. This growing mass-proliferation of information led to the information age, increasingly propelling industries into the global markets of today, where success often means being able to navigate a dynamic, complex and fast-paced environment.

One industry that has been particularly affected by this dynamic and fast-paced environment is offshore wind. Global recognition of climate change has increased the demand for new energy solutions, and a call for action has been raised in a variety of sectors, such as media, government, research institutions, and the general public. For example, in 2008 the European Commission produced a report stating that "offshore wind can and must make a substantial contribution to meeting the EU's energy policy objectives through a very significant increase – in the order of 30-40 times by 2020 and 100 times by 2030 – in installed capacity compared to today." (COM(2008) 0791 final)

Despite the fact that offshore wind has been identified as one area which may be able to play a large part in meeting this growing renewable energy need, there are still many technical challenges yet to be overcome in order to make it an economically viable long-term energy solution. Perhaps because the demand for offshore wind is increasing so quickly, perhaps because of the number of technical challenges yet to be overcome, or perhaps simply because relevant parties are realizing how much more knowledge can be gained by combining resources, companies involved in offshore wind are now beginning to pool their resources in order to accelerate the development of the industry.

Interestingly, cases of diverse actors pooling resources for knowledge sharing purposes are also emerging in the management literature. Here, knowledge-intensive, widely dispersed industries are reported to be looking for solutions in which "the locus of innovation extends beyond the individual firm." (Fjeldstad, Snow, Miles and Lettl, 2012, p.34). This cooperation between diverse organizational actors provides opportunities as well as challenges, many of which revolve around the way knowledge is acquired, combined and maintained in these configurations.

And this leads us back to the quote by Alvesson and to the second question, namely: *how* do organizations wanting to harness the 'significance' that knowledge has to offer go about it? Although knowledge is increasingly being recognized in today's turbulent and fast-paced business environment as the key to business success (Drucker, 1999; Gu, 2004; Moitra, 2002; Nonaka and Peltokorpi, 2006) there are still many challenges to be overcome in terms of approaching how this is done. Many of these challenges come from the fact that: "our existing organizational systems, managerial vocabularies, and professional mindsets have evolved to address the challenges of the industrial era, and its inherent focus on standardization, binary thinking, and uni-dimensional recipes." (Bahrami & Evans, 2005, p.136) For knowledge management, this implies that narrow and prescriptive conceptualizations may not be sufficient for finding business solutions to solve knowledge process problems.

Other scholars feel that "Because KM evolved from a spectrum of theoretical traditions ranging from philosophy to computer science and economics, it is considered to be a 'mixed bag' of 'idealistic theories' without a coherent theoretical base." (Nonaka and Peltokorpi, 2006, p. 73) In the perspective of Alvesson and Karreman (2001, p. 996) "Knowledge management is inherently problematic as a concept. Most uses of it tend to be either tension-ridden or trivial." Additionally, as stated by Foss and Mahnke (2002, p.78) "Knowledge management is also akin to [other management] fads [of recent decades] in that there is no clear disciplinary foundation for it."

Out of this context, a knowledge gap has arisen between the extensive number of divergent and often prescriptive approaches to the study of knowledge management on the one hand, and their ability to account for and aid the complex realities faced, in practice, by organizations dealing with knowledge processes on the other. Bridging the gap requires, first, a reconceptualization of knowledge - one that is inclusive enough to describe the way that knowledge processes unfold, while exclusive enough to be meaningful, delineating what is, and is *not,* knowledge. This is particularly important because as it stands now, "'knowledge' has no essential meaning, and people use the term in an infinite number of ways." (Alvesson, 2009, p.231)

In addition to re-conceptualizing knowledge, a reconceptualization is also needed of how knowledge can be meaningfully managed. This reconceptualization will require a solid paradigmatic foundation, which is why an organic paradigm perspective has been chosen, within which both knowledge and management can be purposefully drawn together. Currently, there is a dis-alignment in knowledge management literature, creating a situation where "the more management, the less knowledge to 'manage', and the more 'knowledge' matters, the less space there is for management to make a difference." (Alvesson and Karreman, 2001, p.996) To address this issue, I propose a reconceptualization of knowledge processes in terms of a framework that focuses on answering three key questions: *1) why do organizations want to use knowledge management; 2) what problems arise when attempting to manage knowledge;* and *3) what is necessary for successfully managing knowledge?* Through this reconceptualization, the focus will be placed on providing a comprehensive view of knowledge management that moves away from giving one right answer to these questions, and instead provides a foundation for finding individualized and context specific approaches to tackling the real-world challenges that innovative organizations face every day. With this in mind, the research questions to be answered in this PhD dissertation are as follows**:**

Which drivers, obstacles and critical success factors exist for managing knowledge processes in the context of organizations involved in offshore wind energy innovation?

- **To what degree can synergies be formed for the development of the organizations' knowledge resources?**

- **How can dynamic capabilities be harnessed, providing both super-flexibility and focus?**

Acknowledging that the literature on organizational knowledge covers a broad spectrum of theories and approaches (Lopez, S.P., Peon, J.M.M., Ordas, C.V.J., 2004), the main question draws this literature together in the context of an actor oriented innovation program. Specifically, utilizing the three overarching categories of drivers, obstacles and critical success factors provides a framework to select theories and tools that are relevant for individual organizations through case studies. *Drivers* discuss the reasons why an organization would want to use knowledge management theories and tools; *Obstacles* discuss the problems that arise when attempting to manage knowledge in theory and in practice; and Critical Success Factors discuss what is necessary for knowledge to be managed in a way that helps organizations achieve their main objectives and goals. Approached in this way, knowledge management can be meaningful with relation to how knowledge is perceived, as well as how it is managed in practice.

The purpose of the sub-questions is to highlight two key issues pertaining to knowledge management in a way that can add practical benefit to the actor oriented innovation program being studied. In other words, the sub-questions re-frame some of the main themes covered by the primary research question, providing practical suggestions for managing knowledge processes in the specific case being studied. Together, the main question and two sub-questions bridge the above mentioned gap by bringing all relevant theories and tools together, from an organic paradigm perspective, under the umbrella of knowledge management drivers, obstacles and critical success factors. This allows for an inclusive, people-centric and contextual analysis of theory *and* practice, bringing new insights and understanding to the field of knowledge management, and to the managers of the specific actor oriented innovation program being studied.

The contributions of this PhD dissertation are three-fold. Theoretically, this dissertation provides a reconceptualization of knowledge. As a consequence, 'knowledge' repositories and all other means of facilitating knowledge are re-classified as '*knowledge conduits*.' The purpose of this new terminology is to give scholars and practitioners a means to avoid the common trappings of considering knowledge as a thing outside of human understanding, a pitfall that has often led to simplifying processes and overlooking the important, tacit, dimension that is part of *all* knowledge. Secondly, a new framework is presented, from which to examine the management of knowledge processes, and is understood as adding specificity and meaning to knowledge management theory and practice. The last contribution of this dissertation is to provide practical guidelines for enhancing knowledge management processes within the actor oriented innovation program being studied, and toward the end of helping involved actors to better achieve their main objectives and goals. In line with this last contribution, this case study also contributes to research on the subject of large-scale, multiparty collaborations, which is specified as a new organizational form emerging as a response to the increasing global demands of the twenty-first century (Fjeldstand, Snow, Miles, Lettl 2012).

The case that has been chosen for this dissertation is the Carbon Trust Offshore Wind Accelerator program. The Carbon Trust is an independent non-profit organization put in place by the British government in 2001 to accelerate the transition to a low-carbon economy (www.carbontrust.co.uk). The Carbon Trust Offshore Wind Accelerator program gathers nine major European energy companies for the purpose of accelerating the development of offshore wind technologies and ultimately reducing the cost of offshore wind. It is a case of semi-open innovation, and a case that is managed in unique and unconventional ways, which are understood as emerging out of the climate of uncertainty and fast-paced change discussed above. This case is

deemed to be particularly significant for understanding knowledge processes because of its unique actor oriented organizational form and its importance in the context of renewable energy innovation.

1.1 Approach

The approach used by this dissertation is to operate using the concept of the hermeneutic spiral, a concept that has been very well articulated in *Truth in Method* (Gadamer, 1994, p.190), where it is written:

> "The meaning of the part can be discovered only from the context, i.e., ultimately from the whole. […] Fundamentally, understanding is always a movement in this kind of circle [what I refer to as a spiral], which is why the repeated return from the whole to the parts, and vice versa, is essential. Moreover, this circle is constantly expanding, since the concept of the whole is relative, and being integrated in ever larger contexts always affects the understanding of the individual part."

Taking this statement as a point of departure implies that everything that is presented in this dissertation has remained malleable up to the point of submission, being re-thought, changed, and/or amended to present the most clear and coherent understanding to date. Practically speaking, this means that organizational learning literature, knowledge management literature, innovation literature, and Carbon Trust Offshore Wind Accelerator program literature, as well as interview material and field analyses have been continually analyzed and re-analyzed to gain a better understanding of knowledge management structures, theories, and methods. The culmination of this process is twofold. Firstly, an understanding of knowledge management is developed which can support an inclusive understanding of important drivers, obstacles and critical success factors, many of which are found in existing management literature, but are currently understood in restrictive ways. Secondly, this understanding is applied to the Carbon Trust Offshore Wind Accelerator case, illustrating the complexity and duality involved in knowledge processes, and offering a more nuanced understanding of actor oriented innovation programs generally.

The second chapter presents the case of the Carbon Trust Offshore Wind Accelerator program. This case is deemed uniquely qualified as a context in which to study knowledge management for three main reasons. First, this case is an example of a new organizational form called an 'actor oriented scheme,' displaying the key characteristics of having: actors who have the capabilities and values to self-organize; commons where the actors accumulate and share resources; and protocols, processes, and infrastructures that enable multi-actor collaboration (Fjeldstad, Snow, Miles and Lettl, 2012). Second, this case is an example of a 'super-flexible organization'

(Bahrami and Evans, 2005), displaying novel approaches to management, organization and strategy as the key characteristics. Third, this case can also be seen as working within a framework of semi- open innovation (Ulhøi, 2004), identifying it as a hybrid between private and collective innovation. Each of these three organizational concepts: being *actor oriented*; *super-flexible*; and operating within a framework of *semi-open innovation* places this case study in the forefront of new and emerging organizational structures - structures that are uniquely qualified to meet the information and knowledge challenges of the 21st century.

The third chapter of this dissertation presents the methodology and begins by explaining the overall framework, including social constructionism and a new term coined *integrative investigation*, which relies upon hermeneutic conceptualizations. The choice for, and usefulness of, qualitative method and case study research is then discussed, as "case studies have the advantage of allowing new ideas and hypotheses to emerge from careful and detailed observation." (Blanche, Kurrheim, Painter, (eds) 2006, p.461) Next, the choice of analyzing knowledge management in relation to renewable energy innovation is explained. The selection of the Carbon Trust Offshore Wind Accelerator program is also argued for, on the basis of its unique actor-oriented organizational form and its engagement in and development of semi-open innovation. This chapter also discusses the choice of selecting interviewees' at all organizational levels, a choice which was made in order to get a holistic view of the way that knowledge is managed in this specific case. The use of qualitative method and semi-structured interviews has been applied in order to probe for more and more issues and conceptual understandings. Interviews have been transcribed and coded with the aid of the computer program NVivo, a procedure that has been carried out with the aim of identifying and clarifying drivers, obstacles and critical success factors of knowledge management for the empirical analysis of this dissertation. To conclude, this chapter discusses the use of action research, and what this has meant for both the research process, as well as for the Carbon Trust OWA program.

The fourth chapter consists of the theoretical analysis, which is separated into six sections, discussing: 1) knowledge management origins and underpinnings; 2) a new definition of knowledge; 3) knowledge management drivers; 4) knowledge management obstacles, 5) knowledge management critical success factors, and 6) conclusions and extensions of knowledge management in the context of semi-open innovation programs. The first two sections discuss the origin of the concept of knowledge management, providing a new definition of knowledge, and orienting the rest of the discussion within an organic paradigm. Next, knowledge management *drivers* refer to catalysts which lead organizations and scholars to turn to knowledge management for tools and practices. In the fourth section, knowledge management *obstacles* are discussed,

referring to concepts and issues that may hinder the management of knowledge processes. For organizations and their subsequent projects and programs, the contested nature of these concepts may leave organizations who want to use knowledge management strategies at a loss for knowing what to believe, or where to focus their attention. The fifth section, discussing critical success factors, highlights a variety of factors that may lead actor oriented innovation programs to be better able to achieve their goals, by understanding and utilizing a wide range of tools and processes associated with knowledge management. This chapter is concluded by drawing each of the preceding sections together, highlighting what this re-conceptualization may mean for the future of knowledge management studies, as well as its implications for actor oriented innovation programs.

The fifth chapter contains the empirical analysis. Information gathered during the primary data collection process is presented here. All interviews, along with Carbon Trust Offshore Wind Accelerator program literature and other information attained about the case and the industry has been analyzed in a holistic manner, and through a hermeneutic process. Theory informed what was observed in practice, and information collected during this research process informed the theories and tools that were selected, leading the drivers, obstacles and critical success factors in this chapter to mirror those presented in chapter four. Each section highlights support for the theories and tools that are presented in this dissertation. This chapter also highlights new insights into the means by which actor oriented innovation programs manage knowledge in ways that contribute to the achievement of their overall business objectives.

The sixth and final chapter of the dissertation presents the conclusion, thus responding to the research questions posed above. Theoretical knowledge management drivers, obstacles and critical success factors are discussed with relation to empirically gathered knowledge management drivers, obstacles and critical success factors that exist in practice (for the Carbon Trust Offshore Wind Accelerator program), as well as discussing the implications this has for future research. The two sub-questions covering the degree to which synergies can be formed for the development of the organization's knowledge resources, and which processes can best describe how dynamic capabilities can be harnessed, providing both super-flexibility and focus, are also discussed, listing specific practical suggestions for achieving program objectives. Finally, the entire process that was undertaken is reflected upon with two goals in mind: to describe the process that has unfolded during this dissertation, with a primary focus on lessons learned; and to discuss the limitations of this study, and how this research might be extended in the future.

Chapter 2: The Carbon Trust Offshore Wind Accelerator Program

This chapter will present the case that will be explored in this dissertation with relation to knowledge processes. In order to do this in a clear and structured way, the first section will give a brief background about the Carbon Trust organization and why it was created. This will lead, in the next section, to the specific case of the Offshore Wind Accelerator program, how it came about, and the way in which it has evolved, including a timeline of organizational change. The third and final section in this chapter will discuss the relevance of this case for the study of knowledge management, describing it as an actor-oriented (Fjeldstrad, Snow, Miles and Lettl, 2012), super-flexible (Bahrami and Evans, 2005) program, and a case of semi-open innovation (Ulhøi, 2004). Each of these elements will also be discussed as making this case (of an actor oriented innovation program) increasingly important for the study of knowledge management in today's ever more interconnected and fast changing markets.

2.1 The Carbon Trust – a brief history

Image from: The Carbon Plan: Delivering our low carbon future, HM Government, 2011, p.28

If you were to take a tour around residential England, you would likely be told, as I was, that the numerous chimneys filling the British horizon are remnants of the industrial revolution, where densely populated and polluted city life caused many health problems for its inhabitants. In the long term, changes started by the industrial revolution are referenced in relation to having a very real impact on climate change today. For example, it was stated in an official document released by the current British government (HM Government b, 2011, p.13) that:

> "Climate change is one of the greatest threats facing the world today. There is an overwhelming scientific consensus that climate change is happening, and that it is primarily the result of human activity. There is now almost 40% more carbon dioxide in the atmosphere

than there was before the **industrial revolution**, the highest level seen in at least the last 800,000 years. As a consequence, global average temperatures continue to rise. 2000–09 was the warmest decade on record, and 2010 matched 2005 and 1998 as the equal warmest year."

A similar report also indicates that without taking action to reduce carbon emissions, there is a high risk of irreversible changes taking place, such as melting polar icecaps and the release of methane from oceans which would cause further global warming. In a similar report (HM Government a, 2011, p.5), it is also stated that:

> "[The] Government's approach to avoiding the risk of dangerous climate change has at its heart the Climate Change Act 2008, which requires Government to reduce greenhouse gas emissions by cutting emissions by at least 34% by 2020, and 80% by 2050."

These ambitious targets set by the British government have led to a number of diverse measures that are being taken to ensure the reduction of carbon emissions. These include, but are not limited to, reform of the electricity market, support for new low emission vehicle technologies, tackling emissions from farming, establishing a Green Investment Bank, encouraging local communities to host renewable energy projects, and delivering zero carbon new homes from 2016 (HM Government a, 2011, pp.12-15). In addition, it is stated (HM Government a, 2011, p.9) that:

> "The Government will also need to ensure that we stimulate innovation and develop the necessary skills and technologies in the UK. This will require significant public and private sector investment in all stages of the innovation process, from research, through development and demonstration, to deployment. The Government directly supports innovation and works through the Research Councils, Technology Strategy Board, Energy Technologies Institute and Carbon Trust."

One of the ways that the British Government has helped to stimulate innovation and technologies in the UK, as identified in the quotation above, is through the Carbon Trust. The Carbon Trust, which was founded in 2001 by the UK Government, is an independent, non-profit company with the mission: to accelerate the move to a low carbon economy (Carbon Trust home page, 2013). In a presentation from the Carbon Trust's Chief Executive Tom Delay (Delay, 2010), it states that the Carbon Trust provides:

> "…specialist support to business and the public sector to help cut carbon emissions, save energy, and commercialize low carbon technologies. By stimulating low carbon action we contribute to key UK goals of lower carbon emissions, the development of low carbon businesses, increased energy security and associated jobs."

As is shown here, the mission of the Carbon Trust is in line with that of the British Government (as discussed above). The way that this mission is achieved by the Carbon Trust is twofold. In the

short term, the Carbon Trust helps to cut carbon emissions by providing specialist advice and finance to help organizations to cut carbon emissions, as well as setting standards for carbon reduction. In the long term, the Carbon Trust aims to reduce potential future carbon emissions by helping to open markets for low carbon technologies, leading industry collaborations to commercialize technologies, and investing in early-stage low carbon companies (Delay, 2010). In relation to these longer term objectives, the Carbon Trust has initiated a number of research, development and demonstration (R,D&D) activities which were presented, in March of 2010, as having the following budgets (Sykes, 2010):[1]

- Advanced Bio-energy Accelerator (£20m)
- Advanced Solar PV Accelerator (£10m)
- Marine Energy Accelerator (£3.5m)
- Marine Renewables Proving Fund (£22.5m)
- **Offshore Wind Accelerator (£30m)**
- Biomass Heat Accelerator (£5m)
- Industrial Energy Efficiency Accelerator (£15m)
- Low Carbon Buildings Accelerator (£10m)

As demonstrated by this overview of activities, the Offshore Wind Accelerator program is one of the largest programs that the Carbon Trust funds. Now that a brief history of the Carbon Trust has been presented, we will move to a discussion about the way that the Offshore Wind Accelerator program was initiated and has developed over time.

2.2 The Carbon Trust Offshore Wind Accelerator Program

Image from: http://www.carbontrust.com/our-clients/o/offshore-wind-accelerator

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[1] These budgets include funding from both the Carbon Trust and participating industry partners.

On the Carbon Trust's website (Carbon Trust, 2013), The Offshore Wind Accelerator is presented as follows:

> "The Offshore Wind Accelerator (OWA) is Carbon Trust's flagship collaborative RD&D program. Set up in 2008, the OWA is a joint industry project, involving nine offshore wind developers with 77% (36GW) of the UK's licensed capacity that aims to reduce the cost of offshore wind by 10% by 2015. Cost reduction is achieved through innovation. Technology challenges are identified and prioritized by the OWA members based on the likely savings and the potential for the OWA to influence the outcomes. Projects are carried out to address these challenges, often using international competitions to inspire innovation and identify the best new ideas. The most promising concepts are developed, de-risked and commercialized as the OWA works closely with the supply chain throughout the process… The OWA is two-thirds funded by industry and one-third funded by the UK Department of Energy and Climate Change (DECC)."

This statement serves to describe how the OWA program is seen today. It is a project that brings together nine offshore wind developers, with the purpose of reducing the cost of offshore wind by 10% by 2015. However, before getting into more detail about who these industry partners are, or what exactly they are doing to reduce the cost of offshore wind energy, let us take a step back, and examine the way that the Carbon Trust OWA program came into being. In an interview with the current head of the Carbon Trust OWA management team, the following story was related:[2]

> "The Carbon Trust launched their first accelerator program around 2002, 2003, looking at marine energy. So the Carbon Trust was originally set up in 2001, and they were quite small. There weren't that many people involved. And it was looking at how you could help business reduce carbon emissions. And because of this broad mission, you can do a lot of different things. So, it morphed into a company that does things like venture capital, applied research grants, incubator support for startups, as well as coming up with standards for measuring carbon, providing advice to companies on how to reduce their carbon footprint, all kinds of different things. And there was a view the Carbon Trust could help make a difference in reducing the cost of marine energy, because there was no consensus on what the best technology was, no one really understood the cost of energy. And there was a view that there were a lot of skills within the UK, but there needs to be some kind of cohesion around it to try and bring down the cost and share information. So that was the first Accelerator Program. And after that we grew our portfolio of Accelerator programs, and the Carbon Trust did some scoping work to see which technologies were likely to be the most impactful for reducing carbon. And they identified things like CCS [Carbon Capture and Storage] and offshore wind as the main ones that can deliver carbon reductions for the UK. So, in 2007 there were a number of studies that were done by the Carbon Trust that were involving consultancies like LEK and BCG to work out what the challenges are in offshore wind, in terms of technology and market and policy, and whether there are any opportunities for using innovation for reducing cost. And there was a guy called Mike Hay that used to work for the Wind Energy Association who was recruited by the Carbon Trust because he had good links with the industry. And he was really the guy who did all the business development with the energy companies to set up the Offshore Wind Accelerator. And he was really the guy who came up

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[2] All interview transcriptions are included in Appendix 1: Primary Interview Transcriptions

with the model of having just developers in there, aligned around having cost reduction and delivering it in time for Round 3."[3]

This story gives a bit of background about how the Carbon Trust developed, how the OWA program got started, and by whom. However, it also raises the question: what is Round 3? The UK Round 3, as part of the Crown Estate, is comprised of nine deep water areas (zones) off the cost of the UK that have been designated for delivering Offshore Wind Energy. These nine deep water offshore wind zones were awarded to various industry partners and partnerships in January 2010. On the official website of the Crown Estate (The Crown Estate, 2013), they describe the Round 3 wind farms as follows:

> "Through our rights to lease the UK seabed for renewable energy projects we have been involved in offshore wind since 2000. This includes 8 GW of capacity in Round 1 and 2 offshore wind farms which are already in operation, under construction or in development. The UK Offshore Energy Strategic Environmental Assessment (SEA), published in January 2009, identified up to 33 GW of offshore wind capacity in UK waters. This formed the basis of the Round 3 offshore wind program, which will contribute significantly to meeting the UK's renewable energy target. Nine offshore wind farm zones of varying sizes were identified within UK waters to deliver the capacity identified in the SEA. Renewable energy developers were asked to bid for exclusive rights to develop offshore wind farms within the zones. The successful development partners for each zone were announced in January 2010."

So, where Round 1 and 2 were shallow water offshore wind sites, Round 3 will be further from shore, posing many challenges which the Carbon Trust OWA program is addressing in a variety of ways. Each of the nine industry partners who are part of the Carbon Trust OWA program also has a stake in one of the nine Round 3 zones, and together, the nine partners hold exclusive rights to 77% of the Round 3 zones. The challenges—and urgency—of needing innovative technology to develop the Round 3 zones was well stated by the head of the OWA management team, explaining that:

> "Round 3 is much further from shore, so up to 200 kilometers off shore, and maybe 2,500 turbines on a site. And its deeper waters–rather than less than 30 meters, it's up to 60. So it's technically more challenging. And in terms of the time scales, the developers are getting consent at the moment to build those projects, which takes at least 2 years, to get planning approval. And then construction is likely to start in 2015. But they need to take the decisions about what turbines to use, what foundations they use, now. So, any information that we can give them now is relevant to their projects. So there is quite a lot of urgency to the work that we are doing."[4]

Up to this point, information presented has served to describe why the Carbon Trust OWA program is doing what it is doing. In short, the Carbon Trust was set up so that the ambitious

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[3] Carbon Trust OWA Manager, Jan 17, 2012. Recording time: 2:10
[4] Carbon Trust OWA Manager, Jan 17, 2012. Recording time: 10:50

renewable energy targets in the UK could be met. Because a large part of future renewable energy in the UK depends on offshore wind energy, there was recognition that the industry would need technology development in order to meet the challenges that it was facing. The OWA program was set up to help meet those challenges through cooperation between the industry partners that would be developing offshore wind farms in the various UK Round 3 zones.

Now let us turn to the specific structure and activities, or the what, of the Carbon Trust OWA program. The preliminary interview conducted for this dissertation was with an individual who was approached by Mike Hay (noted above as having developed and initiated the OWA program). Mike Hay asked this individual about the possibility of his organization (an energy company and offshore wind developer which now has a stake in the UK Round 3) becoming a partner in the OWA program. As he described it:

> "I was approached by a guy from the Carbon Trust at the offshore wind conference in Berlin, in 2007. I was actually the first that the Carbon Trust talked to on this… what Mike Hay asked me at the conference was – if costs for offshore wind were to be reduced, what I though the focus should be on…I think I mentioned foundations as one area, and definitely access systems in high waves as another one. And some other issues as well… So, what happened then was that the Carbon Trust approached other companies because they had decided that they wanted to make a program in view of the huge ambitions that they have in the UK for offshore wind. They made a decision that they wanted to have a program about how to accelerate the reduction of costs for offshore wind. And they wanted to find out what they should focus on in that work. So we had a meeting with them here in Copenhagen, and in Skærbæk, which is our office in Jutland, where I invited colleagues that are experts on various aspects of offshore wind power. And we then discussed with the Carbon Trust what we thought the focus should be on. And then when they went home, they had several talks with other companies, and then we [this company, other prospective partner companies, and the Carbon Trust] went to a workshop in London, sometime in the summer of 2008. And then other companies were participating in that workshop, and then it was decided what the contents of this program should be. And then we had negotiations on a binding agreement for the program, and that was signed in October of 2008, and then the work started more or less shortly after."[5]

 The workshop in the summer of 2008 led to the following structure being designated for work through the Carbon Trust OWA program:

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[5] Steering Committee Member, March 17th, 2010. Recording time: 22:35

Figure 1. Organizational Structure of the Carbon Trust OWA program, decided in 2008
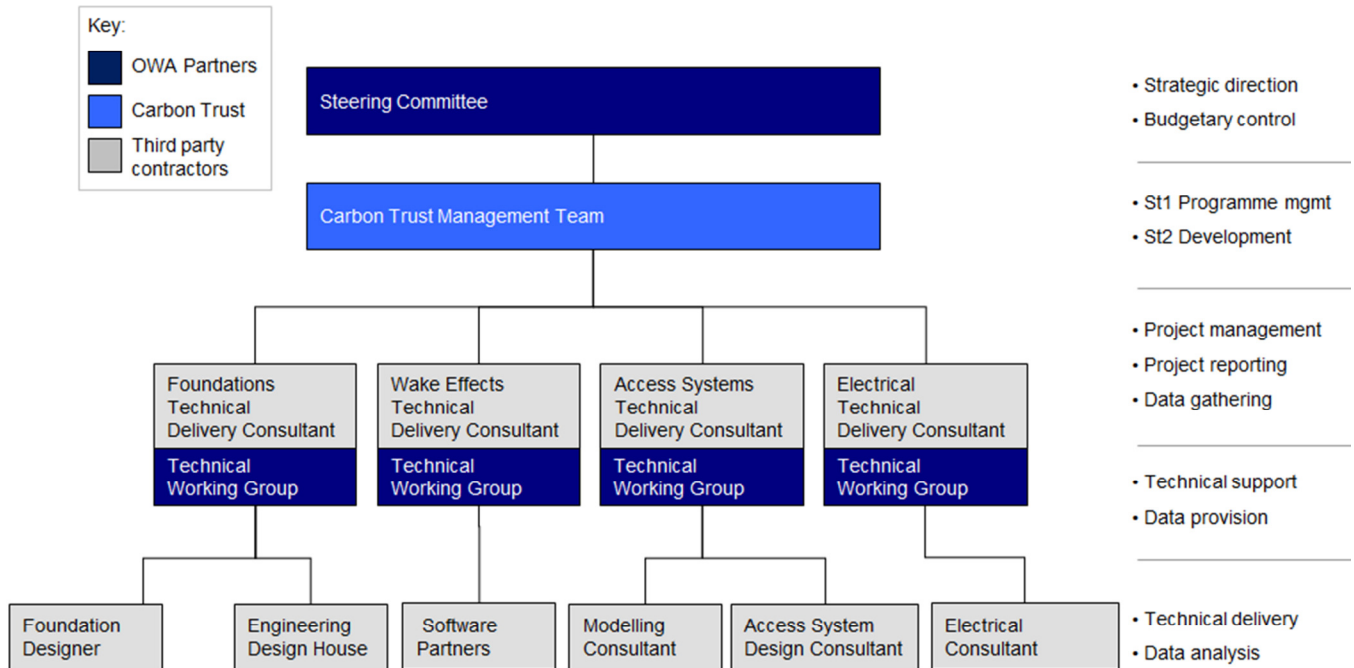
Let us start by explaining the key for Figure 1. The OWA partners, as illustrated above, are all offshore wind developer organizations that today have a stake in a Round 3 offshore wind development zone. When the legal agreements for the Carbon Trust OWA program were signed in 2008, the five partners were: 1) Airtricity (now SSE Renewables), 2) DONG Energy, 3) RWE Innogy, 4) Scottish Power Renewables, and 5) Statoil. The Carbon Trust , in terms of the OWA program, comprises a core team of people (never exceeding five people) who manage this particular program on a day-to-day basis. They are aided by various support teams within the wider Carbon Trust organization, for example, a legal team, a marketing team and an IT support team. The third party contractors are all organizations that have been awarded contracts through a call for tender. These cover a wide range of organizations, from consultancies to engineering firms.

If we now move to the top of Figure 1, the **Steering Committee** is comprised of one to two individuals from each of the partner organizations who decide the overall strategic direction of the program, and are in charge of the budgetary control for each of their respective organizations. **The Carbon Trust OWA management team** is in charge of the overall program management and development. They meet on a regular basis with a wide range of stakeholders, including but not limited to the Steering Committee members, the Carbon Trust management, and the Department of Energy and Climate Change, Scottish Government, Welsh Government and Northern Irish Government (all of which contribute funding to the Carbon Trust).

On the next level the structure of the OWA program splits into four. Each of these four areas is an area in which OWA members would like to accelerate innovation and reduce cost, and it is in each of these four areas that we see the main "work" of the program being done. The four areas, called **working streams**, are comprised of 1) Foundations, 2) Wake Effects, 3) Access Systems, and 4) Electrical. Each of these areas was explained in slightly more detail by a Steering Committee member who said:

> "The four focus areas for the Offshore Wind Accelerator are (1) new concepts for foundations and installation methods at 30-60 meter water depth, (2) improved tools for calculation of wave lengths and wind resources, (3) more efficient ways of transportation and access to turbines in connection with operation and maintenance, and finally (4) new concepts for electrical infrastructure, generators, etc."[6]

Returning to Figure 1, each of these four focus areas has a **Technical Delivery Consultant (TDC)**. Technical Delivery Consultants (TDCs) act as project managers for each of the respective working streams. They facilitate interaction within their respective working stream, project reporting, as well as data gathering, whether from inside their own organizations or from other third party contractors. Just as each working stream has a TDC (in the structure above), each working stream also has a **Technical Working Group (TWG)**. Technical Working Groups are comprised of technical experts within each of the respective working streams, and there are one to two representatives participating in these groups from each of the OWA partner organizations. These Technical Working Group members provide technical support and perspectives from each of their respective organizations, as well as data provision where and when applicable. The bottom row in Figure 1 describes a range of third party contractors who are typically **innovators and designers** (foundation designers, engineering design houses, software partners, modeling consultants, access system design consultants, and electrical consultants) not related to the OWA partner organizations, who are contracted for work in one of the working streams. These individuals are then expected to deliver technical and/or data analysis results to the OWA program. Although the structure of the OWA program has changed somewhat over time, this basic structure still serves as a good overall guide to the activities of the OWA program, and those involved. At the end of this section, an updated figure will be presented which, although very similar to this one, will none-the-less serve to show the structural changes that have been made over the last five years.

To this point, both the background and structure of the OWA program have been described. Now let us take a closer look at the contextual dynamics that have contributed to establishing the OWA program as it is today, by examining what has happened within the Carbon Trust OWA program

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[6] Steering Committee Member, March 17th, 2010. Recording time: 7:55

over time. To do this, a table has been created, covering the major organizational changes that have happened since the Carbon Trust was initiated by Mike Hay in 2007. Table 1: Carbon Trust OWA Timeline of Organizational Change will serve as a reference point for activities of the OWA program, while a description of each of these activities will follow, providing a somewhat more thorough understanding of the developments that have affected the program over time.

Table 1. Carbon Trust OWA Timeline of Organizational Change

Period	Event/Action
Dec. 2007	Conference in Berlin – Discussions concerning partner participation and possible focus areas for the OWA program
summer 2008	Workshop in London – Brainstorming with potential partners to select the particulars of the OWA program
Oct. 2008	Carbon Trust publishes the report, "Offshore wind power: big challenge, big opportunity"
Oct. 2008	Signed agreements between the Carbon Trust and five partners (offshore wind developers) – Airtricity (now SSE Renewables), DONG Energy, RWE Innogy, Scottish Power Renewables, and Statoil, to start the 18 month pilot project to identify novel technologies to demonstrate
Nov. 2009	Seven foundation concepts short-listed out of 104 entries for the OWA foundation competition
winter 2009/ spring 2010	Change of Carbon Trust OWA management, ending with Phil de Villiers as head of the OWA program after four others have occupied the post within the course of one year
spring 2010	Foundation design concept development ("Stage 1.5") – Further de-risking measures take place for foundation concepts; the four most promising designs for Round 3 become the foundation finalists (Keystone 'twisted jacket', Universal Foundation, SPT Offshore, GBF)
spring 2010	Negotiations between the Carbon Trust and OWA partners to change the OWA model to create two types of activities for "Stage II" of the OWA - Common R&D projects – paid for by all OWA members - Discretionary Projects – OWA partners opt-in to participate in demonstration projects
June 2010	OWA Stage II – contracts signed and work started
June 2010	Three new offshore wind developers join the Carbon Trust OWA – Mainstream Renewable Power, Statkraft, and E.ON--increasing the market share of OWA members from 45% to 60% of the UK's licenced capacity
March 2011	Fuga wake effects modeling tool available for use by OWA partners (developed through Wake Effects research area), delivering a step-change improvement in speed (runs in 30s, not weeks)
Aug. 2011	Access competition – 13 designs selected out of 450 entries to receive financial and technical support from OWA
Oct. 2011	Keystone's Twisted Jacket foundation is successfully installed at Hornsea – the first OWA Discretionary Project, and the first foundation installed for UK's Round 3
June 2012	Fjellstrand (OWA Access Competition finalist) wins order to build 6 vessels
July 2012	Two new team members join the Carbon Trust OWA management team (now core team of five)

Sept 2012	Turbine Advisory Board – first meeting
Sept. 2012	Cable installation becomes a fifth research area of the Carbon Trust OWA program
Dec 2012	Vattenfall becomes the ninth developer to join OWA, increasing market share to 77% of UK licensed capacity for offshore wind
Jan. 2013	3e's FLIDAR Floating LIDAR system completes sea trials at Gwynt Y Mor to validate reliable performance compared to a fixed met mast
Feb. 2013	PISA project kicked off to improve design methods for monopiles
Feb. 2013	Universal Foundation successfully installed at Dogger Bank
March 2013	Six LIDARs installed at Rødsand II to start the wake effects measurement campaign
March 2013	Two sets of sea trials undertaken to determine performance of new transfer systems using OWA sea trial procedures
May 2013	Higher voltage Cables Competition launched – competition launched for development of new 66kV cables

As already mentioned, Mike Hay approached possible partners of the OWA program at a conference in Berlin in December 2007, and in the summer of 2008, there was a workshop held in London, in order to decide the content and structure of the OWA program. The process leading to deciding on the four work streams was explained by an OWA management team member as follows:

> "So, to set up the work streams, we commissioned a piece of work that looked at what the major opportunities are for cost reduction in offshore wind. And I think Garrad Hassan and L.E.K. where involved in that piece of work. And they identified about 70 different options for cost reduction. Some of them are very technology focused, some of them are more to do with how you procure an alliance, and so on. And these options were assessed based on how much cost they could save, and whether the Carbon Trust is likely to be able to influence the outcomes. So those options were presented to the developers who were most interested in the OWA. And then they chose the 4 that we are focusing on now. So the Foundations, Access Systems, Wake Effects, and Electrical Systems. So I think the Carbon Trust proposed sort of top 5. And the developers got rid of two of the ideas that were proposed, and replaced it with a 4th one."[7]

The goal of each of these work streams was then, and is now, to accelerate technology and reduce cost in each of these areas. The structure of the OWA program was also set up so that Steering Committee members would meet face-to-face approximately every two months in London at the Carbon Trust headquarters, which has remained relatively stable over time. Additionally, Technical Working Group meetings were also set up to be held face-to-face as needed (also at the Carbon Trust headquarters in London) How often these meetings are held has varied, and does vary greatly, depending on the work stream and the activities being worked on. The reason for holding all of these face-to-face meetings with OWA partners is that:

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[7] Carbon Trust OWA Manager, Jan 17, 2012. Recording time: 4:50

"It ensures that at the end of the project you have something that is of value to everybody because [partners] have to buy in throughout the project. And I think by doing this we are able to sort of steer and change the project slightly early on, so we can identify quite early on when it goes into directions that we don't want it to go down."[8]

Another aspect that makes the Carbon Trust OWA structure unique is that all of the partners are end users of the technology that is developed through the program, and do not have a desire to own the technology. As stated by an OWA management team member:

"[The partners] are not technology companies, they are technology users. So they are not making profits by creating [Intellectual Property] IP. And that's another unique aspect. OWA is very focused because they are just developers. What is very unique, I think when you look at research programs - they normally try to get as much diverse expertise into their research program as possible. But then you have very diverse objectives, and that makes it more difficult - where here they all agree that we don't need IP. And then working with the innovators, that makes that much easier as well."[9]

As noted above, having partners that are only interested in developing offshore wind projects has also meant that innovators and designers are more willing to share their novel concepts within the OWA program, because they do not fear that their intellectual property rights will be taken from them. Returning now to the above timeline, in October of 2008, the Carbon Trust published a report titled: "Offshore Wind Power: Big Challenge, Big Opportunity". This report has received wide recognition since its publication, and as stated by an OWA management team member:

"One of the reports that the Carbon Trust published in 2008 is "Big Challenge, Big Opportunity," and that explained what a lot of the major issues are, and it's amazing that that report's still used to highlight some of the key issues. I know that in the US for example, DoE [Department of Energy] have produced a report which is basically a version of "Big Challenge, Big Opportunity" for the US market. So that's quite a good outcome from the Carbon Trust, to be able to influence things like that."[10]

Also in October of 2008, the non-disclosure agreements were signed between the Carbon Trust and the (then five) partners, and Technical Delivery Consultants were hired through an open tender in each of the four work streams. This began Phase I of the OWA program, which was an 18 month pilot period to identify novel technologies to demonstrate. During this Phase, the OWA program ran a Foundations Competition, to identify novel offshore wind foundation designs that could help to reduce cost and move innovation forward in this area. In November of 2009 seven foundation concepts were short-listed out of 104 entries for the OWA Foundation Competition, and these seven designers were invited to the Carbon Trust headquarters in London for

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[8] Carbon Trust OWA Manager, Jan 17, 2012. Recording time: 29:20
[9] Carbon Trust OWA Manager, Jan 17, 2012. Recording time: 1:19:20
[10] Carbon Trust OWA Manager, Jan 17th, 2012. Recording time: 1:23:05

interviews. Then, towards the end of 2009, Phil de Villiers stepped in as the head of the Carbon Trust OWA program, and has been filling this role ever since. In his words:

> "When I came into the program the OWA was moving from sort of a pilot phase to a longer term phase. So it was originally set up for a sort of 18 month period, to see how it was going to work out, with a relatively small contribution from the developers – there were only five involved to start with. And we wanted to expand it, so we increased the lengths so that it would run at least until 2014; we increased the contributions, and looked to see if other developers wanted to join as well. So I was really involved in setting up the Stage 2 of the OWA."[11]

The fact that Phil de Villiers was the fourth person to fill the role as head of the OWA program within one year was also quite disruptive from the perspective of the partners. As stated by a Steering Committee member:

> "I mean I was really worried if this [OWA program] was going to be a success or not, just because of all these changes in the management. So I have to admit, it was not fun. And I was really wondering if we should continue or not, because I think it's very important to have this continuity in the project in terms of management, because I felt like we had to start all over again, at least with some of the new entrants on the Carbon Trust side… I think Benj Sykes who was on board at that time. He was not part of the Offshore Wind Accelerator [he was the Head of Technology Acceleration for the Carbon Trust] – I think his commitment at that time, he convinced us at least at that time that he will at least follow this up from where he was standing. So at least we saw Benj Sykes there, but now we have Phil, and I think that's good."[12]

Phil De Villiers reiterated the fact that his boss, Benj Sykes provided continuity for the OWA program when it was going through a lot of internal changes, in an email message, saying:

> "Reflecting on our interview, you asked a question about how Carbon Trust had ensured continuity when the OWA manager position shifted from Mike Hay to James to Clarke Simmons to me… my boss Benj Sykes was very important, because he was actively mentoring me for the first six-months I was in the role, explaining the critical issues to be addressed, helping me to build relationships with the OWA members, helping to negotiate the terms of OWA Stage II, and managing the relationship between Carbon Trust and DECC [Department of Energy and Climate Change]."[13]

However, during the spring of 2010, it was not only the management that was shifting in the Carbon Trust OWA program; it was also the partners' desire to undertake novel foundation demonstrations together in Phase II. As stated by a Foundations Technical Working Group member:

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[11] Carbon Trust OWA Manager, Jan 17th, 2012. Recording time: 8:30
[12] Steering Committee Member, May 11th, 2012. Recording time: 7:55
[13] Carbon Trust OWA Manager, email correspondence. Jan 19th, 2012

> "Stage I was the foundation competition, and the evaluation and the meetings with the initial bidders and then we ended up with, I don't remember if it was 6 or 8 concepts that the utility companies could all bid into. And the idea was that we should move into a Stage II afterwards which was design and construction. But after Stage I, none of the utility companies wanted to proceed with the concepts, so what they did is they invented Stage one and a half, and they called it the de-risking stage… The formal reason [for not moving directly into Stage II] is because none of the utility companies saw enough potential in the concepts, and they required further de-risking. The concepts required further de-risking for the companies to go into it. That was the formal explanation, and I think, you know, there might also be other political issues, and it might also just be the fact that the companies are not ambitious enough. You know, they didn't see it as an opportunity. The way the people in the Technical Working Group saw it, I don't think they realized that it was an opportunity. But it might also be that it's the political question "Can we do this together with Statoil or E-On or RWE is this possible, with our competitors, to do this?"[14]

So, for whatever reason (and there is further evidence to support all of the above reasons), it was decided in the spring of 2010 to enter into Phase one and a half, where four novel foundation designs (Keystone 'twisted jacket', Universal Foundation, SPT Offshore, GBF) were chosen as the Foundation Competition winners, and further de-risking measures took place in the form of an installation cost study and a fabrication cost study for the four chosen foundation concepts. Because it was apparent that partners were hesitant to commit to demonstrating the novel foundation designs, the Carbon Trust very cleverly came up with a solution to the problem, which was to create Common Projects (paid for by all OWA partners) and Discretionary Projects (where OWA partners opt-in to participate in demonstration projects). Common and Discretionary Projects were proposed as part of the negotiations for the activity of the OWA program in Stage II, and this division was generally welcomed by the OWA partners. In discussing common and discretionary projects, a Steering Committee member said:

> "As long as we are early in the projects, like when we've got common projects [Phase I], that's not a problem, I mean that's more like an R&D type of project. But when we come towards pilots, testing, and prototypes [Phase II] – then the costs start to rise, and these discussions are more difficult of course. But I think having these discretionary projects is a way of avoiding a lot of these problems, because only those that want to participate, participate. And I think we have found a good way of also doing that. So that is working even though there are different approaches [both common and discretionary projects] to it [the work of the OWA program]."[15]

In addition to deciding on changing the OWA model to create two types of activity for Stage II (Common and Discretionary projects), the OWA program also attracted three new partners, namely Mainstream Renewable Power, Statkraft and E.On, bringing the total number of partners

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[14] Foundations Technical Working Group member, Dec. 12, 2011. Recording time: 20:20

[15] Steering Committee Member, April 18th, 2012. Recording time: 11:50

up to eight, and the total percent of UK licensed capacity for offshore wind from 45% to 60%. In June 2010 contracts were signed with all eight partners for Stage II, and the work began.

Then, in March of 2011, the Fuga wake effects modeling tool became available for use by the OWA partners. This tool was developed through the Wake Effects work stream, and it delivers significant improvement in the time that it takes to run calculations (runs in thirty seconds rather than weeks). This has been considered one of the "big wins" for the OWA program by many of its participants. In discussing the "big wins" of the OWA program thus far, a Wake Effects Technical Working Group member said:

> "I mean the big one is this bit of software called Fuga, which is really a bit of a game changer. I mean it allows us to do stuff that previously we just couldn't do in terms of flexibility and now we can really optimize projects based on layouts and design. And yeah, it has taken runs that used to take weeks down to minutes. So you can really churn through runs, and it just means that you can test a lot more hypothesizes, and therefor you'll eventually find a better project. So that's something we really achieved there."[16]

Also of note, in August of 2011, the OWA program completed its second competition, taking the learning from the Foundation Competition and applying it toward a similar competition for the Access Systems work stream. Out of 450 entries, thirteen designs were selected to receive financial and technical support from the OWA program. All of the OWA partners were also very happy with the outcome of this competition, saying, for example that:

> "We obviously recognize that this [Access Competition process] is worth a lot to us, that we didn't have to do this evaluation – well, we would never have evaluated all the 400 concepts ourselves – but we are happy with the robust process and the evaluation, and we are happy with narrowing down the set of interesting concepts, novel concepts, and then we will have to see whatever comes out of it in the end. But we of course recognize the benefit of these processes when they are robust, and we feel that it's credible, so to say. So it doesn't have to be euros immediately, that makes us happy for the time being, that's not the only thing that brings our mood up. But in the end we hope that this – that the evaluation of the 400 down to 13, and then down to somewhat fewer, that in the end, a couple of years from now, we will have the first tangible results, and that will be increased safety, or reduced cost, or whatever it might be."[17]

This quotation clarifies that although this Access System competition was a success, there are still expected to be further, tangible results coming from

Keystone at Hornsea 2011
Image from:
Offshore Wind Accelerator Newsletter

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[16] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 1:09:55
[17] Steering Committee Member, May 5th, 2012. Recording time: 26:45

the results of this competition, in terms of what is available on the market in the future.

Then, in October 2011, another major success was achieved when the Keystone Twisted Jacket foundation was successfully installed at Hornsea (one of the nine Round 3 zones). This was a joint venture between Mainstream Renewable Power and Siemens Project Ventures GmbH, with contribution from Dong Energy, marking the first OWA Discretionary Project. It was also the first foundation installed for UK's Round 3. As stated by Keystone's Managing Principal:

> "The goal of Mainstream was to have the first met mast[18] installed in Round 3, which they did. So from their perspective it was a crowning achievement. Of all companies that were awarded Round 3 development sites, they were the first one to get their meteorological measurement. Out there, installed on the platform, so that's significant. And they are one of these developers that are trying to sell the development to someone else. So from their perspective, that kind of helps them along, because the faster they can get the data, the faster that they can demonstrate that this is a good site, and somebody might want to buy it."[19]

Another significant development of the OWA program happened in June 2012, when Fjellstrand (an OWA Access Competition finalist) won an order to build six vessels. The significance of this development is that it provides further evidence that the OWA program is yielding tangible results that benefit the offshore wind industry. As stated in an Offshore Wind Accelerator Newsletter[20] (OWA Newsletter, 2012, Issue 6, p.1):

Fjellstrand WindServer
Image from: Offshore Wind Accelerator
Newsletter, September 2012

> "This is an exciting development not only for Fjellstrand [And their Fjellstrand WindServer design], but also for OWA, as it endorses the designs developed for the Access Competition… The design was developed by Fjellstrand for the Access Competition. OWA provided financial and technical support for tank testing and to develop and de-risk the design, and to validate the performance benefits. The design should allow turbines to be accessed in harsher metocean conditions, improving availability."

Then in July 2012, two new team members joined the Carbon Trust OWA management team, bringing the number of core management team members up to five. This was also a significant event, because with the number of activities being undertaken by the OWA program generally, having additional core management team members means that the team as a whole is able to be

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[18] A met mast is a temporary measurement tower placed on top of an offshore wind foundation that measures the wind resource on a prospective site. Typically they are as tall as the proposed wind turbines, and they log the wind speed data at frequent intervals for at least one year.
[19] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 28:35
[20] See Appendix 3: OWA Newsletter, 2012, Issue 6

more effective. This also meant that there were more people handling a very wide variety of tasks, and so in order to reduce the confusion about who was doing what, and who partners should contact concerning which issue, the OWA management team came up with a matrix describing who was responsible for what task. Describing this, an OWA management team member said:

> "All of us [Carbon Trust OWA management team], we don't really have fixed job descriptions, you just work on whatever's most pressing at the time, and so maybe I'll talk to you about contracting today, and then [someone else] will contact you about contracting tomorrow, and he'll also talk to you about delivery. You know there was a little bit of frustration that people had, you know: I don't know who to contact when I have to send invoices or when I have a question about this. So we did a bit of a grid for them, of who was responsible for what."[21]

So, an increase in core OWA management team members meant that they not only had more resources available to handle the large number of tasks undertaken by this team, but they also had a more structured understanding of who was going to deal with which task, making interaction more clear both within the management team, and for all of the OWA partners as well.

In September of 2012, there were two important developments that are listed in Table 1: Carbon Trust Timeline of Organizational Change, the setting up of a Turbine Advisory Board, and a new work stream, the Cable Installation Technical Working Group. As stated in an Offshore Wind Accelerator Newsletter (OWA Newsletter, 2012, Issue 6, p.2):

Box 1: Turbine advisory board and cable installation TWG

New turbine advisory board and cable installation TWG

The scope of OWA Stage II Year 3 includes two new initiatives.

Turbine Advisory Board
The Board is designed speed up the commercialisation of technologies developed within OWA. The turbine OEMs will have two roles.

Firstly, to meet twice a year to provide feedback on the latest findings from OWA and to comment on turbine implications.

Secondly, to participate in specific OWA projects where there is a clear interface between balance of plant and turbines, eg, impact of larger rotors on foundation designs and on wakes models.

Siemens, Vestas, REpower, Gamesa, Mitsubishi, Samsung, Areva and Alstom will attend the kick-off on 27 September.

Cable installation TWG
A new cable installation TWG has been set up and will look into reducing the time, cost and risks associated with cable installation. Specific projects will include alternatives to J-tubes and free-hanging cables.

As is shown in the box to the left, Stage II began at the start of the third year of OWA program activity. In relation to the turbine advisory board, this is an interesting development because turbines

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were consciously left out of the OWA program when it began. The reason for turbines being excluded and the importance of them coming into the OWA program later was explained by a Steering Committee member who said:

> "There was a conscious decision, which was correct, taken in the setup [of the OWA program] to look at everything except the turbines. So the foundations, wakes, electrical, and access, and one or two small sub-groups have been added in too, but not turbines. On the basis that turbines are being developed by the turbine companies, and in some cases very secretive, but in a lot of cases very specialized, and therefore very difficult for us to be involved in. But we've got to the stage now where some really quite radically new turbine concepts are coming through. They're all getting bigger, and it is very clear that a large component of the cost reduction that's achievable in offshore wind in the UK is related to these things. Therefore we have to be sure that the work of the OWA is totally aligned, and as well as doing its work to improve foundations, wakes, electrical, and access - it also facilitates what the turbines need to do to deliver their cost reduction. So that's going bigger, and the other innovations as well in the turbines. So that's a bit lacking at the moment, and I'm very keen to see that we build that into the OWA program to be fully effective."[22]

As this statement articulates, including turbines into the work of the OWA program may be a way to further reduce the cost of offshore wind in the future, as well as making sure that new innovations coming from the OWA program can properly interface with the larger turbines that are reaching the market. The Turbine Advisory Board (where turbine manufacturers discuss with OWA partners) may be an important first step in this direction. The other major development in September 2012 was Cable Installation becoming the fifth work stream of the OWA program. This was important because it was previously a sub-group of the Foundations work steam, which meant that not all participants of the work stream were interested in the issues being discussed. This point was made by an OWA management team member in January of 2012, when discussing a lack of cohesiveness in the Foundations work stream:

> "I think it's because it's such a diverse range of work, and I think actually we have a group called 'Cables' – it's not one of the research areas, but it's not really in Electrical, and it's not really in Foundations, so you have people from both that are participating, and there are some people that aren't interested in it at all... we call them part of the Foundations group, but it's going to be people from the companies that are either in the Foundations Group or the Electrical group, but then there are some other people that just attend this. We have a lot of work coming forward in Cables – it's a pretty big issue as well, so it will be interesting – we will be having our year 3 planning session in a month I think, and the outcome of that might be that we decide there's a Cables group."[23]

As this statement demonstrates, creating a separate Cable Installation work stream meant that Foundations and Electrical work streams could be more focused on their specific issues, and it

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[22] Steering Committee Member, April 24th, 2012. Recording time: 14:10
[23] Carbon Trust OWA Manager, Jan 27th, 2012. Recording time: 15:40

hopefully creates more cohesiveness and interest within each of the three work streams (Foundations, Electrical and Cables) for the respective Technical Working Group representatives.

Another major development for the OWA program happened in December, 2012, when Vattenfall became the ninth offshore wind developer to join the program, bringing the total percent of UK licensed capacity for offshore wind from 60% to 77%. One of the main advantages of Vattenfall joining the OWA program, besides the increased funding that the program received, was that another of the OWA partners was already involved in a partnership with Vattenfall, and not able to share some of the findings from the program with them because they were not previously a member. Referring to not being able to share results from the program in this instance, an OWA management team member said that Vattenfall joining the OWA:

> "made that problem disappear. I mean it still might happen but I think now the OWA partners represent 77% of the off shore wind consented lands by the Crown Estate. So, hopefully that's enough that it will cover most of the bases."[24]

So, as more of the UK Round 3 offshore wind developers have joined the OWA program, it has made sharing information in other partnerships easier as well.

Next, in January of 2012, the Wake Effects TWG had another success when an alternative to setting up a met mast, namely 3e's FLIDAR Floating Lidar system, completed sea trials at Gwynt Y Mor (an offshore wind development site) to validate performance compared to a fixed met mast. As stated in an Offshore Wind Accelerator newsletter[25] (OWA Newsletter, 2013, Issue 7, p.3):

The FLIDAR unit, deployed at Gwynt Y Môr in October 2012
Image: RWE 2012

"The initial results suggest that the FLIDAR design will become a bankable alternative to fixed met masts, which should dramatically reduce development costs because met masts – which can cost several million pounds – will no longer have to be built to validate wind resource… At the end of January, DONG Energy announced they would be using FLIDAR at one of their sites in the Irish Sea for one year, which is a great endorsement of floating LIDAR and the FLIDAR design."

Although more measurement is still needed in order to prove bankability, this was an important first step that promises great cost reduction in terms of wind measurement for offshore wind sites.

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[24] Carbon Trust OWA Manager, Jan 28th, 2013. Recording time: 9:25
[25] See Appendix 4: OWA Newsletter, 2013, Issue 7

Then, in February 2013, the PISA (Pile-Soil Analysis) project kicked off to improve design methods for monopiles. Explaining more about this discretionary project, an Offshore Wind Accelerator Newsletter (OWA Newsletter, 2013, Issue 7, p.2) clarified:

> "Led by DONG Energy, the two-year project aims to reduce the conservatism in design standards for piled structures. If successful, this should make monopiles more cost competitive in deeper waters supporting larger turbines. The approach for the project is to get a number of academic institutes to create a body of evidence to inform new standards. A panel of technical experts and an independent technical review panel will be established to guide the research and to review the outcomes. Many OWA members will be participating in this project, including RWE Innogy, ScottishPower Renewables, Statkraft, SSE Renewables and Statoil."

This project is both very appealing, as well as very challenging, which was well stated by a Foundations TWG member when he said:

> "We've been using the monopile for a very long time, and it's a very simple, easy, relatively inexpensive way of building foundations. And going into deeper waters, and further offshore… The monopole concept is just not going to cut it. They won't last. They'll fall over if we build them in very deep water. And the problem is that building it in 10 meters of water, and 20 meters of water is not going to double the cost, it's going to triple or quadruple the cost. And that's the problem that the whole industry has to come to terms with. And I think it's going to be SO much more expensive to build these foundations in deeper waters, and making it even harder to choose the right concept."[26]

Being a simple and relatively inexpensive foundation solution understandably makes it very appealing to offshore wind developers. However, the technology is not advanced to a point where monopiles can be built in the deep water conditions of the UK Round 3 zones. However, if this project is successful, it may make monopiles a viable solution for deep water as well, which would be an example of taking past learning forward, improving on a tried and tested foundation concept.
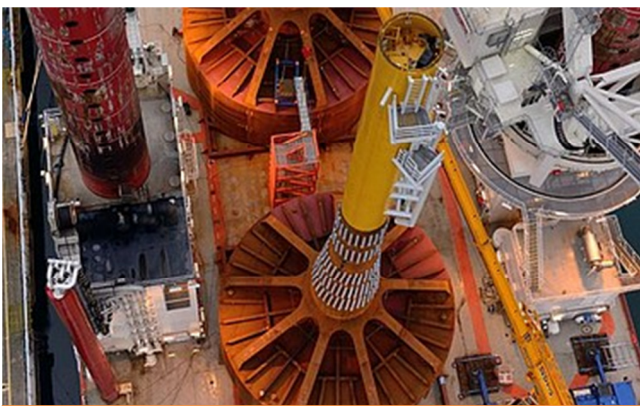
Dogger Bank wind farm features novel turbine foundations – Image: Universal Foundation's Suction Bucket Foundation

The next event on Table 1: Carbon Trust OWA Timeline of Organizational Change also took place in February 2013, when the Universal Foundation Suction Bucket was successfully installed at Dogger Bank (One of the nine UK Round 3 zones). As stated in an Offshore Wind Accelerator newsletter (OWA Newsletter, 2013, Issue 7, p.2):

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[26] Foundations Technical Working Group member, Dec. 12, 2011. Recording time: 1:33:35

"In February 2013, the first of two innovative suction bucket Universal Foundations was successfully installed at the Dogger Bank, 125 km off the UK's east coast to support a meteorological mast."

In the newsletter, it was also stated that this successful instalation followed an unsuccessful instalation, and correctins to the process were made for the second, successful instalation. This also shows a learning process that is being undertaken by members of the OWA program, a process that requires action to come to fruition.

Then, in March 2013, six LIDARs were installed at Rødsand II (a pre-existing offshore wind farm owned by E.On). This is a common project that builds upon the results from the first LIDAR project completed in January 2013 (OWA Newsletter, 2013, Issue 7, p.2):

> "The measurements will allow wake effects such as turbulence to be better understood, which should allow more accurate wake effect models to be developed. Data will be collected over the next six months. This project is being jointly funded by all OWA members."

This common project is taking the learning form the first Lidar project (completed in January 2012), and building upon learning gained at that time to improve the concept, thus gaining further "bankability" for the concept.

Also in March of 2013, two sets of sea trials were undertaken to determine the performance of new transfer systems using OWA sea trial procedures. Describing the way in which this process was set up, an OWA management team member said:

> "We have a fund of money, a certain portion of which would go to any of the partners that would trial one of the access systems, so if a partner says "yeah I am really interested in [a particular concept], they really just need to demonstrate their access system in order to help them move toward commercialization. I'll test their design on my vessel, I'll charter the vessel, and I'll do the test according to… [particular] specifications...." Then the Carbon Trust would say OK we appreciate that this is a commercial project and you're taking on some additional risks so we're going to give you a fund of 'x' thousand pounds to make this interesting for you to do. But then it is up to that developer to put together the trials. So then they're working along with that innovator…"[27]

In this way, the OWA program is helping to get new access system concepts to market, by making it attractive for the partners to test new technology, which was done twice in march 2013. Last on Table 1 is listed the third Competition launched by the OWA program, this time in the newly founded Cables work stream, for the development of new 66kV cables. As stated by an online press release from the Carbon trust on May 23rd, 2013 (Carbon Trust News, 2013):

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[27]Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 48:25

> "The goal is to ensure that new 66kV cables are developed in time to be used on Round 3 projects in the UK. Moving from 33kV to 66KV brings a number of benefits including the need for fewer substations, reduced system losses and cutting overall cable requirements."

As with the other initiatives undertaken by the OWA program, the goal of this competition is to improve innovation and reduce cost for use by offshore wind developers (OWA partners) in the UK Round 3 zones. This competition will also be able to take learning from the previous two competitions run (for Foundations and Access Systems work streams), and apply it to this competition, hopefully attracting the best new ideas from around the world.

This concludes the activities that are listed in Table 1: Carbon Trust OWA Timeline of Organizational Change (representing the most current information that was collected for this dissertation). Overall, the Carbon Trust OWA program can be viewed as an evolving program, which had some trouble in its first years, as reflected in a high rate of change within the Carbon Trust OWA management team, as well as problems among the partners in agreeing which foundations concepts should be demonstrated, and by whom. Since that time, four new partners have joined the OWA program, multiple foundation concepts have been demonstrated, a new work stream has been added to the activities of the program, and a number of partnerships have emerged within and because of the program, in some instances also bringing new technology to market (for example, Fjellstrand's WindServer). Today, the organizational structure of the OWA program that is presented on the Carbon Trust's website looks like this:

Figure 2. Organizational Structure of the Carbon Trust OWA program, as depicted September 2013

The main changes, in comparison to Figure 1 presented at the beginning of this section are three-fold. First, a new work stream – the Cables work stream – has been added. Second, additional partners have also been added to the program, bringing the total number of partners up to nine offshore wind developers who are participating in this program. The third main difference is that the Technical Delivery Consultants have been removed from this Figure. Although some of the work streams are still primarily managed by a TDC (such as the Wake Effects Technical Working Group), the performance of TDCs has varied greatly within the OWA program, which has meant that the OWA management team has played an increasingly important role in managing many of the work streams, and TDCs can now be seen as fulfilling a support function for the Carbon Trust management team (where and when they are present). As stated by the head of the OWA management team:

> "Well I think the Carbon Trust is improving the way that they interact with the Technical Working Groups, to get clearer steer from the Technical Working Groups on what they want to do, and what's important to them. And I think if we continue to build on that, then it will make it easier to get things done. The Carbon Trust probably needs to have some more face-to-face meetings with the Steering Committee members as well, to really understand what their agendas are, and what they're planning to do in the next couple of years as well. So we're going to plan some more face-to-face meetings in the next couple of months."[28]

As stated here, the Carbon Trust OWA management team is very conscious of their role in engendering participation and action within the OWA program generally, and they are constantly seeking to improve. This may also be one of the reasons why the OWA program has continued to increase its activities, as well as the number of partners participating, over time.

We now move to the last section of this chapter, which will discuss the Carbon Trust OWA program in relation to its relevance for the study of knowledge management.

2.3 The Carbon Trust OWA as an actor oriented innovation program

There are three aspects of the Carbon Trust OWA program that make it important and unique with relation to the study of knowledge management, which will be discussed in this section. In particular, the OWA will be described as an actor-oriented (Fjeldstrad, Snow, Miles and Lettl, 2012), super-flexible (Bahrami and Evans, 2005) program, and a case of semi-open innovation (Ulhøi, 2004). Together, these aspects create an increasingly important area of study with relation to knowledge management, because "High dynamism coupled with high complexity challenges traditional organization designs. In response, leading firms in complex, dynamic environments are experimenting with reconfigurable organization structures." (Fjeldstad, Snow, Miles and Lettl, 2012, p.736) Because knowledge depends on understanding, figuring out how

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[28]Carbon Trust OWA Manager, Jan 17th, 2012. Recording time: 1:37:50

understanding can be acquired and developed by individuals in new and changing contexts is particularly important in the twenty-first century, were mass-proliferation of information has resulted in "the need for rapid, effective responses to opportunities and challenges." (Fjeldstad, Snow, Miles and Lettl, 2012, p.738) Let us begin by looking at actor oriented, as opposed to hierarchical, schemes of organization.

The **actor oriented** scheme (Fjeldstad, Snow, Miles and Lettl, 2012) is understood as stemming from a highly interconnected global environment where "pressing challenges include keeping pace with shorter product life cycles, incorporating multiple technologies into the design of new products, creating products and services with customers and partners, and leveraging the growth of scientific and technical knowledge in many sectors." (Fjeldstad, Snow, Miles and Lettl, 2012, p.734) The problem is that "Traditional organizational forms employ hierarchical mechanisms as the primary means of control and coordination… and those mechanisms can constrain broad collaboration both within and across firms." (Fjeldstad, Snow, Miles and Lettl, 2012, p.735) In general, and particularly with relation to innovation, hierarchical and linear models of organization are continually being brought into question (ex. Leonard-Barton, 1995), because they are limited in their ability to adapt quickly to change, or to accommodate diversity and variability in the environment. With relation to innovation, recent literature would suggest that involved processes are "becoming more interactive in nature, increasingly requiring extensive and repeated interaction throughout the whole innovation process between a diverse range of actors from both within the innovating organization, and from external actors such as customers, suppliers, consultants, universities and public and private sector research institutions." (Hislop, 2009, p.115)[29] This context seems to match that of the Carbon Trust OWA program very closely. As clarified in the previous section, the OWA program is developing technology that will need to incorporate multiple technologies into the design of new products (in this case, the design of offshore wind farms), and does involve actors from customers, to suppliers, to consultants, etc.

In terms of what specifically constitutes an actor oriented program, they are seen as having three distinct elements: 1) actors with the capabilities and values to self-organize; 2) commons that allow actors to accumulate and share resources; and 3) protocols, processes, and infrastructures that enable multi-actor collaboration (Fjeldstad, Snow, Miles and Lettl, 2012, p.739). Let us now examine each of these elements with relation to the OWA program. First, with relation to *actors who can self-organize*, nearly all of the respondents interviewed in the Steering Committee, OWA management team, and Technical Working Groups displayed these qualities. For example, an OWA management team member said:

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[29] See also: (Jones et al. 2001; Swan et al. 2007)

> "Another very strong point of the OWA is that people understand where companies, where certain companies have certain expertise and strengths and weaknesses, and they build on each other… So you have a conference call talking about a business case on cable installation and you know that this partner has a real expert in this particular field. So all the other partners are very much listening to him. And you can ask questions. And to a certain extent he's directing this project probably more than some others. And they all have their certain strengths in certain areas."[30]

So, by understanding their own strengths, and the strengths of others within the program, actors within the OWA are able to organize in a way that allows relevant voices to be heard and taken advantage of, to the benefit of everyone involved.

The next element of an actor oriented program is *commons for resource sharing*. The OWA program has facilitated this by making the Carbon Trust headquarters in London a common meeting place for the primary activities of the program. For example, most Steering Committee meetings and Technical Working Group meetings are held at the Carbon Trust headquarters in London. Also, many of the different workshops and events that are arranged through the OWA program also take place in London. At the Carbon Trust headquarters in London, there are offices for private meetings, meeting rooms for larger meetings, coffee break areas for small talk, as well as public sitting areas to convene for impromptu discussions. In terms of accumulating resources, the OWA program also has a SharePoint site, where all final versions of documents created for the program are stored electronically.

The third element of an actor oriented program is having *processes that enable multi-actor collaboration*, and there are many processes within the OWA program facilitating collaboration. For example, most decisions taken by Steering Committee members and Technical Working Group members are taken in person through a process of discussion and voting (within each respective group), which allows all partners to be heard and influence the process. Also, the work being done for the OWA program is always sent out in an open call for tenders, so that as many different actors have the opportunity to participate as possible. Another aspect of the OWA program that enables collaboration is that the OWA management team is always ready and willing to answer any questions that other members of the OWA program have. For example, a Foundations TWG member said:

> "First of all the Carbon Trust, I think they provide just that important interfacing in-between role. I would deal with them more than anybody else, really. In terms of individuals, in terms of providing information, in terms of taking our views on board, and disseminating them throughout the rest of the project. So I feel sort of quite close to them."[31]

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[30] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:09:30
[31] Foundations Technical Working Group member, May 1st, 2012. Recording time: 4:20

As stated here, the OWA management team also plays an important role in actively trying to enable collaboration within this program. They not only give information freely when asked by OWA members, but they also disseminate information throughout the program on a regular basis so that all of the participants can engage as fully as possible within the program. Taken together, I would argue that the Carbon Trust OWA program is a definite example of an actor oriented program.

In discussing implications of actor orientation, the authors Fjeldstad, Snow, Miles and Lettl (2012, p.747) state: "Managers must realize that the most powerful applications of actor-oriented organization designs do not involve the augmentation of hierarchical organizational forms. Instead, they should use the actor-oriented scheme to redesign their organizations to enhance the ability to collaborate internally and externally." This would appear to be exactly what has been achieved by the OWA program. This program was not housed within any of the partner organizations, but instead convenes members in a separate space in London, where self-organizing individuals can interact in a common space, sharing knowledge for the purpose of developing innovation and reducing the cost of offshore wind energy. In sum, hierarchical and linear structures by their nature constrain complex innovative action and interaction. Because traditional organizational structures often have difficulty dealing with change, and because knowledge is dependent upon both action and interaction, studying actor oriented programs (where increased action and interaction is encouraged through autonomy) in relation to knowledge management is argued to be an important area of study.

In their book "Super-Flexibility for Knowledge Enterprises," Bahrami and Evans (2005) describe "worldwide trends" that exemplify the increasing need for and use of super-flexibility, including "extensive reliance on partnering, collaborative arrangements, offshoring, and outsourcing, variable use of contractors and contingent workers, deployment of cross-functional teams and geo-dispersed virtual groups, dissemination of knowledge management [what is understood in this dissertation as information management] systems and e-business tools, transparent governance procedures, and the re-engineering of core business processes." (Bahrami and Evans, 2005, p.2) What is important about emerging **super-flexible** organizations is that they display novel approaches to management, organization and strategy as their key characteristics. There are five interrelated principals that are understood to guide an organization (or in this case, a program) that is super-flexible. These are (Bahrami and Evans, 2005, p.7):

1) Recycling know-how, talent, and assets in a multi-polar ecosystem
2) Maneuvering the fluid business trajectory real-time
3) Recalibrating assumptions and initiatives as new realities unfold

4) Orgitechting the workplace to create a versatile yet resilient organization

5) Aligning multi-cultural knowledge workers by deploying peer-to-peer leadership practices

The Carbon Trust OWA program can be seen in many ways to fulfill these criteria, or principals. In relation to the first principal dealing with learning from failure, and *putting the learning to effective use*, the OWA program has, as stated in the previous section, taken learning from the first Floating LIDAR project that completed sea trials in January 2012, and applied changes to the design to incorporate learning when launching a subsequent project with six Floating LIDAR in March 2013. The second principal of *maneuvering real-time* has to do with not putting "all eggs in one basket." The Carbon Trust OWA program has been very successful in this area over time, as multiple competitions have selected multiple innovations (four foundation designs, and later thirteen access system designs) for further development. The third principal, of *recalibrating as reality changes*, has to do with making adjustments when implementing new initiatives or projects. The Carbon Trust OWA program is also very aware of the need for adjustment, and it is for this reason that Technical Working Group meetings are held regularly – so that the partner organizations can re-direct projects as needed, and in this way yield the most possible benefit for the industry. This point was also made by an OWA management team member who said:

> "I think the reason why we are monitoring carefully is because we want to be able to re-adjust the direction that we are going. So we are constantly on the tiller of this boat. And constantly adjusting - and we do this together with the buy-in from our partners... And that's the reason why, I think, we really need the partner involvement, and this constant review of where we are, and a good understanding of where we are going as well."[32]

The scholars Bahrami and Evans also have a very informative "Recalibration Process" for super-flexible organizations that is discussed in more detail both in the theoretical analysis and the empirical analysis chapters of this dissertation. Next, the principal of *"orgitechting" (referring to organization, technology and architecture)* describes the ability to make changes to the organizational design while keeping "cohesive building blocks" in place. When comparing Figure 1: Organizational Structure of the Carbon Trust OWA program, decided in 2008 to Figure 2: Organizational Structure of the Carbon Trust OWA program, as depicted September 2013, it is apparent that the OWA program has kept its basic structure (with a Steering Committee, Carbon Trust OWA management team, Technical Working Groups, and innovators and designers), while augmenting the structure over time to include, for example, more partners participating in Steering Committee and Technical Working Group meetings, as well as a new working stream to include a new and important area of technology for offshore wind development. The fifth principal of deploying *peer-to-peer leadership practices* has to do with, for example, having

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[32] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:03:15

customized rather than standardized approaches to interaction, focusing on outcomes rather than procedures, and being dialogue rather than monologue oriented (Bahrami and Evens, 2005, p.142). This is also something that the Carbon Trust OWA program can be seen to facilitate in many different ways. For example, one of the Steering Committee members said:

> "I think generally [the OWA] is a very constructive discussion climate. And it seems to be that everyone is open to share their views. They're not always the same, but it seems to me that they are sharing similar values in terms of: you express your view, present some arguments and so forth, and I just might not agree… if people don't turn in your direction, if you have a different view from the others, it seems that people share the kind of value that it's the majority that will decide."[33]

So, as this statement describes, there is more of a flat, peer-to-peer communication style present within the Carbon Trust OWA program. Although this is a very brief overview of the way in which the OWA program embraces each of these five interrelated principals, these issues are discussed in more detail in the following two chapters (particularly in relation to peer-to-peer interaction and the recalibration process).

The significance of looking at the OWA program as a super-flexible program is that it can contribute to research on the subject of knowledge management at a time when "Effective application of knowledge is becoming the core competitive differentiator. An interconnected world economy is bringing about complex geo-political triggers of change (…) Today there is widespread recognition amongst business leaders, academic scholars and management consultants that the business game is changing, and that novel frameworks, recipes and tools are needed to address the new challenges." (Bahrami and Evans, 2005, p.1) Studying knowledge management in such a context, then, should add to the body of literature regarding the way in which knowledge is understood and used in this increasingly important area of study.

Third, this case can also be seen as operating within a framework of **semi- open innovation** (Ulhøi, 2004), identifying it as a hybrid between closed (private) and open (collective) models of agency. As stated previously, hierarchical and linear models of organization are becoming outdated because they cannot adequately adapt to change. Because of this fact, "contemporary writers typically conceptualize innovation processes as having three closely inter-related characteristics: they are highly interactive, they require the development and utilization of heterogeneous networks of actors, and they involve the utilization of diverse bodies of knowledge." (Hislop, 2009, p. 116) In order to understand knowledge in this context, it is also important to understand the complex, emerging forms of innovation within which knowledge processes are taking place. Through coming to an understanding that innovation is being

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[33] Steering Committee member, May 5th, 2012. Recording time: 44:05

developed in contexts that are not completely private, or completely collective, the dynamics involved in decision-making processes may become clearer. The following figure depicts a continuum ranging from completely closed (private) to completely open (collective), and identifies a middle area where combinations of these elements can exist. This middle area is becoming increasingly prevalent as innovation processes become more interactive and diverse.

Figure 3: Semi-open innovation: a hybrid between closed (private) and open (collective) models of agency

The closed-open source continuum

The private model of agency	Hybrid models of agency	The collective model of agency
● Proprietary knowledge		● Non-proprietary and collectively owned knowledge
● Economic motives		● Psycho-social motives
● Legal measures of control		● Social control mechanisms
● High costs of participation		● Low costs of participation
● Rivalry among innovators		● Cooperation between innovators
● Free-riders are a concern		● Free-riders are not considered a problem
● The value of knowledge diminishes when consumed by others		● The value of knowledge increases with wide consumption
● Market rigidity		● Market flexibility

The private-collective continuum

Source: Ulhøi (2004, p.1096)

As stated by the author of this model (Ulhøi, 2004, p.1097):

 "A co-evolutionary perspective is well suited to addressing organizational phenomena that do not lend themselves to simple linear progression… given its fundamentally evolutionary and social nature, technological development is a result of interactive systems which are in a continual state of readjustment as innovators, entrepreneurs and users engage in recursive cycles of individual and collective sense-making and/or readjustment processes in an attempt to develop more effective learning and incentive mechanisms."[34]

The Carbon Trust OWA program is a good example of semi-open innovation, where there is a hybrid of both closed (private) and open (collective) innovation happening simultaneously. To illustrate this, each of the eight points in Figure 3 will now be discussed with relation to the OWA program. First in relation to *proprietary vs. collectively owned knowledge and information*, the OWA program has many examples of both. For example, by having common projects with

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[34] See also: (Lewin and Volberda, 1999; Lanzara and Morner, 2003)

results shared among all partners, there is definite collectively held information being produced by the program. Discretionary projects, on the other hand, only share knowledge and information with a subset of the partners involved, making those projects more proprietary. Allowing the intellectual property rights to stay with innovators and designers means that much of their critical knowledge stays proprietary, a consideration that, as we have seen, encourages their valuable participation.

Next, in relation to *economic vs. psycho-social motives*, the primary aim of the members of the OWA programs is economic – to drive the cost of offshore wind down through technology development. However, objectives of learning through the process of collaboration were also identified throughout interviews, for example by an OWA management team member who said that, particularly for the more involved companies:

> "They want to learn from the OWA, they like our competitions a lot, and if you ask them what they want to do next, then they'll consider it very carefully and come back to you with a very clear steer on what they want to do next, so they take it seriously and provide good feedback."[35]

So, although economic motives are most often the primary motives for cooperation within the OWA program, pyscho-social motives do also play a part in this process of innovation.

In relation to *legal measures of control vs. social control mechanisms*, the OWA program is also seen to have both in this regard. When talking about engagement among Steering Committee members and Technical Working Group members, this is primarily a social control mechanism, because these individuals participate on a voluntary basis, and input given by them benefits their own, as well as other partner companies, but is by no means required. With regard to innovators and designers, however, their work is detailed as specifically as possible in contract form, and underperformance in these instances results in either lack of additional payment, or termination of the contract. With relation to Technical Delivery consultants, for example, an OWA management team member said:

> "We have KPIs – so key performance indicators. So that could potentially increase your salary. We will pay you X; if you're really good we'll pay you X + 10%. So you could get a 10% bonus essentially. If you're awesome, you'll get a 10% bonus, if you're terrible you'll get nothing. So it's not that much, but it's still an incentive."[36]

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[35] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:07:10
[36] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 51:30

In general, the Carbon Trust OWA management team does actively use a combination of legal and psycho-social mechanisms to elicit engagement within the program.

In relation to the fourth point above, *high costs of participation vs. low costs of participation*, both of these can also be observed to a certain extent within the OWA program. In terms of the partners of the OWA program, they pay a fee to be part of the program, and the common projects that are developed through the program then draw from this collective pooling of monetary resources. However, the amount of money that the partner organizations put in should also be relatively low compared to what they get out of the program. For example, as stated by a Technical Working Group member:

> "…that is why we're still interested in the Carbon Trust – because we pay a relatively small amount for the knowledge that we do share, that we do get from there."[37]

The innovators and designers receive funding to develop their technologies and participate, sharing their ideas and knowledge with program members. So for the innovators and designers, there should be little to no monetary cost of participation. This demonstrates that through joint government and industry funding, the innovation development process itself should yield a very low cost of participation.

Fifth, in relation to *rivalry among innovators vs. cooperation between innovators*, the OWA program is seen as facilitating a degree of cooperation, although not full cooperation, between innovators. For example, one of the innovators, when discussing the competitions that were held by the OWA program, said:

> "As innovators, when we were in a room together, we all gave suggestions, and ideas to the other innovators: 'have you tried this?' Or 'have you looked at this?' Or 'have you looked at that?' You know, and we were just throwing out ideas, just based on kind of like looking at their concept. Well, some of those ideas you could pick up and use and it made the concept better."[38]

Although innovators keep their intellectual property rights, they do also seem to be open to sharing their ideas and cooperating fairly openly with other innovators when given the opportunity to do so. Also, when discussing the Technical Working Groups, a Steering Committee member said:

> "You know, if you get a bunch of engineers around a table, they will VERY quickly start talking about the problems and solutions and comparing notes and cross-fertilization like I said – that's exactly what we want. And sometimes they may actually be discussing things

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[37] Foundations Technical Working Group member, Dec. 12, 2011. Recording time: 38:05
[38] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 1:35:00

that senior management might not be themselves too comfortable with, but actually it has the real benefit of spreading learning and identifying solutions that helps us all."[39]

The fact that "top management might not be themselves too comfortable" with problems and solutions being shared would suggest that there is still a degree of rivalry between developers as well. However, this statement would seem to suggest that cooperation also exists among engineers of the different partner organizations.

Sixth, in relation to *free-riders being a concern vs. free-riders not being considered a problem*, the OWA program can also be identified as a semi-open hybrid in this regard. For example, in discussing this issue of participation, a Foundations Technical Working Group member said:

> "You have some of those observer types, as I said, that maybe are a little bit more hands-off. But I would say it's maybe about 50/50 or something. The others are contributing very well… I think this is ok. This is as good as it gets, I guess. I also notice that as times goes on, people get more involved , and if there is a particular topic that they have been experiencing, they even contribute with their experience, even though they might not talk all the time, they give input when they have something to give. The total benefit I think is very good."[40]

This statement would seem to suggest that while there are some free-riders or "observer types", the Technical Working Groups still seem to be able to function effectively. This statement would also seem to suggest that over time, free-riding has lessened, and TWG members may be opening up to a greater extent, which was a point reiterated in other interviews conducted with TWG members as well. So, although free-riding may affect outcomes to a certain extent, it does not seem to have hindered the OWA program in making increasing progress towards accelerating innovations for offshore wind.

Seventh, in relation to *the value of knowledge diminishing when consumed by others vs. the value of knowledge increasing with wide consumption*, the general consensus within the OWA program seems to be that the value of knowledge will increase with consumption, at least until the offshore wind industry can offer prices comparable with non-renewable sources of energy. Illustrating this point nicely, a Steering Committee member said, when asked if he foresaw a future in which the information and knowledge developed by the OWA program would be public, rather than privately held by the industry partners:

> "All of it will [be public]. It might take longer for some of the bits that we hold onto for a while, but eventually it will all be public domain - because it will benefit everybody in the long run. It makes no sense to do otherwise. Because the people that you see around this grouping here, we don't make a plant – we develop projects and we operate them, that's what

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[39] Steering Committee member, April 24th, 2012. Recording time: 27:50
[40] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 1:24:00

we do. So we don't make things, you know, specific items of a plant. If we can push information or knowledge or data or whatever into the public domain, that improves the supply chain and makes it more competitive, then everybody benefits."[41]

Here, the understanding is forwarded that the value of knowledge increases with consumption because it means that the market will become stronger and more competitive.

Lastly, with relation to *market rigidity vs. market flexibility*, there seems to be a huge demand for offshore wind innovation that is not being met with the current resources available, which would imply market rigidity. Part of what the OWA program hopes to achieve, and has been achieving, is to bring more players to the market, and create market flexibility. So, as this process unfolds, it may be thought of as a hybrid, moving from a more closed (private) market to a more open (collective) market.

In conclusion, the significance of this case being semi-open is that it provides further recognition (in addition to being actor-oriented and super-flexible) of the Carbon Trust Offshore Wind Accelerator case being a new and emerging organizational structure – a structure that is uniquely qualified to meet the knowledge challenges of the 21st century.

Now that we have discussed the background of the Carbon Trust organization, as well as the specific case of the Offshore Wind Accelerator program, including the relevance of this case for the study of knowledge management, we turn to a discussion of the methodological selections that have been made for this dissertation.

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[41] Steering Committee member, April 24th, 2012. Recording time: 17:30

Chapter 3: Methodology and Applied Method

As a starting point, it is important to specify that the concept of hermeneutics has guided all decisions made throughout this research process. The main idea is that moving from the whole, down to its parts, and back to the whole in repetition can help us to understand individuals and their perceptions at a specific time and place, and how that relates to their immediate context and the wider context of a particular phenomenon being studied over time. Because no one is a blank slate, or *tabula rasa*, in order for individuals to understand, it is important to link new understandings to what we have already understood in:

> "…a constant alternation between merging into another world and linking back into our own reference system. By means of this movement back and forth, we can successively come to an understanding of the unfamiliar reference system, something which also leads to the gradual revising and/or enriching of our own: there is a 'fusion of horizons.'" (Alvesson, Skoldberg, 2009, p.120)[42]

So, in order to truly understand phenomena, movement is necessary, and rather than being described as a hermeneutic *circle*, moving from part to whole and pre to post understanding, it may more usefully be thought of as a hermeneutic *spiral*. This hermeneutic spiral moves non-linearly as one constantly compares what is already understood with new impressions that affirm, change or augment ones understanding of both the whole, and the parts of which it consists. Gaining an appreciation of this natural (organic) process has helped many researchers (myself included) to pay attention to detail, as well as taking a step back to see the "bigger picture," for the purpose of creating understanding that is process oriented and context rich.

 This hermeneutic spiral process also has a set of very specific methodological implications for this dissertation that will be discussed in the sub-sections that follow. It has also had a very specific impact on the way that information is presented in this dissertation. This spiral process could have meant, for example, that a journal of sorts was presented, where changing and evolving understandings were continuously presented, ending at the point in time when the subject of observation (the Carbon Trust Offshore Wind Accelerator program) was no longer being observed or considered with relation to knowledge management and this dissertation. However, although it may have presented an interesting evolution of understanding, this continuous flow of thoughts would not be able to embody the "whole" of my understanding regarding the subjects being addressed. For this reason, my own writing has continually been assessed and re-assessed, revised revisited and revised again, in order to present the fullest understanding to date regarding issues of knowledge management and how they have been

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[42] See also: (Gadamer, 1998, pp. 306-307)

treated within the case of the Carbon Trust Offshore Wind Accelerator program. The intention is, through this process, to produce a cohesive, holistic, as well as nuanced, understanding of knowledge management that may be useful for directing future research on the subject. Additionally, this dissertation seeks to discuss the extent to which the presented understandings of knowledge management are supported by the case of the Carbon Trust Offshore Wind Accelerator program, and how knowledge processes may more usefully be managed by this program in the future to achieve the goal of *reducing the cost of offshore wind* by *accelerating relevant technology*. Let us now return to the framework supporting this dissertation, and discuss issues of social construction and integrative investigation.

3.1 Framework – social construction and integrative investigation

In their seminal book titled *The Social Construction of Reality*, Peter Berger and Thomas Luckmann (1966, p.204) write:

> "Man is biologically predestined to construct and to inhabit a world with others. This world becomes for him the dominant and definite reality. Its limits are set by nature, but, once constructed, this world acts back upon nature. In the dialectic between nature and the socially constructed world the human organism itself is transformed. In this same dialectic man produces reality and thereby produces himself."

This statement leads to some very important understandings about the nature of what individuals know, and how we come to know it. First, this statement places importance on interaction, as we "inhabit a world with others." Creating meaning does not happen in a vacuum, and meaning is not pre-established and fixed, which means that there is not one "truth" that is waiting somewhere to be discovered. Rather individuals negotiate meaning, and meaning changes over time as new understandings are negotiated and reached. Because individuals use language as one of the predominant means of communication, "It is important to reflect upon how words do not merely mirror reality, but construct a particular version of it… the key point is social recognition and social construction – not knowledge as an objective fact." (Alvesson, 2004, pp. 27-30) And this leads to the second and perhaps most important point in Berger and Luckmann's statement above, namely that reality is not some 'fixed' entity, but rather the reality for any particular individual is formed through their surroundings and interactions, and is thus "socially constructed." In relating this idea to the field of knowledge management, the scholar Mats Alvesson asserts that "knowledge and theory in social science are never about presenting the absolute truth or an objective picture in any abstract or neutral way. We always proceed from our pre-understanding, based on conscious and unconscious assumptions and expectations." (Alvesson, 2004, p. 236) This articulation, along with the end of Berger and Luckmann's statement pointing to a dialectic process, where nature impacts individuals, and individuals in turn impact nature, brings us back

to the hermeneutic spiral, where part impacts whole and vice versa in a continual process leading to new understanding, development, and evolution. But if there is no universal or "absolute truth," then how is it possible to evaluate a concept (such as knowledge management) or a phenomenon (such as the Carbon Trust Offshore Wind Accelerator program)?

These processes, as is the case with any social process, involve many complex interactions, meaning that the often applied cause and effect predictions do little to accurately describe or predict outcomes in social contexts. Reiterating this, the scholar Philip Anderson states that "Simple boxes-and-arrows causal models are inadequate for modeling systems with complex interconnections and feedback loops, even when nonlinear relations between dependent and independent variables are introduced by means of exponents, logarithms, or interaction terms." (Anderson, 1999, p. 217) This would suggest that linear causality is an insufficient way to analyze social phenomena. Indeed, as stated by Andrew Abbott, "all too often general linear models have led to general linear reality, to a limited way of imagining the social process." (Abbott, 1988, p.183)   The types of common presumptions made when using general linear reality are explained by Abbott as, for example: denying the importance of context and history for a particular outcome; ignoring change by describing entities as "fixed" where the only change happens by way of attributes; maintaining that causal flow always moves from large to small, or; that the sequence of events has no impact on the outcome (Abbott, 1988). As should be apparent, general linear reality does not compare the parts with the whole to understand how individuals, events and interactions are interrelated and contribute to evolving phenomena over time. Hence we come to a point where we know what is not desired, namely linear models predicting cause and effect relationships, which are often presented by positivist and functionalistic methodologies.

The alternative presented in this dissertation is to achieve a holistic, organic and inclusive understanding of processes or phenomena (in this dissertation, of knowledge management processes in the case of the Carbon Trust Offshore Wind Accelerator program) through a new term: **integrative investigation**. Integrative investigation is understood as a more accurate name for the concept of *explorative integration*, which has been developed by the scholar Erik Maaløe at Aarhus University, Denmark. In Maaløe's terms, explorative integration is defined as a spiral approach "of continuous dialogue between pre-chosen theories, generated data, our interpretation, and feed-back from our informants, which hopefully will lead us to more inclusive theory building or even understanding." (Maaløe, 2004, p.3) As specified by Maaløe, this is an inclusive methodology, which challenges the researcher to articulate their own assumptions up front, in order to critically analyze these ideas, comparing and reforming them as they receive feed-back

from observation and interaction in the field. As articulated by Maaløe in a personal correspondence: "It is such a shame only after fieldwork to be able to identify what we ought to have looked for… By constantly revising the scenario and adding substance to it, moving through the field becomes a learning experience." (Maaløe, 2009, personal correspondence)[43] Thus, by formalizing one's own frames of reference, one is able to more accurately compare them to other individuals' frames of reference, comparing, contrasting and reforming these frames to ensure that the highest level of understanding (and learning) possible is achieved. How precisely this is achieved, as a step-by-step process, is articulated below in Figure 4: Integrative Investigation, with the accompanying explanation.

The reason for the change in terminology from *explorative* integration to *integrative* investigation is that explorative integration connotes a type of un-formalized search, which is deemed disingenuous with relation to this methodology. The idea is not that researchers should constantly seek out new theories, but rather that they should use their knowledge of existing theories on a subject or subjects, integrating them to form a first impression, or starting point, for their investigation. This initial integration is then enhanced and augmented as the researcher collects empirical evidence, comparing new information to these initial ideas, and integrating new "parts" to form a more inclusive whole, both theoretically and empirically. As such, integrative investigation moves beyond explaining theory, which is "the prevalent mode for theory testing" (Maaløe, 2009) and moves instead toward *understanding* and *interpretation* of theory within a specific context.

In this dissertation, the implication of using integrative investigation as a methodology will be to achieve the aim of understanding and interpreting knowledge management, both theoretically from an organic paradigm perspective and within an actor oriented innovation program, namely the Carbon Trust Offshore Wind Accelerator program. Let us now move to a step-by-step description of how to proceed from the perspective of integrative investigation. Integrative investigation proceeds through three modes (adapted from: Maaløe, 2009, p.20):

1) *Explanatory mode*: It begins through a design to uncover whether the theories are strong enough to actually explain the moves and situations that are bound to occur in the field of change that we, as researchers, are going to step into.

2) *Interpretive mode*: Any observance or conclusions we draw as we go along are consciously seen as an interpretation within the process. We do not "just observe and make

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[43] See Appendix 5: Maaløe: Personal Correspondence

notes," we knowingly select what we are able to see and have words for and thus make ourselves vulnerable to be helped to perceive other modes of sensing.

3) *Understanding mode*: By opening up to the life worlds of others, relying not only on language as an informational tool, but being sensitive to the expressions, hesitations to speak, laughs and metaphors, we try to obtain a glimpse of the realities hidden beneath the speech of others as well as ourselves.

These three modes create a research process with "a constant dialogue between emergent impressions of what people in the field contain of life experiences, vis-à-vis the personal as well as the theoretical predispositions of the researcher." (Maaløe, 2009, p.20) This process can also be depicted as follows:

Figure 4: Integrative Investigation[44]
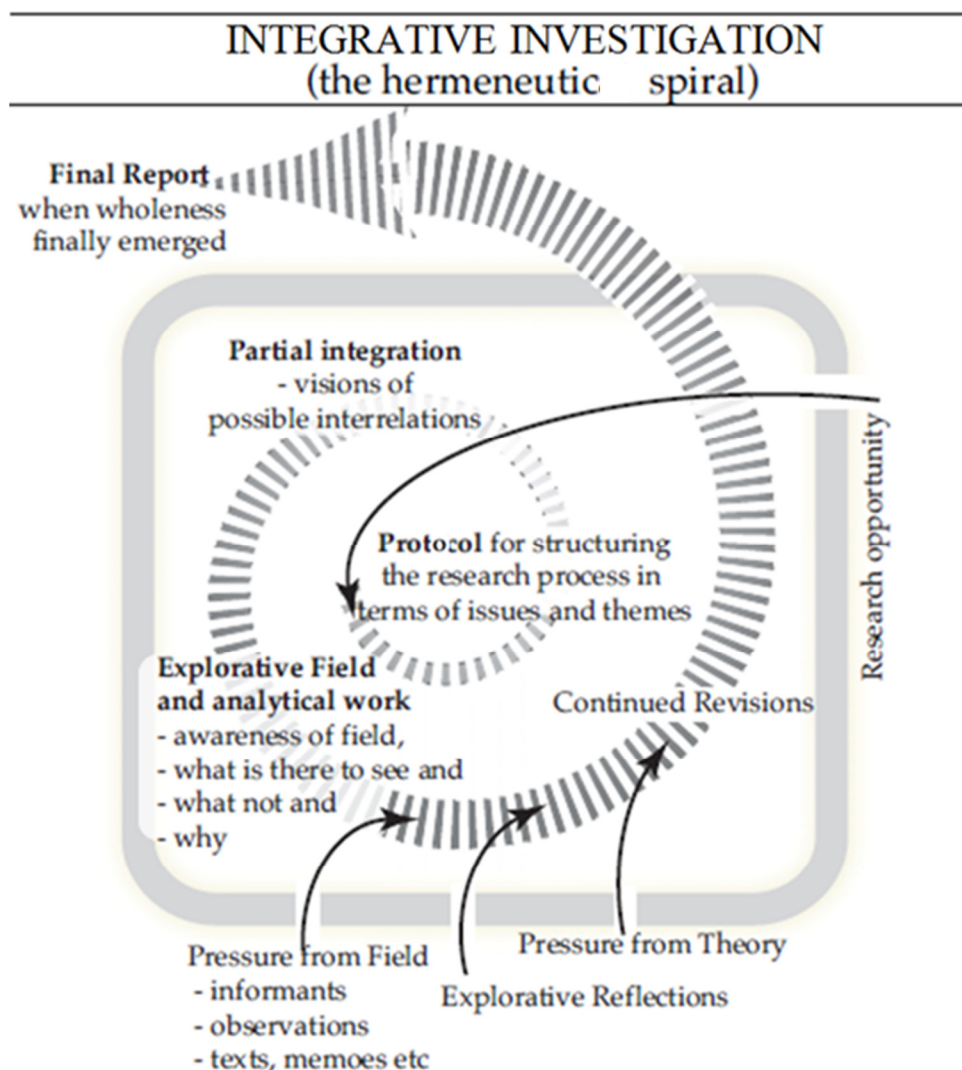
Integrative investigation is a successive inclusion of interpretations and understandings (parts) into the overall picture of a phenomenon (the whole). This process coincides with the hermeneutic spiral, and indeed is even named "the hermeneutic spiral" as a sub-heading, lending further credence to the use of this methodology in line with the overall hermeneutic process utilized throughout this dissertation. Let us now relate this figure to the three modes presented just above, and explain how each has been dealt with in this dissertation. They can be grouped as follows:

Explanatory mode: ***Protocol*** & ***partial integration***
Interpretive mode: ***Explorative field and analytical work***
Understanding mode: ***Final report***

First, under the category of the explanatory mode is ***protocol***, where the research process is structured by highlighting important issues and themes. For this dissertation this process started by reading literature on knowledge management from a variety of perspectives, from IT management to Human Resource management. This also led to the interrelated field of organizational learning. Literature on talent management was also included, with the idea that managing individuals, and thus their talent, was important. Many important issues and themes came out of this initial reading, re-reading and organizing. In particular, tacit and explicit knowledge were highlighted, as well as a debate about the usefulness of IT systems for knowledge management. How to define knowledge per se also presented itself as a contested issue, raising the question of whether talent management literature was really relevant or necessary for getting at the human aspect of knowledge management (as the field of knowledge management itself was so inclusive, and had a somewhat more robust view on this issue than the literature available on talent management). In the end, the choice was made to focus all efforts on the issue of knowledge management, excluding talent management, and including organizational learning as an important part of managing knowledge processes.

Next, and also with relation to the explanatory mode is ***partial integration***, where first attempts at sensemaking are made between themes and issues. In relation to the process of this dissertation, in order to make sense of knowledge management issues, key issues were initially separated into three categories: managerial group practices, team practices, and individual practices. Each of these categories had their own set of practices which seemed beneficial and particular to each of them. After nearly a year of study, it became apparent that the case in point would consist of multiple partners, which meant that context and alliance literature was also relevant. However, alliance literature seemed too focused on joint ventures, where only two organizations were

collaborating. A more complex process of interaction (where over five separate organizations were collaborating) needed explaining, and the issue of innovation became central (because the case I would focus on was developing technical innovations in offshore wind). Thus, literature selections with relation to knowledge management would somehow need to reflect issues of multi-partner collaboration and innovation as well.

When I was deep in the process of categorizing and trying to make sense of the myriad of issues relevant to knowledge management and the case study, I went to a PhD course in November 2010 at Aarhus University with Professor Charles Snow of Penn State University. After listening to my presentation, he suggested that what I needed was a way to identify what was critically important with relation to knowledge management for my specific case study. Over the following two days of the PhD course this idea developed into the categorization of drivers, obstacles, and critical success factors for knowledge processes. The idea behind this classification was to structure knowledge management issues in a way that could describe how they are seen in practice, discussing each issue in terms of what has been, or could be done to positively impact knowledge processes. Professor Show also gave a presentation about actor oriented organizations, which helped me to at last identify a meaningful way to describe the type of case I would be studying. This course thus provided me with two key elements of the framework that are presented in this dissertation.

Shortly after this PhD course, I went to New Mexico State University for a semester to study with Professor David Boje, who also had a great influence on my ability to look for the unexpected and see nonlinearity and spiral processes at work within organizations. This experience of working with Professor Boje also gave me a way to perceive more inclusive and organic aspects of phenomena. He inspired me to look at the dynamic and dialectic nature of events, taking past present and future into consideration for understanding a more inclusive whole. This would prove beneficial as I prepared for the primary interviews that I would begin conducting upon my return to Europe.

These are only a couple of the more prominent examples of how different ideas were formed at this stage, although a number of other stories could be told here as well.

We now move from the explanatory mode to the interpretative mode, which consists of ***Explorative field and analytical work.*** Explorative field and analytical work is where the researcher gains an awareness of the field, finding out what is there, what is not there, and why. This time is also informed by a series of external and internal pressures to augment or change how one perceives and understands what is transpiring in practice. These pressures come from

interviews conducted, reports, emails, and other literature gathered, observations made in the field etc. Other pressures come from one's own reflections, changing and reshaping how individuals and situations are perceived, as well as additional literature that is read and incorporated at this time. For this dissertation, all interviews conducted covered three broad issues: 1) orientation regarding work with the OWA program, 2) Social network questions to discuss where, when, why and with whom interactions took place regarding the OWA program, and 3) questions related to the topic of knowledge management, including what they understood by knowledge and how it functioned within the processes of the OWA program.

Because the categories of drivers, obstacles and critical success factors did not have any real content in them, part of what I was trying to understand during interviews was what was important to the individuals that I interviewed regarding the OWA program, what helped them to do their job, what hindered them from doing their job, or what did they think might help them do their job better. Observations were also made of working behavior, and informal conversations were had at conferences and over lunches, all of which was compared and contrasted to the existing knowledge management literature. As time went on, the categories of drivers, obstacles, and critical success factors gradually began to be filled in. As this process unfolded, the primary writing process of this dissertation began. Reports were also presented to the OWA program members whom I interviewed, which presented some of the results of my work, meaning more discussions and also some changes in how the OWA program operated.

And this leads to the final mode – the understanding mode – which has culminated in the *final report*, or dissertation, that you are now reading. This is the most whole, complete understanding that I have of knowledge management and how (and to what degree) knowledge processes function within the Carbon Trust OWA program, to date. In the chapters that follow, what is presented has been thought and re-thought, worked and re-worked until the most clear argumentation possible is presented. The aim is that by the end of this dissertation a clear and well founded conceptualization of what knowledge and knowledge management is and is not will have been presented, along with a clear understanding of how knowledge management can usefully be applied in practice, particularly with relation to actor oriented innovation programs. It is also an aim to present a deep understanding of how the Carbon Trust OWA program has managed knowledge processes, and how they might more usefully be managed in the future.

The idea behind using integrative investigation is not that a researcher doing a similar study would follow exactly the same path or come to exactly the same conclusions as presented in this dissertation. Instead, it aims to provide a holistic way to approach knowledge and knowledge management, one that necessitates changing and evolving realities to guide decisions that are

made in each new circumstance. The theories and tools presented in this dissertation may, however, be able to guide future research on knowledge management in a direction that is beneficial for the field as a whole, leading to a more robust understanding of how knowledge processes can be managed, particularly with relation to actor oriented innovation programs. What could easily be replicated from the use of integrated investigation is a robust and well substantiated process, leaving researchers with new insights about how theory relates to practice, and how one area is able to enrich and inform the other to draw conclusions that are useful for both. We now turn to a closer examination of the choice of theoretical literature.

3.2 Qualitative method and case study research

As stated in the book *Research in Practice*, "Qualitative research, in contrast to quantitative research … seeks to preserve the integrity of narrative data and attempts to use the data to exemplify unusual or core themes embedded in contexts." (Blanche, Kurrheim, Painter, (eds) 2006, p.563) As specified in the introduction, the field of knowledge management is currently divided on a number of issues, from the meaning of knowledge itself to an understanding of which areas are of critical importance to the field. For this reason, conducting a qualitative (as opposed to quantitative) study is deemed both relevant and important, in order to gain greater depth of understanding about what is involved and necessary for knowledge processes and their success in aiding actor oriented innovation programs in achieving their goals. For the research presented in this dissertation, having the three overall categories of drivers, obstacles, and critical success factors provided an empty framework in which to place meaningful "core themes" which were "embedded in the context" of the Carbon Trust Offshore Wind Accelerator program. The "core themes" or constructs which appear in this dissertation were structured and restructured, replaced and re-arranged until primary interviews were concluded, and all theoretical and empirical information could be analyzed in a holistic manner, drawing out main concepts, as well as inconsistencies and unusual findings from the case as it compared to the management literature on the topic of knowledge management.

For example, the use of so-called "knowledge repositories" is a topic that is often discussed in relation to knowledge management. However, IT tools, although seen as necessary to a certain degree, were not prioritized by respondents in this case study. The degrees to which IT tools are perceived as necessary and useful in this case present some interesting findings with relation to knowledge processes. Namely, it is suggested that the word "knowledge repository" is a misnomer, and that the type of information that IT tools provide needs to be very carefully selected based on there being a real need for a particular IT tool. Face-to-face interaction, on the other hand, was an issue that was highly prioritized by all respondents as important for a variety

of knowledge processes. However, the complexity of the situation (having nine different organizations participating on a variety of individual projects) meant that in practice some creative solutions had to be found. The ways in which personal interaction is dealt with in this case, and the degree to which these ideas could be carried over to other actor oriented innovation programs, is one issue discussed throughout the dissertation.

So, rather than seeking to generate quantifiable data from pre-determined categories, for the purpose of making broad, generalizable comparisons (which is typically the case with quantitative research); a qualitative method was chosen in order to study knowledge management related issues with "depth, openness, and detail… [in an] attempt to understand the categories of information that emerge from the data." (Blanche, Kurrheim, Painter, (eds) 2006, p.47) The categories that did emerge at the end of this process do, to my mind, paint an overall picture of the way that knowledge processes are perceived and managed within the Carbon Trust Offshore Wind Accelerator program. Because theory and practice informed each other in an iterative, hermeneutic process throughout the time of investigation, the resulting theoretical analysis (presented in chapter 4) and empirical analysis (presented in chapter 5) are a mirror image of one another.

In chapter 4, the theoretical analysis presents an understanding of knowledge management in the case of an actor oriented innovation program. This understanding has been informed and shaped by the case study, contributing to the selection of relevant theories and tools that were deemed relevant to the knowledge processes of this case. Similarly, in chapter 5 the empirical analysis is presented in a way that was shaped by theory, as well as the way in which respondents used language to talk about processes that they found important for the Carbon Trust OWA program. This means that chapters four and five are more or less a result of the chosen theory and issues discussed based upon this theoretical choice. If the topic of this dissertation had been related to the field of engineering, discussing technical aspects of the concepts being designed within this program, the results would look very different. Or, if the topic had been work-life balance, again the results of this dissertation would have had a different focus in the discussion, and different important categories to highlight and analyze.

This does not, however, mean that structures and themes were imposed on respondents; rather, the interviews conducted were semi-structured, meaning that there was "a sequence of themes to be covered, as well as suggested questions. Yet, at the same time there [was] openness to changes of sequence and forms of questions in order to follow up on the answers given and the stories told by the subjects." (Kvale, 1996, p.124) This was deemed the best way to uncover new concepts

that might emerge from the information being given by the respondents, while at the same time covering a range of issues presented in knowledge management literature.

3.3 Case study selection

As a starting point, statements like the following have led not only to the selection of knowledge management as the predominant theoretical base for this dissertation, but also to the selection of a case study involving innovation (Moittra, 2002, p.i):

> "Increasingly […] globalization has also led to the establishment of a twenty-four hour innovation engine, generating knowledge across geographical and national boundaries, though it still largely remains a challenge to effectively manage this innovation engine."

This statement describes exciting developments, as well as tough challenges for those who want to "effectively manage innovation." The key elements in this statement are also presented in a more structured way by the scholar Donald Hislop, who describes three characteristics of contemporary innovation processes. According to Hislop (2009, p.126) contemporary innovation processes:

1) **Are highly interactive** – with dynamic, intensive communication happening between organizations and a diverse range of actors (other individuals, groups, and organizations)

2) **Develop and utilize networks** – an increasing need to access knowledge not possessed internally, creating a complex web of diverse relations among for example competitors, customers, suppliers, research organizations, universities and governments

3) **Involve complex interaction of knowledge processes** – not just knowledge creation processes, but also knowledge acquisition, knowledge sharing, organizational learning, etc.

As suggested here, a good case study of contemporary innovation in which to study knowledge processes should include dynamic interactions, a diverse web of relations, and complex interaction.

When I began my search for a case study, I had recently participated in a climate conference, which gave me an awareness of exciting innovations happening in the wind industry. This led me to select a group of Danish organizations that are currently involved in wind innovation regarding possible collaboration concerning my PhD research. One of these organizations was DONG Energy, whom I contacted because of their 85 -15 strategy. As stated by Dong Energy's CEO, Anders Eldrup, "Today, 85 per cent of DONG Energy's power and heat production comes from

fossil fuels and 15 per cent is carbon-neutral. DONG Energy wants to turn the numbers around within a generation. We call the strategy 85/15." (United Nations Global Compact, 2010) This strategy means that over the next 30 years DONG Energy will reduce CO2 emissions per produced kWh to 15 percent of current levels, and wind energy will play a large part in this shift. DONG Energy Wind Power is currently the market leader within offshore wind energy, having more than 20 years of experience in the industry, which, as stated on their website, has resulted in "unique knowledge and skills." (Dong Energy Wind Power, 2013)

For this reason, in September 2009 I contacted Charles Nielsen, the R&D Director at DONG Energy who had presented their 85/15 strategy at the Joint Actions for Climate Change conference in June 2009. Eventually this led me to a person in DONG Energy who was involved in a number of different wind energy projects, one of them being the Carbon Trust Offshore Wind Accelerator program. In our discussion of the OWA program, it became apparent very early on that this was a very complex case, leading this individual to suggest my collaborating with another project instead – one that did not have as many participants involved in the work. As he put it: "That would be another option. Where we maybe have the two of us, Dong Energy, and a 3rd partner – maybe Siemens Wind Power – that would be another option. What do you prefer?" (DONG Energy, March 17th, 2010. Recording time: 24:15) Because the Carbon Trust case promised to have all of the elements described above as a *contemporary innovation process*, my immediate response was: "I think that we should do this, and see if it is possible."

This meant that instead of having a joint venture with two partners as my case study, I would be studying a partnership between eight (and what is today nine) different offshore wind developers located in different countries around Europe, and headed by the Carbon Trust located in London. Additionally, the projects being developed would be accelerating innovation in not one, but four (and what is today five) separate areas, and require a number of diverse and complex partnerships between *competitors, customers, suppliers, research organizations, universities* and *governments*. In short, this case was selected precisely because of its complexity. Because of the number of actors, and the number of different yet related innovations being developed, this case promised to hold the most insight for understanding knowledge processes in *contemporary innovation*.

As Alliance and Joint Venture literature typically focuses on collaboration between two organizations, the selection of this case also meant the need for theoretical literature on new organizational forms. In the previous chapter, the Carbon Trust was presented as an actor oriented innovation program, containing elements of super-flexibility (Bahrami and Evans, 2005), actor oriented organizational form (Fjeldstad, Snow, Miles and Lettl, 2012), and semi-open innovation (Ulhøi, 2004). The reason for paying particular attention to the organizational form of the Carbon

Trust OWA program is that, as stated by the scholars Tsoukas and Vladimirou (2001, p.984): "there are, indeed, important differences between organizational forms concerning the dominant types of knowledge to be found in each one of them."[45] As stated here, the way that knowledge is perceived and used within this type of organization (or program) may differ in important ways from other organizational forms. This understanding also fits well with the ideas already proposed by integrative investigation, qualitative method, and case study investigation, that the goal is not to create generalizable data from pre-determined categories, but rather to use the hermeneutic spiral process to build understanding about this specific case, creating meaningful categories and themes as they emerge.

As stated by the authors discussing the super-flexibility of organizations: "We hope that our findings on the organizational architectures of high technology companies provide additional insights and offer practical suggestions for addressing a few of the organizational design challenges of the post-digital age." (Bahrami and Evans, 2005, p.110) Indeed, additional insights and practical suggestions were not only taken from their book to inform this case, but this dissertation also aims to do something similar for the field of knowledge management with relation to actor oriented innovation programs – to offer new insights and practical suggestions that have been gained from the case analysis of the Carbon Trust Offshore Wind Accelerator program.

We now move from the discussion of case study selection to a discussion of the way in which data was collected and processed for this dissertation.

3.4 Data collection, processing and feedback

Starting from the perspective that individuals have their own unique ways of seeing things and shape their realities collectively, I have used integrative investigation to look at what is happening in the Carbon Trust OWA (an actor oriented innovation program), and compared it with theories that I had already read. When I saw something that was unfamiliar within the OWA program (such as the organizational structure), I located literature that could shed light on problems or issues being faced, being careful to get a well-rounded perspective regarding each particular issue. In order to keep away from having a linear progression to my work, the hermeneutic spiral was used to continually analyze the actor oriented innovation program as a whole, and then look at specific aspects of individuals within participating groups, then at each group as a whole, etc., repeating this process again and again. This iterative procedure provided a foundation for understanding the context of this actor oriented innovation program in a more nuanced, dynamic

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[45] See also: (Lam, 2000)

and holistic way. Despite this hermeneutic spiral process, there were also a number of steps that were followed with relation to data collection, which will now be presented in chronological order, followed by a table presenting a timeline of primary data collection.

The first primary data collected for this dissertation took place on March 17, 2010, when I had lunch with, and subsequently interviewed, an individual who got involved with the Carbon Trust OWA program in the planning stages in December of 2007. Over lunch, we discussed my previous knowledge of the wind industry, my project aims, and how this individual's organization was meeting some of the challenges of the offshore wind industry at that time. Semi-structured interview questions were prepared in advance, but the formal interview began with the interviewee giving a power point presentation of the structure and activities of the Carbon Trust Offshore Wind Accelerator program. During this presentation, Figure 1: Organizational Structure of the Carbon Trust OWA program, decided in 2008 was presented.
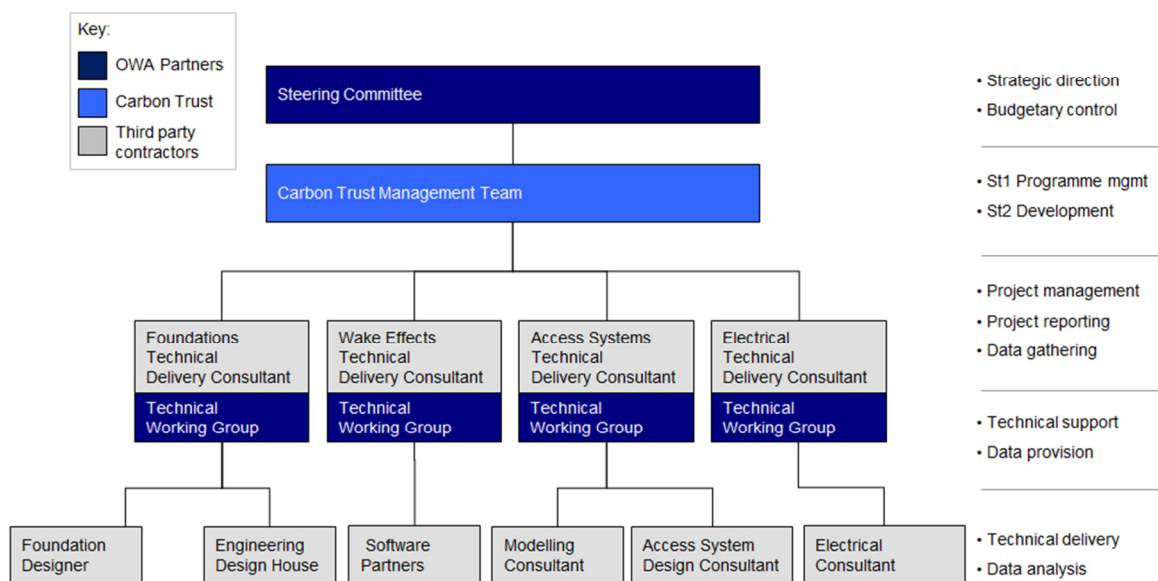
A discussion followed about the roles and responsibilities that the individuals at each level of this structure fulfilled. From a hermeneutic perspective, it was immediately apparent to me that I would need to interview individuals at each level of this figure (in order to get a well-rounded understanding of the whole, as well as the individual parts of this process). Because eight different offshore wind developers were already involved in this program, and because of the fact that the third, fourth and fifth tears of this structure break into four or more separate technical areas, it was decided at this preliminary interview that my focus would remain on the first technical area (Offshore Wind Foundations), with only supplementary interviews being conducted in the other technical areas as needed. It is also understood that "much of the real work of knowledge management takes place in the context of specific projects to manage specific

forms of knowledge, or to improve particular activities related to knowledge." (Davenport and Prusak, 2000, p.112) For this reason, it was particularly important that a specific project be selected and studied with relation to the OWA program. Because of the pre-designated focus on foundation designs, the Twisted Jacket foundation project was chosen - a concept that was designed by Keystone Engineering Inc., a company located in New Orleans Louisiana, USA.

So, with relation to the concept of *unit of analysis*, a social constructionist point of view means that the focus of this dissertation is placed on the individual. However, from an integrative investigation and hermeneutic (and for that matter, social constructionist) point of view, it is also important to understand how these individuals act and react within groups and throughout the program as a whole. In order to understand multiple units of analysis (at individual, group and program wide levels), a social network analysis was conducted, to come to an understanding about the dynamics within and between individuals, groups, and the OWA program overall. Conducting a social network exercise also allowed for the identification of influences coming from outside of the program, which had direct or indirect influences on knowledge processes taking place within the program.

If we now return to the preliminary interview conducted in March 2010, it was decided that all of the participating organizations (nine in total) would be informed collectively of my project, and have the opportunity to comment on my general project aims, and whether participation in my PhD research was a good idea, at the same time as drawing up a collective non-disclosure agreement (NDA) for each individual that I interviewed to sign separately. All of the partner organizations participating in the OWA program subsequently agreed to participate in this research, and I began conducting interviews with participants of the OWA program in December of the following year (2011).

In the time between my preliminary interview and subsequent interactions with OWA program members, I had time to build up my own knowledge base about knowledge management and the processes that it entailed. I attended PhD courses, from which I gained knowledge about issues such as complexity theory and organizational change, shared and distributed leadership, social network analysis, coaching and organizational learning, global markets and interviewing. I also read extensive literature on the topic of knowledge management from a variety of different perspectives, including:

- *Information Technology and Information Systems (IT)*
- *Human Resource Management (HRM)*
- *Organizational Learning*
- *Culture and Cross-Cultural interaction*

- *Talent Management*
- *The Tacit and Explicit nature of Knowledge*
- *Organizational Change*
- *Technically oriented Research and Development (R&D)*
- *Social Networks*

In addition, I also went to study with Professor David Boje at New Mexico State University, who specializes in storytelling organizations, and who was teaching a course on qualitative research methods during my stay in the spring semester of 2011. During this qualitative methods course I did a number of preliminary analyses of the Carbon Trust OWA program from what was available on the Carbon Trust website, various reports and presentations that had been published, as well as information I had gained from my preliminary interview and subsequent email correspondence with the Carbon Trust OWA management team. Building up some understanding about the OWA program before conducting interviews, as well as trying to look at particular issues from a variety of angles (through deconstruction analysis) was a good way to formulate some basic understandings and expectations of activity that I had, assumptions which I (in line with integrative investigation) could later challenge with new understandings presented to me during interviews. During my study abroad period I also presented a paper on nonlinear, spiral knowledge processes within organizations at a conference in Philadelphia, Pennsylvania on April 14th, 2011. This paper presentation gave me still further opportunity to discuss with numerous scholars (including some from Aalborg University) about my ideas of knowledge processes within different organizational contexts.

Upon return from my study abroad period, I felt prepared to begin constructing my semi-structured interview guides. I prepared different (yet similar) interview guides for individuals participating at each of the different levels in Figure 1: Organizational Structure of the Carbon Trust OWA program, decided in 2008 (meaning that roughly speaking, there were five different interview guides).[46] All **interview guides** covered, as mentioned earlier, three broad issue areas. I will now go into a little bit of detail regarding each issue area, to illustrate the types of questions that are represented in each of these areas.

The first broad issue was that of work orientation with regard to general work responsibilities, and then more specifically with relation to the OWA program. Typical questions in this category include questions such as: *Please tell me a bit about your background and how you came to be involved in the OWA program. How do understand the structure of the OWA program? What are the most important elements in the program for partners to manage or understand? How is success measured? How is performance evaluated?* etc. These questions are open-ended so that

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[46] For Samples of each of the five types of interview guides, see Appendix 12: Sample Interview Guides

meaning is not imposed, but instead created through responses. Many times examples were asked for, or stories were told about specific instances when things worked or did not work a particular way, all of which helped to create an overall image of not only the organizations that each respondent represented, but also the OWA program, and the way that it has evolved over time.

The second broad issue discussed in interviews was that of social networks. The Carbon Trust and OWA partners (highlighted in dark and light blue in Figure 1) were given a social network exercise. More specifically, each individual interviewed within the Steering Committee and Foundations Technical Working Group (as well as one member of the Carbon Trust OWA management team, and one member of the Wake Effects Technical Working Group) was given a social networking exercise, where respondents were asked to place each of the other partners (as well as the Carbon Trust) at a relative distance from their own primary organization (which was placed in the center of the bull's-eye).[47]

Figure 5: Example of the Social Network Exercise
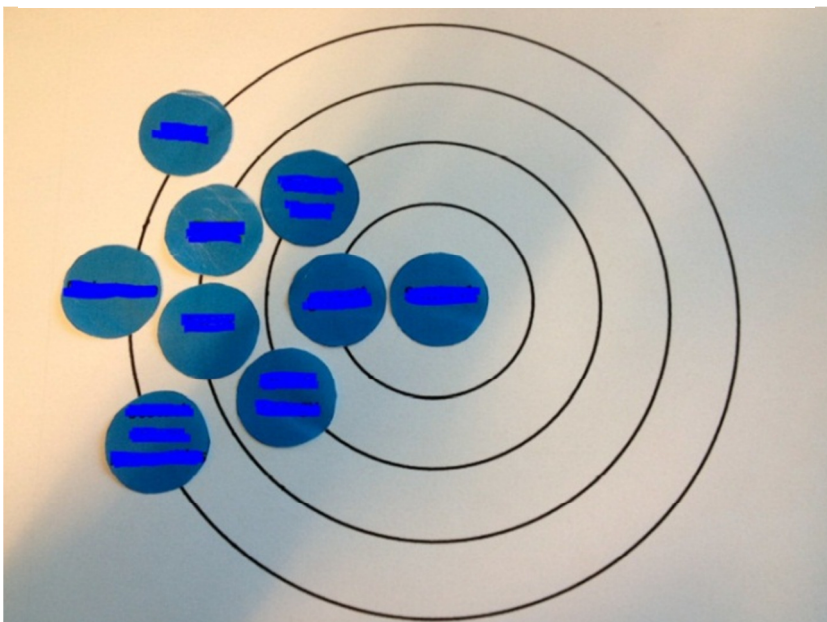
Respondents were told that they could base the placement of the other companies on any criteria they saw fit, and were then asked to explain why they had chosen the positions that they did, and if any other organizations were missing from this exercise. They were also asked what role their organization played in the OWA program, and whether other organizations played similar or different roles than their own.

Overall, this exercise was extremely useful for generating insight with relation to understanding relationships within and between the Foundations Technical Working Group and Steering Committee group, as well as how they perceived the OWA program as a whole with relation to their own and other partner members and the Carbon Trust. Knowledge management literature also stresses the importance of social networks, with statements such as (Hislop, 2009, pp.123-124):

"The importance of examining the social dynamics of knowledge sharing processes within innovation networks is that the character of the social relationship between people in these

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[47] See Appendix 2: SNA

contexts has been found to be a crucial factor influencing knowledge sharing processes… attempts by individuals to have individual knowledge accepted at group level is never a straightforward or automatic process."

As already stated, these social network exercise questions enabled an understanding of multiple units of analysis, from the individual perspective, group perspective, as well as how interactions functioned at a program level.

The third broad issue discussed in interviews was related to the topic of knowledge management. Questions in this section started on a very fundamental level with what the word knowledge meant to the respondent, and then moved on to questions such as: *Is knowledge management something that is dealt with specifically within the CT, and within your daily work at your company? How can knowledge flow in your area of responsibility be improved? How is information or knowledge shared among the partners generally? Is there any area of the OWA program where you feel that you are lacking information? What is the main motivation for you sharing knowledge with other energy companies in the OWA program?* Answers to these questions provided an understanding about how knowledge was perceived by respondents, as well as how knowledge processes functioned or were having difficulty functioning within the OWA program.

Taken together, these interview guides provided a nuanced, as well as inclusive and holistic understanding about the individuals that were participating in the OWA program, the groups within the program that they were part of, as well as the OWA program as a whole, and the role that the program played within the offshore wind industry. If we look at some statistics from interviews collected, we can say that

- Every member of the **Carbon Trust OWA management team** (3 individuals total) were interviewed at least once during primary interview collection
- At least one **Steering Committee** member from each of the eight partner organizations was interviewed during primary interview collection
- At least one **Foundations Technical Working Group** member from each of the eight partner organizations was interviewed during primary interview collection
- Because the Foundations group no-longer had a Technical Delivery Consultant, the **Wake Effects Technical Delivery Consultant** was interviewed, and subsequent interactions with Access Systems and Cables Technical Delivery Consultants also took place. To get a well-rounded understanding of the Wake Effects Technical Delivery Consultant, an interview was also conducted with a Wake Effects Technical Working Group member, as well as a Wake Effects sub-contractor.

- Interviews were also conducted with **every member of the Keystone Twisted Jacket Foundation project (foundation designer)** who were still working at keystone (six individuals in total), and observations were also made about working styles and interactions within this group.

In addition to these interviews (thirty-three in all), lunch meetings, dinner meetings, observation of working styles, after hours drinks, observation of conference presentations regarding the OWA program etc. were also part of the primary data collection, allowing for an organic and inclusive understanding of the individual parts of the OWA program to emerge, as well as the way in which it functions as a whole. The below table depicts the precise timeline of primary data collection.

Table 2: Timeline of Primary Data Collection

Date	Event/Action
March 17, 2010	Preliminary interview conducted with a Steering Committee member regarding Carbon Trust OWA program collaboration (Interview time: 1hr. 27min.)
Dec. 12, 2011	Non-disclosure agreements have been signed by all parties and first formal interview is conducted with a Foundations Technical Working Group member (Interview time: 1hr. 42min.)
Dec. 14, 2011	Interview conducted with Steering Committee member (Interview time: 1hr. 5min.)
Dec. 15, 2011	Interview conducted with Wake Effects Sub-contractor (Interview time: 1hr.)
Jan. 13, 2012	Interview conducted with Foundations Technical Working Group member (Interview time: 1hr. 22min.)
Jan. 13, 2012	Interview conducted with Wake Effects Technical Working Group member (Interview time: 1hr. 46 min.)
Jan. 16, 2012	Interview conducted with Wake Effects Technical Delivery Consultant (Interview time: 1hr. 35 min.)
Jan. 17, 2012	Interview conducted with the head of the Carbon Trust OWA program (Interview time: 1hr. 39min.)
Jan. 17, 2012	Interview conducted with Carbon Trust OWA management team member (Interview time: 1hr. 53min.)
Jan. 18, 2012	Observation of conference call between Carbon Trust OWA management team and Wake Effects Technical Delivery Consultant regarding upcoming workshop preparation
Jan. 18, 2012	Observation of Conference call between Carbon Trust OWA management team and Technical Delivery Consultants from each of the work streams
Jan. 18, 2012	Observation of working style between OWA management team members at Carbon Trust headquarters in London
Feb. 6, 2012	Interview conducted with Foundation Sub-contractor, Keystone Drafting Supervisor (Interview time: 56min.)
Feb. 6, 2012	Lunch meeting with Foundation Sub-contractor, Keystone Assistant to the General Manager for Offshore Renewables
Feb. 7-8, 2012	Interview conducted with Foundation Sub-contractor, Keystone General Manager for Offshore Renewables (Total interview time: 1hr. 36min.)
Feb. 7, 2012	Lunch meeting with Foundation Sub-contractor, Keystone Managing Principal and

	General Manager for Offshore Renewables
Feb. 7, 2012	Interview conducted with Foundation Sub-contractor, Keystone Structural Engineer 1 (Interview time: 1hr. 26min.)
Feb. 8, 2012	Interview conducted with Foundation Sub-contractor, Keystone Structural Engineer 2 (Interview time: 1hr. 45min.)
Feb. 8 - 9, 2012	Interview conducted with Foundation Sub-contractor, Keystone Managing Principal (Total interview time: 3hr. 1min.)
Feb. 9, 2012	Interview conducted with Foundation Sub-contractor, Keystone Resource Manager (Interview time: 1hr. 1min.)
Feb. 9, 2012	Lunch meeting with two Keystone Engineers in the Offshore Renewables group having just joined the organization and not having worked on the OWA Foundation project
Feb.9, 2012	Dinner Meeting with Foundation Sub-contractor, Keystone Structural Engineer 2 and Engineer in the Offshore Renewables group not having worked on the OWA Foundation project
April 16, 2012	Discussion with representative from the same organization as the Wake Effects Technical Delivery Consultant at the European Wind Energy Association (EWEA) conference, Copenhagen
April 17, 2012	Observation of presentation from the head of the Carbon Trust OWA program at the EWEA conference, regarding program structure and Keystone foundation design
April 18, 2012	Joint interview conducted with two Steering Committee members from the same organization (Interview time: 1hr.)
April 19, 2012	Interview conducted with Foundations Technical Working Group member (Interview time: 47min.)
April 24, 2012	Interview conducted with Steering Committee member (Interview time: 46min.)
April 24, 2012	Lunch with Steering Committee members in-between their Steering Committee meeting
April 24, 2012	Interview conducted with Steering Committee member (Interview time: 43min.)
April 24, 2012	Interview conducted with Steering Committee member (Interview time: 1 hr.)
April 24, 2012	After-hours drink and feedback session with Carbon Trust OWA management team member
April 27&May 1, 2012	Interview conducted with Foundations Technical Working Group member (Interview time: 1hr. 41min.)
May 4, 2012	Interview conducted with Foundations Technical Working Group member (Interview time: 1hr.)
May 5, 2012	Interview conducted with Steering Committee member (Interview time: 1hr. 3min.)
May 11, 2012	Interview conducted with Steering Committee member (Interview time: 1hr. 9min.)
May 22, 2012	Interview conducted with Foundations Technical Working Group member (Interview time: 1hr. 17min.)
May 22, 2012	Interview conducted with Foundations Technical Working Group member (Interview time: 1hr. 36min.)
June 4, 2012	Interview conducted with Steering Committee member (Interview time: 1hr. 25min.)
June 13, 2012	Interview conducted with Foundations Technical Working Group member (Interview time: 1hr)
Jan. 25, 2013	Presentation and discussion of first Executive Summary report with two of the Carbon Trust OWA management team members (Discussion time: 41min.)
Jan. 28, 2013	Continued discussion of first Executive Summary report and current OWA activities with Carbon Trust OWA management team member (Discussion time: 1hr. 16min.)
July 15, 2013	Presentation and discussion of second Executive Summary report with Carbon Trust OWA management team member (Discussion time: 1hr.)

July 23, 2013	Continued discussion of second Executive Summary report with Carbon Trust OWA management team member (Discussion time: 1hr. 57min.)
Oct. 1, 2013	Observation of presentation from Carbon Trust OWA management team member at the Offshore Operations and Maintenance Forum, regarding Access System design development

Although articles had been written, and preliminary structure of the dissertation had been outlined and embellished to some degree during the collection of interviews, the primary work of "fitting it all together" in terms of the *theoretical analysis* and *empirical analysis* did not begin in earnest until the autumn of 2012, after most of the primary interviews had been transcribed. At this point, transcripts were sent out to all respondents, and the knowledge of what had been said during the interviews helped to inform the final categories that should be included in the theoretical Analysis.

In January of 2013, an accumulated understanding facilitated by the research process thus far led to the first Executive Summary report being presented to and discussed with Carbon Trust OWA members. The report was titled: *Synergy Formation for the Development of Knowledge Resources: Strengthening Interfacing Capabilities*. The purpose of this executive summary was both to make suggestions for creating further synergy, and also to help trigger further ideas about how to achieve greater synergy within the Carbon Trust OWA project. In this ten page report, eight interfaces (points where problems are shared, and boundaries are common) were presented, representing areas that could be strengthened by creating further synergies. Each of these eight interfaces is examined in detail, covering: 1) examples of what has been said during interviews that support each interface; 2) why each particular interface is important; and 3) suggestions for achieving greater interface synergy in each area.

After this report was delivered and discussed with the Carbon Trust OWA management team, work continued on the theoretical analysis. Once this chapter was completed, a list of important issues was made, and each of these issues was used as a node by which interview transcriptions could be compared. All interview transcriptions were put into the NVivo program, and interview transcriptions were coded by the issue areas just mentioned. After all interviews were coded, the writing process of the Theoretical Analysis began, comparing each issue in the theoretical analysis to what was actually observed in practice in the Carbon Trust OWA program. Again, this hermeneutic process both supported the development of the theoretical analysis, as well as drawing attention to important new issues within the field of knowledge management.

When all interviews were coded, the second Executive Summary report was presented to and discussed with Carbon Trust OWA members. The title of this report was: *Harnessing Dynamic*

Capabilities: Super-Flexibility and Focus. The purpose of this executive summary was to make suggestions for achieving both greater flexibility and focus within the OWA program. In this thirteen page report, eighteen suggestions are made for how achieving greater flexibility and focus may be possible for this particular program. Each of these eighteen suggestions was examined in detail, covering: 1) What the specific suggestion is with relation to theoretical principals 2) examples of what has been said during interviews that support each idea; and 3) suggestions for achieving super-flexibility and focus in each area.

As final touches were being put on the dissertation as a whole (during the fall of 2013) further conversations were held with the Carbon Trust OWA management team about the second executive summary, and results from the dissertation were also presented at a conference in London on October 1st, 2013.[48] The title of the conference was Offshore Operations and Maintenance Forum, and it drew representatives from many of the organizations involved in offshore wind, including partner organizations of the OWA program. A Carbon Trust OWA management team member also made a presentation at the conference.

The process described above culminated in the delivery of this dissertation in November of 2013, presenting an organic, in-depth and holistic understanding of knowledge processes and how they are managed within the OWA program, what they have done well, and what they may be able to improve upon in the future.

3.5 Action Research

As may have become apparent from the description of the research activities in the previous section, periodic feedback was also given to the Carbon Trust OWA management team, regarding how to improve knowledge processes within the program. Changes were also implemented within the program based on this feedback, providing an action research component to this dissertation.

Action Research is a term that was coined by Kurt Lewin in 1946, when describing the character and function of research for the practice of inter-group relations as needing "research leading to social action." (Lewin, p.35) As is implicit with both hermeneutics and integrative investigation, an action research approach "blurs the boundary between research and practice and highlights their relatedness," (Sommer, 2009, p.288; Bargal, 2006) meaning that this approach fits well with the overall methodology of this dissertation. In order to define exactly what action research means more concretely for the purposes of this dissertation, let us turn to the way it has been approached from a management perspective. As understood by Gummesson (2000) and Coghlan and Brannick (2010, p.39):

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[48] See Appendix 13: Presentation: Offshore O&M Forum – PowerPoint Synergy Formation

"Action research always involves two goals: to solve a problem and contribute to science… action research is about research *in* action and does not postulate a distinction between theory and action. Hence the challenge for action researchers is to engage in both making the action happen and stand back from the action and reflect on it as it happens in order to contribute theory to the body of knowledge."

It is also important to recognize, as Senge (1990), and Coghlan and Brannick (2010, p.39) do, that:

"Action research aims at developing holistic understanding during a project and recognizing complexity. As organizations are dynamic socio-technical systems, action researchers need to have a broad view of how the system works and be able to move between formal structural and technical and informal people subsystems. Working with organizational systems requires an ability to work with dynamic complexity, which describes how a system is complex, not because of a lot of detail (detail complexity) but because of multiple causes and effects over time."

In this dissertation, action research can be seen as interwoven with the process of integrative investigation, allowing for both *action* and *reflection* that can contribute to the *body of knowledge* about knowledge management. A *holistic* and *complexity* perspective has also been integrated throughout this dissertation, looking at the whole (the Carbon Trust OWA program) and its parts (individuals within the program), and how all of these elements have developed *over time*.

My journey towards impacting the knowledge processes within the OWA program can be observed in a number of different ways. For example, after returning from a research visit to the Foundations sub-contractor, Keystone, in February of 2012, I corresponded with the head of the Carbon Trust OWA program about concerns that had been raised during the interviews I had conducted while in the United States. In an email reply, the head of the OWA program said:

"This is really valuable feedback – we're in the process of planning new initiatives and I hope we can have a more constructive session with innovators, fabricators and installers. Thanks for passing this on and looking forward to seeing you at EWEA (European Wind Energy Association conference)."[49]

Based on feedback given, a workshop was planned and executed to increase collaboration between innovators, fabricators and installers, which had been pointed out as lacking in a previous project. In addition to other informal feedback sessions, the two executive summaries given to members of the OWA program in January and July of 2013 served as a means for me as a researcher to give very specific suggestions about what could be done to improve knowledge processes within the OWA program. Each of these reports lead to two or more feedback sessions with the Carbon Trust OWA management team, which functioned in practice as not only a

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[49] Carbon Trust OWA Manager, Jan 17th, 2012. Personal correspondence, April 4, 2012

delivery of my ideas as a researcher, but also as an interactive discussion, where new ideas came about during the interaction. For example, in one of these feedback sessions that took place on Jan. 25, 2013, an OWA management team member said:

> "I like the idea of having different TDC's pulled together… so I am thinking of at least two projects that do have a bit of overlap and there could be some value in having those two consultants work together to put together a workshop where they have the Technical Working Group come and leverage the knowledge from both projects. So thank you, that's a good idea, too."[50]

During this conversation, a number of different ideas were discussed about upcoming workshops and how they might be structured to better facilitate communication between the relevant parties. As a general principal, I always ended every correspondence with OWA members by stressing that they were free to contact me at any time if they had any questions about anything that I had presented. At one of the last teleconferences that I had with an OWA management team member regarding the second Executive Summary report suggesting eighteen areas where changes could be made to positively impact knowledge processes, one of the concluding remarks made was:

> "I really appreciate that you share this with us, it's really useful to us… we can get a lot of value from it, because it's really nice to have someone step back and look at the program from the outside, and give ideas. And the fact that you've done all of these interviews – it's very much appreciated that we can benefit from your PhD as well… This was a timely chance to have this call because it will give me some time to think about it and actually plan some of these things that we can do to improve the program."[51]

And, as an action researcher, this was one of my aims in doing this PhD work – not only to move knowledge management literature forward (with specific relation to actor oriented innovation programs), but also to positively impact the knowledge processes that occur in the case studied, the Carbon Trust Offshore Wind Accelerator Program.

The purpose of this chapter has been to present the choice of method, which covers a variety of methodological issues. First, *hermeneutics* has been used as a guide for all decisions made during the completion of this dissertation, studying both the parts and the whole of the process, as the Carbon Trust OWA program has evolved over time. *Social construction* provided a foundation of understanding about individuals and the nature of what they know, and *integrative investigation* was used as the process for integrating theory with qualitative data, and how it should be presented in this dissertation. This chapter also discussed the use of *qualitative method* and *case study research*, arguing for the importance of the Carbon Trust OWA program for studying knowledge management in a contemporary innovation process. The way in which *data collection*,

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[50] Carbon Trust OWA Manager, Jan 15th, 2012. Recording time: 55:00
[51] Carbon Trust OWA Manager, July 23rd, 2013. Recording time: 54: 45

processing and *feedback* was carried out for this dissertation was also described. *Action research* was then further specified as an important component of this process, enabling both theoretical and practical action based development.

Chapter 4: Theoretical Analysis

The aim of this chapter is to provide a clear and in-depth understanding of knowledge management that builds upon concepts discussed in academic literature. In order to do this a theoretical framework has been developed that proceeds through a series of six steps. First, a brief discussion is presented about the origin and development of knowledge management over the past 40 years, leading to the identification of the chosen paradigm. Next the question 'what is knowledge?' is addressed, arriving at a new definition of knowledge and discussing the implications that this new definition holds. The third section identifies the key *drivers*, or catalysts, of knowledge management. Because the purpose of collaboration in actor oriented innovation projects has been identified as *the ability to build and sustain innovation,* drivers can be understood as motivating organizational actors to achieve this end by better managing their knowledge. The drivers discussed below are often the "selling points" of knowledge management, spurring managers to seek knowledge management resources and tools to help them complete innovation projects.

The fourth section discusses *obstacles* related to knowledge management. Although many of these concepts do not necessarily hinder the management of knowledge in practical application, the fact that they are heavily debated and discussed in academic literature makes conceptual development difficult, and thus sends unclear signals to those actors who may be interested in knowledge management. The fifth section of the theoretical analysis presents *critical success factors* of knowledge management. These consist of the many and varied ways in which knowledge management principles can be applied by organizations in practice. It should be specified here that knowledge management should not be thought of as one specific set of principles to be applied by all organizations wanting to *build* and *sustain innovation*. Because of a variety of contextual factors, organizations need to design knowledge management strategies that fit with their individual business needs. Consequently, this section discusses a variety of broad concepts that have proven useful for managing knowledge processes, and are meant as a compendium of considerations and possibilities for organizations deciding to undertake the management of knowledge in a structured way, rather than a stringent regimen of steps for them to follow. It should also be acknowledged that there are undoubtedly other critical success factors that are being used in organizations where knowledge is managed well. This is one of the key reasons that academic literature calls for more research in the field of knowledge management – in order to draw out these concepts, so that they can be shared and provided as options for use in other organizations where better management of knowledge is desired.

Wherever possible, objections that have been raised to the concepts being discussed will be presented. Because knowledge management has evolved from many disciplines and in many divergent ways, concepts are often disputed, which can lead to a feeling of not knowing 'which end is up', a fact that has caused problems theoretically as well as in practice. The structure of the third, fourth and fifth sections (into drivers, obstacles, and critical success factors), is meant as a stabilizing factor for the concepts presented, providing an overarching focus and direction, even when discussions and objections arise. The sixth and final section includes a summary of the processes that were identified throughout the theoretical analysis. The chapter is concluded with a table which lists all of the knowledge management concepts covered, including a short description of what managers can use each of the conceptual findings for, and proposing a new metaphor for the management of knowledge within organizations.

Drawing from a wide range of academic literature on the topic of knowledge management, the present challenge and goal is not to develop one single theory, but rather to develop and evaluate a broad array of narrative and theoretical accounts regarding the nature of knowledge management. In so doing, knowledge management can rather be thought of as a field of study which, when viewed comprehensively, should provide managerial strategies (recommending attitudes, structures, and practices), which can aid in understanding possibilities for managing knowledge processes for the purpose of building and sustaining the sources of innovation.

4.1 Knowledge Management: Origins and Underpinnings

Peter Drucker first coined the term 'knowledge worker' in 1959, in his book *The Landmarks of Tomorrow*. For Drucker, knowledge is capital, and those who possess knowledge are the key to unlocking the potential of an increasingly information-rich society. Throughout his prolific career, Drucker continued to develop his concept of the knowledge worker, explicating the significance of the shift from the industrial age to the information age, and the importance of 'knowledge work' within this new, global, age. As he put it, "The most valuable asset of a 20th-century company was its *production equipment*. The most valuable asset of the 21st-century institution (whether business or non-business) will be its *knowledge workers* and their *productivity*." (Drucker, 1999, p.79)

Over the past 40 years, and particularly within the last 20 years, knowledge management has exploded in popularity, becoming a buzz-word among academics, public policy makers, consultants and business people alike (Hislop, D. 2009). To convey some understanding about just how popular knowledge management has become, a bibliometric analysis covering the period from 1975 to 2004 identified 2727 authors contributing to 1407 publications on the topic of knowledge management (Gu, 2004 in Nonaka & Peltokorpi 2006). Despite, and perhaps because

of its popularity, Alvesson cautions that: "labels that attract a wide audience and have strong rhetorical appeal are often problematic in terms of coherence and invite accusations of faddishness." (Alvesson, 2004, p.166) Knowledge management continues to meet a great deal of criticism and critique from scholars such as Tsoukas and Vladimirou, who note that "organizational knowledge is much talked about but little understood." (2001, p.973) It seems plausible that many such critiques arise from the pronounced lack of coherence found in the literature.

Today knowledge management is highly interdisciplinary, being studied from a variety of perspectives within psychology, philosophy, information science, organization and management studies. The scholars Hazlett, McAdam and Gallagher (2005) see knowledge management as a field of study in a 'pre-science state.' Their understanding of 'pre-science' comes from Kuhn (1970, p.16) and is defined as "the existence of many competing schools [of thought] each coalescing around a different paradigm." This is seen as coinciding with the current state of knowledge management, where a number of methods, models, theories, definitions, and empirical studies have been developed, representing different perspectives that can be "problematic, resulting in a lack of direction and precipitating confusion." (Hazlett, McAdam, and Gallagher, 2005, p.38)

In order to clarify the underlying assumptions upon which knowledge management theories rest, Hazlett, McAdam and Gallagher identify two paradigms, *computational* and *organic*, according to which scholars working in the field can be categorized. Each paradigm has its own set of assumptions, and the theories and approaches that emerge from the different paradigms are therefore also very different.

Table 3: Characteristics of Generic Knowledge Management Paradigms

Computational Paradigm	*Organic Paradigm*
Technological	Socioorganizational
Systems/Techno-centric	People-centric
Linear (mechanistic)	Nonlinear
Explicit only	Tacit and explicit knowledge
Acontextual	Highly contextual
Static environment	Dynamic environment
MAX (optimization)	MAX (adaption)

Source: Hazlett, McAdams and Gallagher (2005, p. 37)

As the above table illustrates, the computational paradigm deals mainly with codifying information – and what is seen as 'knowledge' within this paradigm – into systems for the

purpose of optimizing business performance. Approaches coming from a computational paradigm often deal with issues related to knowledge capture and storage in IT systems. The organic paradigm, on the other hand takes a very different perspective, looking at knowledge as intrinsically linked to the individuals that develop it. For scholars working within this paradigm, knowledge has many dynamic characteristics that are impossible to reduce into strict, mechanistic categories to be digitally stored (Brown and Duguid, 2001; Nahapiet and Ghoshal, 1998; Tsoukas, 1996).

However, the organic paradigm does not exclude the importance of being able to classify and codify information into systems, "rather, they reject an overly technological emphasis without due concern for social networks of individual knowledge workers." (Hazlett, McAdam, and Gallagher, 2005, p.37)[52] Although this organic perspective views dynamic and contextual processes as most important for knowledge management, information systems are nevertheless viewed as necessary in today's global age, where the amount of information that organizations are able to access instantly has expanded exponentially. Here, information systems are seen as *one* component, and not *the* key, to knowledge management.

This PhD dissertation grounds the theoretical analysis that follows in the organic paradigm, a choice that has been made for the following reason. Although viewing knowledge as something that is strictly explicit and that can be codified is tempting for simplicity and explanatory purposes, it is not seen as a realistic way to describe a process that is, by its very nature, highly contextual and dependent on personal interaction. A logical question that one might ask at this point is: What about knowledge is highly contextual and dependent on personal interaction? In order to more fully expand upon the choice of paradigm for this dissertation, it is perhaps first necessary to take a step back, and identify what exactly is meant by the word 'knowledge.' Then, with a firm understanding of what is meant by 'knowledge,' it can be viewed within the frame of organizational management, and thus the field of 'knowledge management.'

4.2 What is Knowledge?

In order to understand what knowledge is, it has often been classified against other terms such as data and information (Davenport and Prusak, 2000). First, data refers to raw numbers, images, words, and sounds derived from observation or measurement. Data on its own is seen as being meaningless, until it is put into a frame that enables understanding. Information, then, provides this frame, organizing data in a meaningful pattern. So, individuals provided with information

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[52] See also: (Moffett et al., 2002; Cliffe, 1998)

will understand the logic behind the numbers, images, etc. presented, and be able to make some sense of it. But now the question becomes: how do we differentiate information from knowledge?

As stated by the scholars Murray and Blackman (2006, p.134) "Knowledge originates from the interaction of information within the context in which it is presented and, especially, within the individual's pre-existing knowledge."[53] There are several important ideas that emerge from this quotation, having to do with the identification of *interaction*, *context* and the *individual* as necessary for knowledge to be present. First among these is that gaining knowledge is an interactive process. For the study of knowledge management, this highlights the element of active engagement, without which information never moves beyond being just that. The next idea that can be taken from this quote is that knowledge requires context, and is context specific. Aspects of context that may play a role in the way information is interpreted may include the source of the information, the physical setting in which the information is received, the precise time that the information is received, related information that was received previously, etc. For the study of knowledge management, this means that context cannot be overlooked or put aside, but rather it needs to play an integral role. As stated by Matts Alvesson (2004, p.96) "knowledge does not exist in a vacuum, as something fixed and packaged, ready to be sold and distributed, even though many authors on knowledge and knowledge intensive organizations prefer such a reified view."

The last idea that I would like to highlight in the above quote is the emphasis placed on individuals. According to Murray and Blackman, knowledge is formed through a process that happens within individuals, adding new information to pre-existing knowledge. This idea has perhaps the most significant impact on the study of knowledge management, because it necessitates the involvement of individuals, and thus excludes theories and approaches that focus primarily on computer hardware or software. To specifically address the question about differentiating between information and knowledge: if we are not talking about an individual, we are not talking about knowledge; knowledge only exists within individuals. This is not to say that the plethora of existing databases cannot be helpful for creating the frames necessary for turning data into information, but they cannot generate knowledge, or be thought of as containing knowledge on their own. Along these lines, Davenport and Prusak (2000) caution that attempting to manage knowledge within organizations has often resulted in "enormous expenditures on technology initiatives that rarely deliver what the firms spending the money needed or thought they were getting." (Davenport and Prusak, 2000, p.xxiv)

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[53] See also: (Ortony, 1993)

Although the above describes what knowledge is not, and the conditions under which knowledge originates (both of which are conceptually helpful for understanding knowledge management) it does not actually reveal what knowledge *is*. Within the literature pertaining to knowledge management, there is an ongoing debate about what is meant by the term knowledge, which is understandable if we take into account, for example, that "epistemologists spend their lives trying to understand what it means to know something." (Davenport and Prusak, 2000, p.5) In line with the computational paradigm, some researchers use the term knowledge as synonymous with information (for example: Hendriks and Vriens, 1999). Other scholars such as Nonaka and Peltokorpi (2006) try to position themselves somewhere in between the computational and organic paradigms, taking Plato's conceptualization of knowledge as 'justified true belief,' and re-conceptualizing 'truth' as "a 'socially validated truth' established through social interactions, instead of existing somewhere to be discovered." (Nonaka and Peltokorpi, 2006, p.80) This definition seems to get at the element of *interaction* identified above, while still reifying 'truth,' implying that it can be made completely explicit, and may therefore still end in digital repositories. Another popular definition of knowledge comes from Davenport and Prusak (2000, p.5) who define knowledge as:

> "a fluid mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of the knowers. In organizations, it often becomes embedded not only in documents and repositories but also in organizational routines, processes, practices, and norms."

This definition, although presenting many important elements of knowledge, is often criticized as being too broad, and therefore becoming meaningless because we are not able to decipher what would not be considered knowledge. In my own reading, the statement that knowledge becomes 'embedded' in 'documents and repositories' makes me wonder how they differentiate knowledge from information.

Tsoukas and Vladimirou (2001) report that researches studying knowledge management suggest (at conferences and elsewhere) that perhaps knowledge should be left undefined, as trying to define it usually seems to 'complicate things'. Rather than agreeing with this sentiment, these authors believe that "what we need is ever more sophisticated theoretical explorations of our topic of interest, aiming at gaining a deeper insight into it [...] If theoretical confusion is in evidence the answer cannot be 'drop theory' but 'more and better theory.'" (Tsoukas, Vladimirou, 2001, p.975) The present theoretical analysis aims to do exactly this. First, in order to provide deeper insight into the area of knowledge, a new definition will be proposed and discussed. Then, in order to add 'more and better theory,' current discussions within knowledge

management will be looked at from the organic paradigm perspective, and regrouped into the categories of drivers, obstacles, and critical success factors for the management of knowledge processes. This categorization has been chosen in an attempt to reduce the level of confusion that currently exists when discussing concepts within knowledge management.

Combining Murray and Blackman's (2006) conceptualization of the way in which knowledge originates with elements of Davenport and Prusak's (2000) very broad definition of knowledge, the definition used here will describe knowledge in terms that are broad enough to give an inclusive and holistic view of knowledge, yet specific enough to provide meaningful direction within the field of knowledge management. For these reasons, the following definition will be used throughout this PhD dissertation when referring to the concept of knowledge: **Knowledge is understanding achieved through processes of combined personal and shared information and experience.** As this definition connotes, knowledge is not something that individuals are born with, or something that is 'out there' to be had. Instead the key to understanding the dynamics of knowledge creation, as proposed here, lies in focusing upon individual and collective processes that are built up over time. On an individual level, knowledge, unlike information, 'originates and is applied in the minds of the knowers' (Davenport and Prusak 2000, p.5). Because no two individuals receive identical information or have identical experiences throughout their lifetimes, no two individuals have exactly the same knowledge base, making knowledge an individual phenomenon.

However, I would also argue along with Alvesson (2004, p.233) that "knowledge is better understood as a social process than as a functional resource, as socially constructed rather than an objective fact." This is an extremely important point to acknowledge, because besides rejecting the computational paradigm, it describes the collective 'shared' element of knowledge processes. On a 'shared' collective level, having ones individual understandings validated or challenged will either reinforce or weaken (and possibly change) ones understanding. What is understood as knowledge on both an individual and (in the present context) organizational level can thus be seen as shifting over time, as new information is reframed in context, and the social validation process moves forward. This process can also be depicted as a feedback loop from individual to collective group level, where 1) an individual has an understanding (knowledge) about something, 2) interaction related to the understanding results in collective affirmation or rejection of the understanding, and 3) the understanding is either strengthened, adjusted or changed, leading to new understanding (knowledge).

Figure 6: Knowledge feedback loop
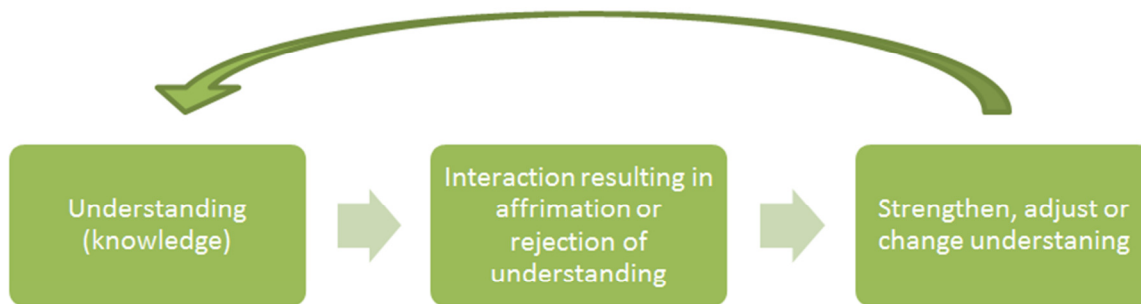
Source: Madsen (2013)

Without this collective process of understanding and validation, I would argue that it would be impossible to "know" anything, because the frames that we as individuals have built up over time for "knowing," or even making sense of things that we can observe (such as a building or a tree) have been learned at some point from the 'social' surroundings (including our parents, teachers, social media, etc.) in which we developed. Once pre-existing frames are built up, new information can be connected to these frames in unique and individual ways, and here in lies the spectacular thing about the information age.

Today there is so much information available to everyone that information can be relatively easily attained and combined by individuals, and these same individuals can then share their understandings with individuals around them (at work, within a network, or community, wherever knowledge is thought to be held) and a process of collective validation or rejection of new understandings can occur. In this way new opportunities arise for personal integration of information, learning, and social validation or rejection of one's understandings, creating knowledge in a wide range of contexts. **Knowledge management is then the way in which knowledge processes are facilitated for the achievement of specific objectives**. Because the objective of collaboration within actor oriented innovation programs is understood here as being to build and sustain innovation, knowledge management can then be understood as building and sustaining *the sources* of innovation. As presented and discussed in chapters two and three, the context in which this dissertation will attempt to provide an understanding of the management of knowledge processes is within actor oriented innovation programs (i.e. people processes). These theoretical understandings will then (in chapter 5) be discussed in relation to the Carbon Trust Offshore Wind Accelerator program, in order to better understand how these concepts can be applied in practice.

Up to this point conceptualizations have been arrived at for knowledge as opposed to data and information; the social aspect of context in which knowledge originates has been emphasized; and an inclusive yet demarcated definition of knowledge has been proposed. Subsequently, knowledge management is understood as facilitating knowledge processes to achieve specific goals. The aim of this discussion has been to provide a foundation, from an organic paradigm perspective, for reframing knowledge management under the categories of *drivers*, *obstacles*, and *critical success factors*, and thereby re-conceptualizing the field of study. The reason for this new conceptualization is to create 'clear, unified foundations in knowledge management' which are seen as lacking in the current literature (Nonaka and Peltokorpi, 2006).

4.3 Knowledge Management *Drivers*

The terms *creation, acquisition*, *capture*, *sharing* and *learning* are often present in knowledge management literature, identifying concepts that are purported to be more efficiently dealt with through the use of knowledge management. Each of these theoretical constructs is important for the management of knowledge, and more specifically important for actor oriented innovation programs. For this reason, each construct will be covered here in turn, and the discussion pertaining to each construct will be two-fold. First, typical understandings and applications of each construct will briefly be articulated. Then, the focus will turn to how each construct might most meaningfully be understood in the context of actor oriented innovation programs, discussing implications for action which these understandings present.

4.3.1 Knowledge Creation

In relation to knowledge management, knowledge *creation*, also known as knowledge *generation*, is often seen as "the specific activities and initiatives firms undertake to increase their stock of corporate knowledge." (Davenport and Prusak, 2000, p.52) Scholars discussing knowledge creation put forward theories and techniques for adapting and combining the sources of knowledge within an organization. Before the mid-90s relatively little attention was directed toward "how knowledge is created and how the knowledge creation process can be managed." (Nonaka, 1994, p.16) Then, in 1994 Ikujiro Nonaka published an article titled: *A dynamic theory of Organizational Knowledge Creation*. By separating *tacit* knowledge (that which is rooted in personal action and individual understanding) from *explicit* knowledge (that which is 'codified' in formal language), and then explaining how they could be combined within organizations, Nonaka put forward the 'Spiral of Organizational Knowledge Creation.' As stated by Nonaka "the articulation of tacit perspectives – in a kind of 'mobilization' process – is a key factor in the creation of new knowledge." (Nonaka, 1994, p.16)

Since the publication of Nonaka's article, and perhaps in part because of it, there has been a great upsurge in both attention to tacit and explicit knowledge (which will be revisited below in section 4.4.3 Conflict, Complexity and the Discovery of Unknown Unknowns), as well as in the subject of knowledge creation generally, cited recently as being 'a topic of great interest to both scholars and practitioners' (Carlile 2002; Hargadon and Sutton 1997; von Krogh et al. 2000; Nonaka et al. 2006; Ribeiro and Collins 2007; Tsoukas 2009). So, why study knowledge creation? As stated by Davenport and Prusak (2000, p.52) "All healthy organizations generate and use knowledge. As organizations interact with their environments, they absorb information, turn it into knowledge, and take action based on it in combination with their experiences, values, and internal rules." The study of knowledge creation also tends *not* to focus on information technology, as "Information technology is … relatively less helpful when it comes to knowledge creation, which remains largely an act of individuals or groups and their brains." (Davenport and Prusak, 2000, p.142)

For the purpose of this dissertation, the aim is to explore how knowledge creation can be understood and applied in the context of actor oriented innovation programs. As seen above, this approach should be focused on individuals, groups, and their interactions. In relation to actor oriented innovation programs specifically, theorizing about knowledge generation should take into account a broad range of individuals coming together in novel contexts, and working toward the specific goal of creating new innovative designs. One author that seems to have a particularly insightful and, I would argue, important approach to knowledge creation for this purpose is Haridimos Tsoukas. He describes a process in which knowledge is generated in organizations through face-to-face communication (direct social interaction), where unsettledness provides the grounds for dialogue. The act of engaging in dialogue in turn provides a means for individuals to 'take-a-step-back' (self-distanciation) and reflect on their own way of thinking, opening up the possibility for re-framing and co-constructing meaning to the end of making new distinctions and thus creating new knowledge. (Tsoukas, 2009, p.950) In order to more fully understand what Tsoukas means by concepts such as 'unsettledness,' 'dialogue,' 'self-distanciation,' etc., and what precisely makes them so important for knowledge generation, an elaboration will be given for the key components of Tsoukas' *dialogical approach* to knowledge creation.

First, dialogue is seen as having the basic aim of removing *unsettledness* (Tsoukas 2009, p.943). Having a common problem or unsettledness (which in the case of renewable energy often comes from new requirements, regulations, customer needs, or in the case of the CT OWA project: developer needs) creates common ground for dialogue. In other words: unsettledness gives dialogue purpose. Next, the process of dialogue requires first understanding others, and second,

potentially altering one's own understanding[54], which, according to Tsoukas, happens more fully in conditions of *direct social interaction*. As specified by the scholars Berger and Luckmann, it is only during face-to-face interaction that other individuals become 'fully real' (1966, p. 43), and thus it seems reasonable that in order to fully understand the perspectives of others, face-to-face interaction is also important. Another factor seen as important for productive dialogue is *relational engagement*, which is the understanding that "participants take active responsibility for both joint tasks and the relationships in which they are involved." (Tsoukas, 2009, p.949)[55]

Next, following Mead, (1934, p.156) and Bakhtin (1981, p. 293), Tsoukas argues that for productive dialogue to take place, it is also important to have *self-distanciation*, where 'new distinctions' are seen to develop insofar as both parties take 'distance from their previously held views' allowing for a 'new sensibility' to emerge (2009, p. 944). What I take from this is that it is very important for individuals to be **open to thinking critically** about what they already know, and to what others are saying. Further, it is only through this process of critical reflection and active listening that the opportunity to build upon or re-shape what we 'know' presents itself. As participants engage in dialogue, they are going through a process that Tsoukas calls *constrained novelty*, where individual contributions to the dialogue create novelty, while at the same time constraining the dialogue through the co-creation of an emerging common frame 'into which later contributions must fit' (2009, p.946). As stated by Mats Alvesson (2004, p.27) "it is important to reflect upon how words do not merely mirror reality, but construct a particular version of it," which in this context seems to mean that the generation of knowledge is achieved through the construction of new meanings that emerge from productive dialogue.

However, for organizations, dialogical *interaction* also needs to perpetuate *action*, which leads us to the part of Tsoukas' dialogical approach explaining three processes that are understood as leading to action. In his words, the processes of 1) conceptual combination, 2) conceptual expansion, and 3) conceptual reframing facilitate "conceptual changes to accommodate or bring about changes in practices."[56] (Tsoukas, 2009, p.946) Conceptual combination[57] is the idea of linking two or more existing concepts. One example of this is the term *corporate social responsibility*, which causes one to think about how individuals within a corporation could have something other than 'profit maximization' on their agenda. Stemming from a consumer desire

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[54] Scholars also discussing this concept include: (Taylor 2002, p. 294; von Foerster 1991, pp. 72-73; Bohm 1996, Chapter 2; Gergen et al. 2004, p.7; Isaacs 1999, pp. 19-20; Luckmann 1990, pp. 52-53)

[55] The idea of relational engagement is similar to that of peer-to-peer interaction, discussed in section 4.3.4 Knowledge Sharing

[56] See also: (Dunbar 1997, p. 485)

[57] The concept of conceptual combination also draws upon the work of: (Wisniewski 1997; Hampton 1997; Sawyer 2007; Glucksberg et al. 1997; Thagard 1997)

for organizations to be more ethical, the idea of corporate social responsibility has led to a wide variety of diverse actions by a large number of organizations (from energy saving to employee care to community outreach, etc.). As this example identifies, describing what is needed through a combination of pre-existing words can facilitate new understandings about how to achieve that which is articulated.

Conceptual expansion[58] extends a concept beyond its core use to match a new situation. Although seen as a creative process that happens when facing something new, it is also an incremental process, which is best understood or accepted when it builds on already known senses of a concept. Analogy is an effective way of using conceptual expansion, like comparing global warming to a greenhouse (as in the greenhouse effect). Like a greenhouse, heat is trapped in the Earth's atmosphere, which allows things to grow and survive, but also like a greenhouse; too much heat will negatively affect certain types of life. Both the Earth and a greenhouse, to a certain degree, are closed systems that need to be monitored and taken care of in order for the life within them to thrive. Understanding global warming by using the analogy of a greenhouse has led many individuals to consider how to keep the Earth's atmosphere in balance, and thus to reduce carbon emissions by, for example, using less fossil fuels and more renewable energy.

Lastly, conceptual reframing[59] describes the process of reclassifying an object, or shifting emphasis from one class membership to another, creating a new understanding of the object, which can happen with or without the use of metaphors. Without the use of metaphor, dialogue between individuals can lead to "arresting moments" (Shotter, 2006) or "aha moments" (Napier et al. 2009) constituting a leap in logic to a new platform, reclassifying previous understandings and giving individuals involved new understandings of problems and solutions. Often, seeing a problem in new light creates the possibility to take new actions. The use of metaphors can also facilitate conceptual reframing. For example, I will continue to argue throughout this dissertation that, similar to the organic paradigm (as opposed to the computational paradigm), a *living organism* is a better metaphor than for example a *mathematical equation* in relation to knowledge and its management within organizations. Using the metaphor of a living organism brings about thoughts of natural processes that happen over time, emerging and evolving in complex ways that are tightly linked to their environment. As knowledge management processes continue to be described, this is hopefully the understanding that will be reflected. Action to be taken by managers based on a living organism metaphor for knowledge management could, for example,

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[58] The concept of conceptual expansion also draws upon the work of: (Murphy 1997; Lakoff and Johnson 1999; Tsoukas and Chia 2002)
[59] The concept of conceptual reframing also draws upon the work of: (Bateson 1972; Bartunek, 1988; Watzlawick et al. 1947)

include focusing on individuals, environmental influences, and processes that embrace complexity.

For Tsoukas, knowledge creation happens through productive dialogue resulting in new distinctions that can spur action, which he visualizes in the following way:

Figure 7: A Dialogical model for Organizational Knowledge Creation in Direct Social Interaction
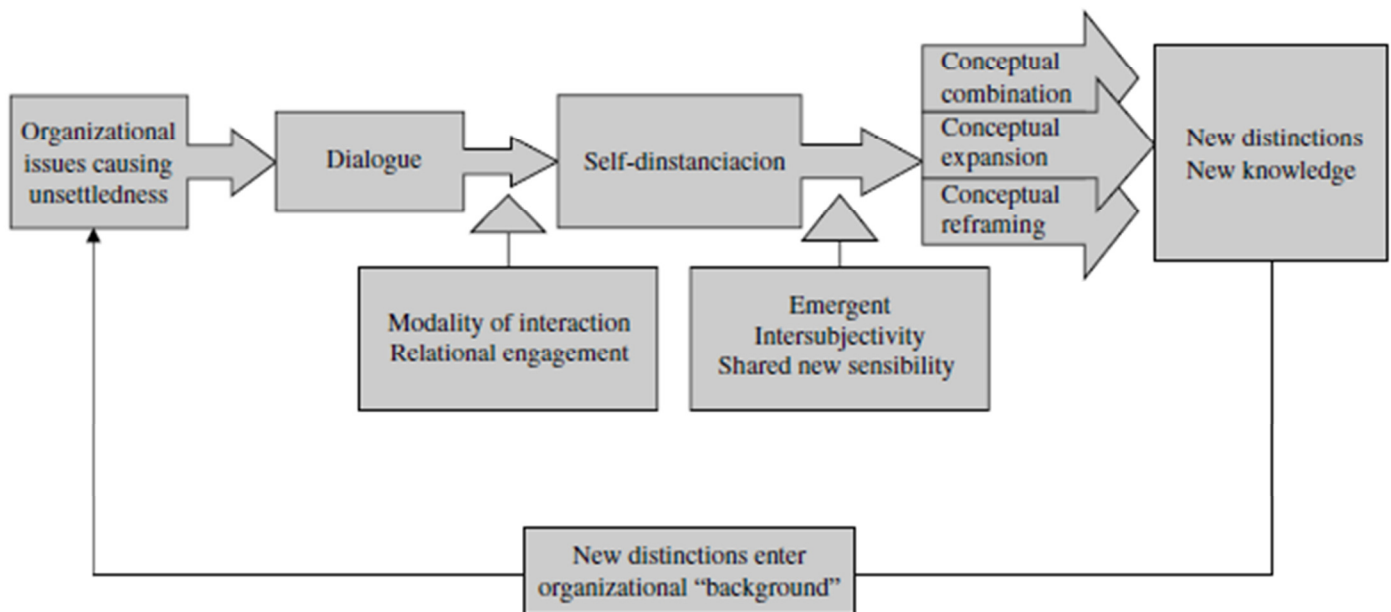
Source: Tsoukas (2009, p. 950)

Organizations may look to knowledge creation or knowledge generation practices or tools to help them quickly and efficiently 'increase their stock of corporate knowledge.' As Tsoukas' (2009) model does a good job of illustrating, creating knowledge is a people process that takes time. Individuals need to interact and reflect about their own understandings and the understandings of others in order to create knowledge. Rather than looking for 'more and faster' in relation to knowledge generation, perhaps what is needed is a better understanding of the way in which knowledge is generated, so that it may be nurtured and encouraged. Toward this end, focusing on the aspects of 1) **personal interaction** and 2) the **time** needed to make new distinctions, seems particularly important and possibly overlooked as busy professionals participating in actor oriented innovation programs pool resources over large distances, and with very time-constrained schedules. Through focusing on increasing time for interaction and reflection, new distinctions may also lead to more and better knowledge creation than was initially anticipated.

4.3.2 Knowledge acquisition

Knowledge acquisition refers to sources of knowledge (individuals) that come from outside an organization. With the increasing degree of complexity in business arrangements (and here I am thinking of actor oriented innovation organizations in particular), what classifies as inside or outside may best be understood through the type of contractual agreements made between parties. Compared to the other constructs discussed under knowledge management *drivers*, knowledge acquisition is relatively less focused upon in the literature, as knowledge management more often revolves around trying to figure out how best to get knowledge flowing *within* an organization – through means such as buying new technology, creating IT systems to share what is commonly termed knowledge (but what is understood here as information), distributing best practices, etc. (Kostova, athanassiou, and Berdrow, 2004; Maznevski and Athanassiou, 2007). Although the environment around an organization is easily recognized as a potential source of knowledge, "few companies think about how to manage their external knowledge resources strategically, to create value beyond an immediate and specific piece of knowledge or information." (Maznevski and Athanassiou, 2007, p.69) One reason for a lack of focus in this area may be the common "not-invented-here" mentality within many organizations.

In her book *Wellsprings of Knowledge: Building and sustaining the sources of Innovation*, the scholar Dorothy Leonard discusses what she calls the Not-Invented-Here (NIH) 'syndrome', namely that many organizations reject outside knowledge coming into an organization. Grounds for rejecting knowledge from external sources can range from wanting to come up with one's own ideas rather than using someone else's to thinking that new technology is flawed (which of course, it sometimes is) (1998, p. 159). Organizations with this view may do well to remember that "originality is less important than usefulness." (Davenport and Prusak, 2000, p.53) In terms of overcoming this 'syndrome', Leonard states that "the most successful antidote to NIH is an organizational culture that embodies a sense of urgency for innovation, encourages interactions with outside sources of expertise, and helps employees understand the wellsprings of creativity – which are almost never filled in isolation." (Leonard, 1998, p.160)

In addition to fighting the NIH mentality, Leonard also gives some important guidelines for acquiring knowledge from outside an organization, namely: scanning broadly; providing for continuous interaction; nurturing technological gatekeepers; and nurturing boundary spanners. Before discussing each of these ideas, let us first turn to the context in which these ideas can be achieved, namely, through networks.[60] In answering the question of how knowledge outside an organization can be accessed most efficiently, it has been suggested that "…managers should use

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[60] Networks are the main focus of discussion in section: 4.5.1 Social Networks

networks of relationships they are building for other purposes to improve the knowledge flows across the firm's boundaries… The keys to tapping into external knowledge resources involve recognizing these networks' potential as knowledge conduits and leveraging them in new ways." (Maznevski and Athanassiou, 2007, p.70) So, rather than seeing relationships as only facilitating one very specific end (such as acquiring a mechanical part for a new machine), nurturing relationships (for example with a supplier) as a potential source of further knowledge may be a way to gain new insights, and thus acquire knowledge that lies outside an organization. This idea of strengthening network relationships is also understood as social capital, whereby "mutual relationships encourage cooperative activity among employees and increase employees' chances for promotion and recognition within the organization." (Reychav and Weisberg, 2009, p.193) Relationships nurtured outside an organization may be particularly helpful if the insights gained from these relationships are helpful for one's own field of work, as well as for the organization more generally. So, by encouraging already formed relationships outside an organization to be enhanced in mutually beneficial ways, an organization can enhance its knowledge acquisition.

Now, with an understanding that networks external to an organization can provide the context for knowledge acquisition by focusing on the relationships therein as fostering social capital (rather than narrow 'means-end' relationships) let us re-visit the other suggestions Dorothy Leonard provides for acquiring knowledge from outside an organization. The first suggestion is to **scan broadly**. As stated by Leonard (1998, p.156), "A study of Japanese, Swedish, and U.S. firms found technology scanning considered second only to internal research as the most important technology-acquisition strategy."[61] Perhaps there is also a word of caution here, because although social capital entails, to some extent, forming deeper relationships within networks, it should not necessarily be at the expense of keeping in contact with many different possible external sources of knowledge (people). Akin to the saying "don't put all of your eggs in one basket," knowing what is going on in a variety of networks may provide knowledge that was not considered valuable to an organization before they had it.

The next suggestion is to **provide for continuous interaction**. Checking to see what is available outside an organization at the beginning of a project, and then working 'heads down' until the project is complete, oblivious to what is going on outside the organization in the meantime, may not be a wise choice, as time does not stand still while we work. Leonard discusses the fact that there is some empirical evidence supporting the idea that "continuous monitoring benefits performance." (Leonard, 1998, p.157) For example, in comparing high and low performing groups, the level of outside interaction was found to be variable within low performing groups,

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[61] See also: (Granstrand et al. 1992)

while in high-performing groups, the level of outside interaction was consistently high (Allen 1977, in Leonard, 1998). If we think about the networks discussed above, having periodic rather than sporadic interactions with external network members may also serve the purpose of 'keeping in-touch', which may have the additional benefit of enhancing social capital.

Nurturing technological gatekeepers is also discussed by Dorothy Leonard as a suggestion for knowledge acquisition, which like the other suggestions mentioned here, can help to "challenge core rigidities" and "encourage inventive serendipity" for an organization. Gatekeepers are understood as "outstanding technical performers who keep their colleagues apprised of the latest happenings in their field." (Leonard,1998, p.157) These individuals should, and often are, seen by organizations as critically important for being able to go through a large amount of diverse information and find key, significant, pieces (Leonard,1998, p.158). Supporting the relationships formed among gatekeepers in actor oriented innovation programs may be particularly important, because the diverse group brought together in this context will have important similarities in terms of the products they are developing and the market needs that they are trying to satisfy.

One last suggestion given by Dorthy Leonard is to **nurture boundary spanners**. Boundary spanners are those individuals who can take information from one group, and present it in a meaningful way to another group. In other words boundary spanners "translate" and "disseminate" knowledge (Leonard, 1998, p.158). For actor oriented innovation programs, boundary spanners are particularly vital, as these programs bring together a wide range of actors. In this context, it is the boundary spanner's job to understand a wide range of capabilities, needs and desires, and combine them in meaningful ways that appeal to the group of actors on a general level. Often, this requires a balance between different, and sometimes contradictory, needs. In their book *Super-Flexibility for Knowledge Enterprises* the scholars Bahrami and Evans describe these boundary spanners as facilitating a "hub role," where both a high level of job competence, as well as highly developed interpersonal skills are needed (2005, p.125). Both Leonard, as well as Bahrami and Evans, also caution that these individuals can become bottle-necks, which Bahrami and Evans do a nice job of illustrating when they state: "The on-going challenge is to monitor organizational "hot spots" proactively, before they turn into chaotic traffic jams, and to assign credible individuals to hub roles in order to minimize "traffic congestion." (Bahrami and Evans, 2005, p.125) So, one important way to nurture these boundary spanners is to make sure that there are enough individuals in this position to cover the needs of the organization/project. If there are too few boundary spanners, having strong job competencies and interpersonal skills will not be enough to manage all the "hot spots" within an organization/project effectively.

In general, it is a pretty safe bet that organizations are not always going to have all the knowledge that they need within their organizations. More specifically, knowledge acquisition is focused upon here because it is a basic tenet of actor oriented innovation programs that the "locus of innovation" extends beyond the individual organization (Powell, Koput, and Smith-Doerr, 1996; Fjeldstad, Snow, Miles and Lettl 2012). Because of this orientation, actor oriented innovation programs in particular stand to gain a great deal from further research in this area. The scholars Maznevski and Athanassiou do a good job of explaining the importance of the type of network relationships desired through these programs when they state (2007, p.77):

> "It is worth building at least a few strong relationships with other players in the industry. Relationships are extremely powerful if they are characterized by the kind of trust that can create tacit knowledge and provide access to nonpublic explicit knowledge among competitors. In these rare relationships, both [all] parties acknowledge that they can build value together, both [all] parties keep their conversations confidential from other competitors, and both [all] parties respect the need to hold back some information."

I would argue that this is exactly what the Carbon Trust is aiming to achieve with the OWA program. Further, the dynamic and complex business realities being faced in the 21st century are only likely to increase in degree over the coming years. It is for this reason that I predict knowledge acquisition becoming an increasingly important and studied concept, not only for actor oriented innovation programs, but for the field of knowledge management generally.

4.3.3 Knowledge Capture

Knowledge capture is a term that has become quite popular over the last two decades within the field of knowledge management, having followed in the footsteps of the information age (Liao, 2003, p.155). It forwards the idea that knowledge can be made explicit, written down or in some other way be extracted from the mind of the knower. This is a very enticing concept, as it implies the ability for an organization to gain a high level of control – indeed if all, or even most, knowledge could be made explicit, and thus 'captured' in some external system, organizations would have a much easier time getting things done. Scholars such as Nonaka and Takeuchi (1995), for example, suggest that by translating the inarticulate forms of knowledge (tacit) into articulate forms of knowledge (explicit), knowledge flow within an organization can be improved. However, the extent to which this is possible is contested in knowledge management literature,[62] and even scholars such as Davenport and Prusak, who write extensively about knowledge capture, have come to the conclusion that "… an excessive focus on technology is the most common pitfall in knowledge management." (2000, p.173)

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[62] This debate is discussed in more detail in section 4.4.1 The Tacit Knowledge Challenge

So how, then, are we to understand the term 'knowledge capture,' its relation to information technology (IT), and its role within processes of and for managing knowledge? In relation to knowledge management generally, and more specifically in relation to actor oriented innovation programs, I will discuss this issue in a three step process. First, it is argued that it is inaccurate to discuss the use of IT with use of the term 'knowledge capture' – a notion that comes back, ultimately, to tacit and explicit knowledge as well as environmental influences. Second, a discussion is presented as to why IT does have a useful role to play in the management of knowledge, and how we might more usefully classify it within knowledge management. Third, the use of IT within organizations is discussed as it is now, and how it could be used by actor oriented innovation programs in the future, as part of a productive process for the management of knowledge.

In order to specify precisely why 'knowledge capture' and 'knowledge codification' are misnomers, let us examine an antidote given by Davenport and Prusak, which is quite telling in terms of why knowledge cannot be strictly 'codified' – "Chess-playing computers, like IBM's Deep Blue, can now compete with the best human players because chess, though complex, is a closed system of unchanging and codifiable rules." (Davenport and Prusak, 2000, p.84) This antidote makes two important points, related to 1) context and 2) the social construction of reality. First let us examine the statement that chess is a 'closed system.' Unlike the 'closed system' found on a chess board, the reality in which we live is often complex and even chaotic. The scholars Thietart and Forgues (1995, p.19), for example, describe the organization "as an open, dynamic, nonlinear system subject to internal and external forces which might be sources of chaos." The practical implication of this is as follows: a particular problem that arises within an organization may be impacted by a number of different internal or external environmental factors, and looking to only one common solution (or set of solutions found in a database) might not take into consideration the environmental change (or set of changes) that caused the problem in the first place.

The next important statement made by this antidote is about 'rules,' and the social construction of reality. In chess, everyone adheres to the same set of rules, but in the social world, the 'rules' that individuals adhere to are different and change over time, also changing from one place to another. As stated by the scholars Brown and Duguid (2001, p.207), "people… have different assumptions, different outlooks, different interpretations of the world around them, and different ways of making sense of their encounters." For this reason, it is not possible to strictly say that if I have problem "A", the way to fix it is by doing "B." The solution might be "B," but perhaps it can be more quickly and efficiently be accomplished by doing "E" or "F." Or the context may

have changed, so "B" does not work at all by itself, and "B" along with "G" is required. Finding solutions to problems requires the context and intuition of individuals solving the problem which is, at best, difficult to provide through the use of a databases and IT tools. It is perhaps for this reason that the scholars Tsoukas and Vladimirou (2001, p.982) recognize that "knowing always is, to a greater or lesser extent, a skillful accomplishment, an art." The skill that art (or knowing) requires is difficult, if not impossible, to acquire through information technology, and by extension, to describe knowledge as "captured" or "codified" in IT systems, external to the understanding that comes from human beings and their interpretation, is misleading.

The problem experienced by many organizations time and again is that: "Much of the energy in knowledge management has been spent on treating knowledge as an "it," an entity separate from the people who create and use it." (Davenport and Prusak, 2000, p.146) The element that is missing from IT systems in relation to knowledge – something which will never be provided – is the tacit, or implicit, understanding that can only be achieved by 'individuals and their brains.' In other words, "…explicit knowledge of patents and reports does not become usable simply by being codified. It needs to be evaluated and made accessible to the people who can do something with it in order to benefit the organization." (Davenport and Prusak, 2000, p.85) To my mind, this demonstrates that IT tools, and the information that they hold and provide, cannot be classified as knowledge. However, evaluating written information (whether in patent form, or stories describing best practice, etc.) and then making it available to others is an integral part of the entire codification process, and this storage and distribution of written (or visual) information is a vital knowledge *conduit*, which organizations have been relying on in one form or another since before the industrial revolution.

Despite the common misnomer of referring to IT systems as 'knowledge capture' systems, or 'knowledge repositories,' when understood for what they really are (a type of knowledge *conduit* – a facilitator of knowledge, not knowledge in and of itself), IT systems can indeed be useful for knowledge processes and their management. The next question then becomes: What is it about IT systems that make them a useful knowledge conduit, or facilitator for knowledge processes? One very important reason that IT systems are useful for the management of knowledge is that they allow information, which is vital for knowledge, to be made widely available, and without which, transactions would be "limited and local" (Davenport and Prusak, 2000, p.45). So availability to information is one big advantage that IT can provide. Also, on a very general level, putting information into an IT system 'represents' knowledge " in forms that can be shared, stored, combined, and manipulated in a variety of ways." (Davenport and Prusak, 2000, p.87) So, by putting information into an IT system, it can not only be preserved, but it can also be used by a

number of individuals in ways that would not be possible if the information had stayed in one individual's brain.

Akin to the idea of IT systems as knowledge conduits, or facilitators of knowledge, Davenport and Prusak (2000, p.18) state that:

> "The computational power of computers has little relevance to knowledge work, but the communication and storage capabilities of networked computers make them knowledge enablers. Through e-mail, groupware, the Internet, and intranets, computers and networks can point to people with knowledge and connect people who need to share knowledge over a distance. […] new information technology is only the pipeline and storage system for knowledge exchange. It does not create knowledge and cannot guarantee or even promote knowledge generation or knowledge sharing in a corporate culture that doesn't favor those activities. The proverbial phrase "if we build it, they will come" does not apply to information technology."

For actor oriented innovation programs, looking at IT tools as a means to store and share information, as well as communicate, is seen as particularly useful, as these programs often need to connect many widely dispersed actors, as well as the information that each of them may wish to contribute.

This leads us to the last discussion of this section, namely how IT systems are currently being used, and how they can be used by actor oriented innovation programs, as conduits for the management of knowledge. When speaking about the use of IT tools in relation to knowledge management, it may be informative to talk about two different ends of a spectrum. On one end there is information and codification, where information is stored in databases, providing the 'templates' for 'thinking' and 'action' (Alvesson, 2004, p. 176), and on the other end is personalization, which focuses on interaction through the use of IT.

On the codification end of the spectrum would be information repositories, where information is stored for those who wish to access it, and have access to it. Somewhere in the middle of the spectrum one could expect to find, for example, expert networks (people locators), group discussion systems, and email. On the other end of the spectrum (the personalization side) would be more direct forms of communication like telephone calls, teleconferencing, and videoconferencing. None of these will be discussed here at any great length, but instead will be touched upon briefly to identify their purpose, benefits and drawbacks as knowledge conduits. This spectrum can be visualized as follows:

Figure 8: Spectrum of IT tools that can be used as knowledge conduits

Codification   **Personalization**
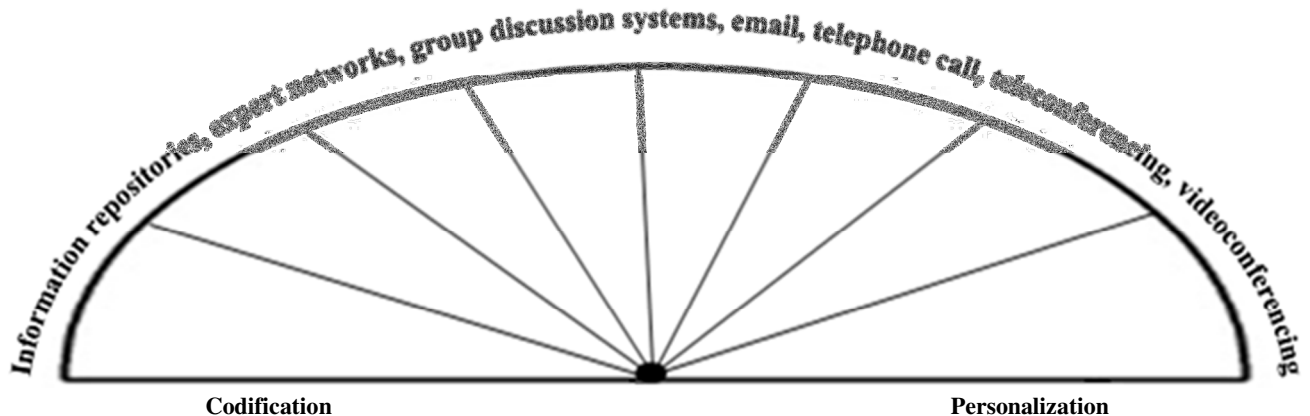
Source: Madsen (2013)

Starting with the codification side of the spectrum, let us first examine information repositories. Davenport and Prusak identify three 'types' of repositories that they have come across in their extensive research on the subject, and while the authors identify each as types of knowledge, the argument put forth in this dissertation is that they are actually types of information. They are as follows: "1. External knowledge (example: competitive intelligence); 2. Structured internal knowledge (example: research reports, product-oriented marketing materials and methods); and 3. Informal internal knowledge (example: discussion databases full of know-how, sometimes referred to as "lessons learned")." (Davenport and Prusak, 2000, p.146) Perhaps the best feature of information repositories is the capacity to hold a great deal of information in one place. However, like a library, it is extremely important that each piece of information is classified in a way that will allow individuals who need the information to find what they are looking for when they need it. Categories and key terms need to be specified and updated on a regular basis, as categories and meanings will change over time, and for this same reason, "it is often useful to devise a thesaurus to assist users as well." (Davenport and Prusak, 2000, p.159) For actor oriented innovation programs, 'categories' and 'meanings' are likely to change at a particularly fast pace, as new developments occur rapidly, specifying a particular need for updated classification. Also, in terms of informal internal knowledge, formalizing the information given in story form may provide the best chance for others to learn from it. As stated by Davenport and Prusak "stories and rhetorical strategies provide the richest and most flexible approach." (Davenport and Prusak, 2000, p.87) By providing 'lessons learned' in story form, others may be better able to follow the train of thought that led individuals to their decisions, and therefore help them to learn from their experiences.

Next, somewhere in the middle of the spectrum lie expert networks, group discussion systems, and email. As identified previously, the best way to truly understand someone is to interact with them face-to-face. One way that this can be facilitated in organizations is through the use of expert networks (or maps of knowledge sources) that can locate people within an organization that have expertise within a particular area. Along this line of thinking it has been noted that "the codification process for the richest tacit knowledge in organizations is generally limited to locating someone with the knowledge, pointing the seeker to it, and encouraging them to interact." (Davenport and Prusak, 2000, p.71) Although an expert network does not provide interaction or contact in and of itself, it does provide the means to this end. Both group discussion systems and email provide a means for communication in written form, although unlike direct interaction, time is needed for a response to be given. All of the information technology presented in the middle of the spectrum requires individuals to actively engage and use the technology in order for it to be effective, a process which can often be time consuming and, consequently, get set aside and forgotten. The most important thing to remember for actor oriented innovation programs, as well as organizations in general, is that the set of IT tools that are selected should be selected because they are *needed* and will be *used,* not because they are available or look interesting. A word of caution that bears returning to is that information technology "cannot guarantee or even promote knowledge generation or knowledge sharing in a corporate culture that doesn't favor those activities. The proverbial phrase "if we build it, they will come" does not apply to information technology." (Davenport and Prusak, 2000, p.18)

Finally, on the personalization side of the spectrum there are IT tools such as the telephone, teleconferencing and videoconferencing. The reason for these tools being placed on the personalization side of the spectrum is that they provide 'real time' interaction opportunities for individuals. Rather than showing you what someone has written down or presented (as with information repositories) or where someone is within an organization or network (as with expert networks), these IT tools are meant to connect individuals directly. Each of these methods of communication has its advantages and drawbacks. Having a telephone conversation with one individual allows for immediate feedback, and is a good way to 'keep in touch' if you are not able to meet with the person face-to-face. Teleconferencing provides the advantage of getting many people's opinions at once. However, without the cues that come along with being face-to-face, it may be difficult to have open discussions, and purposeful and targeted "question and answer" type conversations may be better suited to teleconference calls. Video conferencing allows for an extra layer of understanding, namely that individuals can see each-other. This can be a great idea if the technology works well. Getting videoconferencing up and running for multiple parties at once can be a challenge though, and if the connection is poor, individuals can leave the

interaction feeling more frustrated than informed. Long distances between individuals in actor oriented innovation programs can make these IT tools useful when face-to-face interaction is not always an option. However, the key with personalization IT tools, whether for actor oriented innovation programs or an organization generally, is that each has its advantages and disadvantages. By understanding the purpose of the interaction, an evaluation can be made about which personalization IT tool(s) may best serve the purpose at hand.

Before concluding the discussion about 'knowledge capture,' it seems appropriate to briefly touch upon the topic of 'knowledge retention.' Knowledge retention is an issue often discussed in relation to knowledge management, and forwards the idea that after having acquired knowledge, or the people with it, that knowledge then needs somehow to be retained within the organization. This concept is related to 'knowledge capture' because it can imply the need for writing down, or otherwise 'preserving' or 'capturing' knowledge (and what I would call information) before the individual leaves the organization. However, the common problem is that a lot of what people know is tacit, or implicit, and requires 'in the moment' thinking in order to react to a specific situation. Any information that is attained from an individual before leaving an organization, program or project will be based on a previous context, and may not provide the exact information needed or desired for individuals in the future. Also, within actor oriented innovation programs this issue is not seen to be a main priority or focus because: 1) these type of programs may not entail a desire for long-term commitment by its members – if these programs are formed to develop a particular innovation for example, they may be disbanded once the project is completed; and 2) on a more general level, trying to retain an individual's knowledge is extremely difficult (if not impossible) - how do you know you are capturing the precise information that will be helpful or necessary for people at a later point in time?

At the beginning of this section the question was posed: How are we to understand knowledge capture, its role in information technology, and its role within processes of and for managing knowledge? In relation to the term 'knowledge capture', it is suggested here that this term is a misnomer, and that what is actually being talked about is information capture. Information technology is seen as a knowledge conduit, *facilitating* knowledge by providing the opportunity to capture and share information. A number of different IT tools are discussed on a spectrum from codification to personalization, each of which is briefly examined with regard to its usefulness for actor oriented innovation programs. The term knowledge retention is also briefly discussed here, as it is often mentioned in connection with knowledge capture, although it is seen as a relatively less useful concept in the context of actor oriented innovation programs and this dissertation. Overall, although IT tools can be helpful for organizing, storing and disseminating

information, as well as connecting individuals, a deep understanding of the needs of an individual project (or organization) should be obtained and made explicit *before* turning to the use of information technology. If these tools do not fulfill a need, chances are they will not be used, and precious time and resources will have been used in vein.

4.3.4 Knowledge Sharing

Knowledge sharing, also known as knowledge transfer, is another concept that entices organizations to turn to knowledge management for solutions. Sharing information: between individuals, within groups, and among organizational units is unquestionably necessary for all organizations. For example, a common problem faced by many different types of organizations is that when knowledge sharing is not present, "different employees repeatedly facing the same problem … "reinvent the wheel" as they become familiar with the details of the problem and fabricate a possible solution."[63] (Huang, 2009, p.788) For actor oriented innovation programs, the benefits of sharing what we know is particularly pronounced, as steep learning curves exist for innovations, and knowledge sharing is seen as providing the opportunity to "avoid redundancy in knowledge production, allow for the diffusion of best practices, and enable problem solving by making relevant personal knowledge available to the problem solving process."[64] (Huang, 2009, p.789) Sharing what we know is also seen as a means to 'reduce time to market' for new products through 'improved group processes.' (McNeish, and Mann 2010)

However, this is not necessarily as simple as it may sound. The scholar Mats Alvesson (2004, p.171) states, for example, that: "Knowledge is not easily transferred. The very idea of knowledge 'transfer'—indicating a kind of postal delivery—may be misleading… knowledge is not a thing or thing-like object." As identified previously with discussions of the 'tacit-ness' of knowledge, the fact that much of what is known is dependent upon how the knower connects and combines information – internally and intuitively in unique ways – means that the sharing of knowledge is also a unique process highly dependent on individuals and their interactions. This process takes time and effort on the part of those sharing what they know, which raises the question: why should/do individuals share what they know? The question of 'why share knowledge' is an interesting and important topic, especially for actor oriented innovation programs, where collaborative and competitive interests can exist simultaneously (Andersen and Drejer 2009). After examining the "why" of knowledge sharing, the "how" will also be investigated, identifying some key themes that have emerged in the literature about the conditions under which knowledge is most likely to be shared.

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[63] See also: (Galletta et al. 2002)

[64] See also: (Husted and Michailova, 2002)

Why should we share what we know? A number of scholars forward the understanding that "one of the barriers to effective knowledge sharing is the basic insecurity and fear that prevails in many organizations. Knowledge is a source of employees' power and only guarantee of employment."[65] (McNeish and Mann, 2010, p.25) The idea here seems to be that if individuals share what they know, someone else will know it, and there will be no reason for the organization to employ them further. In addition, individuals are also seen as being reluctant to share knowledge because of "a fear of ridicule, related to concerns that sharing knowledge may reveal limitations to others."[66] (Hislop, 2009, p.151) This would suggest that by sharing ones knowledge, others also find out what one does not known, in addition to what one does. The scholar Donald Hislop looks at knowledge sharing (contributing with one's knowledge) as opposed to knowledge hording (keeping ones knowledge to ones-self), where both have positive and negative consequences. Knowledge sharing is seen as having advantages such as: intrinsic reward (feeling good about ones-self); financial or non-financial rewards; and elevated individual status as others come to understand what one knows, along with improving the performance of a group/ organization. (Hislop, 2009, p.149) To this list I would also include the benefit of reciprocity, the idea that by sharing knowledge, one will also receive knowledge in return through the process of interaction. Disadvantages of knowledge sharing are seen, by Hislop, to include: being time consuming; and "potentially giving away a source of power and expertise to others." (2009, p. 149) Hording knowledge (or free riding) on the other hand, is seen as having the advantage of avoiding giving away or losing any power, but is also seen as having the disadvantage of others possibly not understanding or recognizing the knowledge that one possesses. (Hislop, 2009, p.149)

This comparison between knowledge sharing and knowledge hording reveals some of the considerations that may be undertaken when deciding to share knowledge. Suffice it to say, sharing ones knowledge is not a straightforward or automatic process. Within actor oriented innovation programs, it has likely been understood by the individuals involved that "the growing complexity of innovations means that all relevant knowledge is unlikely to be possessed internally by [one] innovating company, requiring the development of … networks to access such knowledge." (Hislop, 2009, p.123) This would suggest that for actor oriented innovation programs, the above considerations may impact not only individual, but also group, as well as organizational interests, in different ways, as "strategic tensions may arise among actors with collaborative and competitive interests." (Andersen and Drejer, 2009, p.690) However, what is pertinent for present purposes is simply to understand that the considerations that are undertaken

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[65] See also: (Constant et al., 1994; Das and Teng, 1998; Huber, 2001; Bock et al., 2005)
[66] See also: (Ardichvili et al. 2003; Newell et al. 2007; Renzl 2008)

when deciding to share knowledge (and particularly within actor oriented innovation programs) are complex and intricately linked to the knower and their judgment in any given contextual situation.

Using this understanding as the basis for further discussion, the next task is to examine the ways in which knowledge sharing can best be facilitated. First and foremost on this list is face-to-face, or 'social', interaction. Because knowledge has to do with "the value added by people – context, experience, and interpretation…,"(Davenport and Prusak, 2000, p.129) the best way to facilitate knowledge sharing (a.k.a. knowledge transfer) is most often seen to be finding "effective ways to let people talk and listen to one another." (Davenport and Prusak, 2000, p.88) The alternatives to face-to-face interaction, namely using information technology such as internet, intranet discussion groups, and groupware discussion databases, all tend to have "variable quality and a lack of personal contact, which tends to reduce trust and commitment." (Davenport and Prusak, 2000, p.47) Because of the complexities of individuals and their dynamic interactions, as opposed to IT systems and their linear, mechanistic nature, the scholar Jay Liebowitz suggests that "the most challenging aspects of successful knowledge management strategies deal with organizational behavior and the successful formation of teaming and business processes." (Liebowitz, 2009, p.112) In relation to knowledge sharing, we might therefore usefully ask: what types of behaviors, what types of teams, and what types of processes make knowledge sharing most effective? This will be the task of the remainder of this section.

In terms of the types of behaviors that may best facilitate knowledge sharing; those related to *trust* are often highlighted in academic literature as important, exemplified by statements such as: "knowledge sharing is influenced by the degree of trust that exists between people."[67] (Newell et al. 2007, p.158) Building trust can be understood as a way to mitigate some of the fear and uncertainty that is presented above as reasons for not sharing knowledge. Literature relating to trust reveals that trusting relationships are often built through reciprocal interaction over time, providing benefits to all individuals concerned (Rousseau et al., 1998; Zaheer et al., 1998). In addition, transparency is found to be important for helping individuals concerned to understand the benefits that are provided to them through knowledge sharing. (Anderson and Weitz, 1998; Anderson and Narus, 1990; Morgan and Hunt, 1994; Doney and Cannon, 1997; Tapscott and Ticoll, 2003; McNeish and Mann, 2010) In other words, if actors make information available to each other that may affect each other's' interests, and communicate openly about it, trust is likely to be built, and knowledge is likely to be shared. So, the behaviors seen here as important for knowledge sharing are **continual interaction** and **transparency** (i.e. clarity about what

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[67] See also: (Chowhury, 2005; Politis, 2003)

information is being shared and how it pertains to other's interests). When not all information and resources within organizations are being shared (as is the case with the Carbon Trust OWA project – described as an actor oriented innovation project), being transparent about what *is* shared and why seems particularly important, as partial information and resource sharing might otherwise be perceived as knowledge hording, and elicit similar behavior from the other actors involved. I would also like to suggest that these two behaviors—continual interaction and transparent communication—create a feedback loop, facilitating greater and greater trust and knowledge sharing, as they continue. However, if this loop is affected by lack of interaction or lack of transparency, the feedback loop can easily be negatively affected, and fear and uncertainty about the agendas of others and how that may impact one's own position can stop processes of knowledge sharing, and turn them into situations of knowledge hording instead. Because of this, it is very important that once trusting relationships are established they are also maintained, if continued knowledge sharing is desired.

Next, in terms of team characteristics that may best facilitate knowledge sharing, a horizontal, peer-to-peer approach to interaction, rather than a vertical, parent-child approach to interaction, is seen as facilitating knowledge sharing. The scholars Newell et al., for example, state that: "Knowledge work is best conducted in organic and informal settings, with egalitarian cultures and where horizontal, as opposed to vertical, communication dominates." (Newell et al. 2002, p.98) Focusing on horizontal communication, the scholars Baharmi and Evans provide a very useful figure to represent the differences between vertical and horizontal communication. In this figure, vertical communication is labeled 'parent/child' communication, and horizontal communication is labeled 'peer-to-peer' communication.

Figure 9: A comparison between "parent/child" and peer-to-peer leadership practices
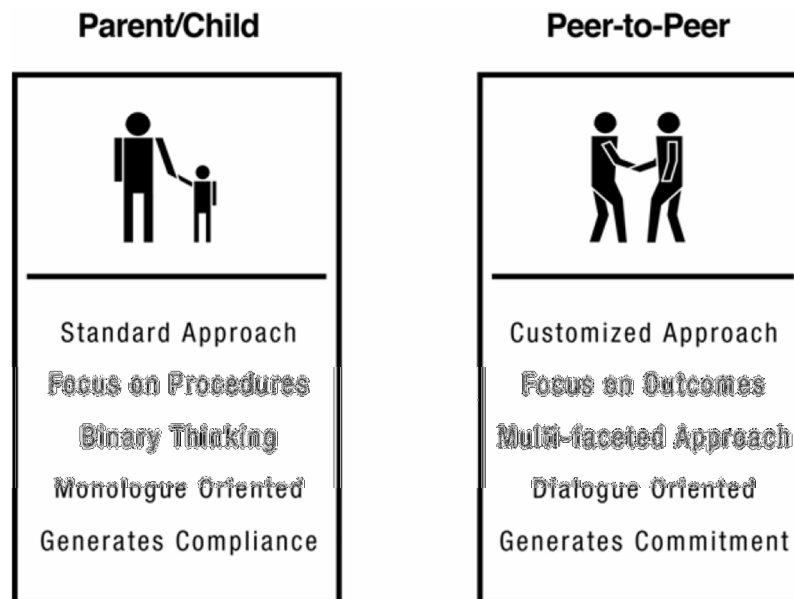
Bahrami and Evans (2005, p.142)

Although, as illustrated in this figure, Bahrami and Evens discuss peer-to-peer interaction as a useful leadership practice, there is reason to believe that it may also be a very useful group practice, following the scholars Newell et al. (2002) for effective knowledge sharing. Peer-to-peer group practices would also seem to coincide with what Henry Mintzberg (1979) termed "adhocracy" where, contrary to typical forms of bureaucracy, teams de-emphasize hierarchy in favor of coordination achieved through decision making in groups, and organic processes of mutual (dialogue oriented) adjustment. Peer-to-peer thinking, according to Bahrami and Evans, "puts emphasis on meritocracy and egalitarian norms. … Power is based on one's reputation and value-added contributions." (Bahrami and Evans, 2005, p.142) Basing an individual's personal status on their contribution to the group may also be an impetus for them to share their knowledge, and thus help to achieve 'outcomes' more quickly. Actor oriented innovation programs are seen as needing to be highly adaptive and flexible, as changing internal and external factors impact innovations and the markets in which they will be utilized. **Peer-to-Peer interaction** in groups is seen here as particularly useful in this context, as this approach allows rapid change to occur through concentrating on customized and multi-faceted approaches that, through continual dialogue, focus on outcomes.

Another team characteristic that seems to be particularly important for knowledge sharing is *group cohesiveness*. As opposed to the idea of group cohesiveness as a type of 'group think,' where everyone has the same approach to solving a problem, a multi-dimensional approach to group cohesiveness has been adopted by a number of scholars (e.g., Huang, 2009; Chang et al,

2006; Carless and De Paola, 2000; Zaccaro, 1991; Zaccaro and Lowe, 1988; Carron et al., 1985), proposing that there are two useful forms of group cohesiveness: interpersonal cohesiveness and task cohesiveness. Interpersonal cohesiveness is seen as "the degree to which positive interpersonal relationships exist among members of the group." (Huang, 2009, p.795) **Close proximity** (Hoegl and Proserpio, 2004) and **care** (feeling concerned and interested in other group members) (von Krogh, 1998) are understood to be important for creating interpersonal cohesiveness. Task cohesiveness is understood as arising "as a result of mutual dependency between individuals who group together for the purpose of achieving goals." (Huang, 2009, p.795) In actor oriented innovation programs, where a diverse range of actors are pooling their resources to achieve specific innovation outcomes, the innovation or project objectives may serve as the cohesive element related to a task, as discussed here**. Agreeing on end goals** can also be linked to the idea of reciprocity described above. A common goal that all individuals want to achieve may reassure the individual that s/he will not be the only one sharing because it is in everyone's best interest to share what they know in order to reach said goal. In addition to taking a peer-to-peer approach within actor oriented innovation project groups, this discussion would suggest that knowledge is also more easily shared within groups if they a) get to know each other over time and build up positive interpersonal relationships with each other, as well as b) agree on end goals. In this context, cohesiveness can provide an environment where (as opposed to the group-think phenomenon of individuals assimilating each other's way of thinking) each individual shares their unique knowledge and experience for the purpose of achieving common innovation objectives.

Lastly, in terms of overall organizational processes that may facilitate successful knowledge sharing, it has been suggested that it is important to have **basic terms and working knowledge in common**. As stated by Davenport and Prusak, even R&D departments sharing results within the wider organization can cause problems, as "knowledge creators and users may not even speak the same language." (Davenport and Prusak, 2000, p.59) In order to increase the likelihood that ideas and knowledge can be shared within an organization, and particularly within actor oriented innovation programs (where actors may be drawn together from disparate locations and organizations), having periodic cross-function, or cross-silo, forums may provide the opportunity for diverse actors to get together and discuss their various understandings, and come to some mutual agreement about how to talk about and understand what is happening within the organization. Nonaka and Takeuchi (1995, p.99) give a very good example of how this has been done at Sharp, where top managers a) hold monthly meetings to discuss R&D projects, and b) hold regular conferences where directors from Lab, R&D, and Intellectual Property departments meet together in order to collectively plan ways to transfer new knowledge to the organization's

business groups. The outcome of these regularly scheduled forums, where individuals can meet and discuss, is that common language is created for understanding shared objectives, helping the organization to move forward in a more cohesive way.

This idea of a **'cross-silo' forum** is also forwarded by Bahrami and Evens (2005, p.123), who state: "Many technology companies use periodic review meetings to provide cross-silo updates on products, customers and competitors. …The challenge is to ensure that there is a clear purpose behind the targeted interaction, and to invite the appropriate stakeholders to the right forum." Deciding how these forums should be set up will be different for each project/organization, as challenges faced, and outcomes desired, will be different in different contexts, and over time. However, the advice given by these authors is informative: Think carefully about who could benefit from this type of interaction, and then form a program that will add value to each of the participating stakeholders, as well as to the overall organization.

In returning to the question "why share knowledge?" the discussion here has hopefully identified the fact that there are a variety of personal and/or strategic reasons why individuals may choose to withhold or share what they know with other individuals, within groups, or with wider organizational or practice based networks. Despite this complexity, I have suggested that there are particular behaviors, types of teams (groups), and types of processes that may positively influence individuals' desires to share their knowledge. First, promoting trust through continual interaction and transparency are identified as behaviors that are conducive to knowledge sharing. Within groups, promoting peer-to-peer behavior among group-members is identified as positively influencing knowledge sharing. Promoting interpersonal cohesiveness (through close proximity and care), and task cohesiveness (through finding consensus on end goals), is also forwarded as promoting knowledge sharing. In terms of organizational processes that may facilitate knowledge sharing, cross-silo forums may help a diverse range of actors better understand each other, promoting knowledge sharing by coming to agreement about, and understanding common terms and working knowledge.

4.3.5 Increased Organizational Learning

One final construct concerning why scholars and business practitioners turn to knowledge management for answers remains to be discussed. It is the promise of increased organizational learning. The scholar Arie Y Lewin, for example, describes Nonaka's (1994) article on organizational knowledge creation as having the potential to stimulate "the next wave of research on organization learning." (Nonaka, 1994, p.14) Davenport and Prusak identify organizational learning as "an important component of knowledge management success – maybe even more so than others." (2000, p.170) Without the ability to learn, what could we possibly know? The

answer to this question is simple: nothing. Our ability to learn is a condition for us to know, and therefore, managing processes of knowing implies managing processes of learning.

Like knowledge, organizational learning has been described in many ways, including "everything from the most prosaic training to broad changes in culture." (Davenport and Prusak, 2000, p.158) The scholar Etienne Wenger places learning in the context of 'doing,' and forms a 'community of practice' perspective on learning that will be explored further in this section. The reason for this is that in addition to being insightful for organizations and their management generally, this approach to organizational learning seems particularly well suited to actor oriented innovation programs. As demonstrated in chapter two, organizations involved in these programs show signs of starting to act on the understanding that "your most threatening competitor may be your best partner when it comes to learning together. If you hoard your knowledge in a social learning system [particular to innovation contexts, such as the offshore wind industry], you quickly appear as taking more than you give, and you will progressively be excluded from the most significant exchanges." (Wenger, 2003, p.98) The significant exchanges discussed here are seen as occurring in communities of practice, (Wenger, 2003) suggesting that those involved in actor oriented innovation programs purposely form what is understood here as 'communities of practice' for purposes of learning from each other, thus placing all involved in a better position to *build and sustain innovations*. But before going any further, let us first understand what is meant by learning. Once this has been established, it will be possible to explore what precisely defines a 'community of practice,' and how 'communities of practice' can usefully be nurtured to produce rich learning environments.

Wenger puts forward a social definition of learning, combining competence and experience, where 'competence is historically and socially defined,' and our experiences combine with this socially defined competence to create learning. (Wenger, 2003) Like my own definition of knowledge (p.71), learning viewed from this perspective seems to present the idea that we, as individuals, need to interact with others in order to validate or reject our understanding so that we can advance to new understandings over time, and thus *learn*. However, because individuals have different experiences, and connect these experiences to previously held competencies in different ways, learning is also an individual phenomenon. In Wenger's words, learning is: "an interplay between social competence and personal experience. It is a dynamic two-way relationship between people and the social learning systems in which they participate. It combines personal transformation with the evolution of social structures." (Wenger, 2003, p.78)

Within this social theory of learning, communities of practice are highlighted as particularly important. The reason for this is that although it is not possible for human beings to learn about -

and thus know - everything, it is possible to learn and develop deep knowledge in a few particular areas, which is understood as happening over time in communities. Putting 'communities of practice' in a historical context, and connecting them to the concepts of learning and knowledge, Wenger (2003, p.80) states:

> "Since the beginning of history, human beings have formed communities that share cultural practices reflecting their collective learning: from a tribe around a cave fire, to a medieval guild … to a community of engineers interested in brake design. Practicing in these "communities of practice" is essential to our learning. It is at the very core of what makes us human beings capable of meaningful knowing."

As this statement does a good job of illustrating, the social order of individuals has been naturally organized in communities throughout history. But what exactly is it about these communities – what are the attributes - that make communities good at facilitating learning processes? Wenger suggests that there are three attributes or 'dimensions' that work together to form a 'social unit of learning', otherwise known as a well-functioning community of practice. These three attributes consist of: enterprise, mutuality and repertoire. (Wenger, 1998)

Enterprise is understood by Wenger as connected to "*the level of learning energy.*" Individuals need to take initiative to push the development of the community and maintain a 'spirit of inquiry.' Without anyone taking responsibility to identify where new knowledge and information is needed, nothing new will be learned and the community will become 'stagnant.' It is also identified by Wenger that it is important to "remain open to emergent directions and opportunities." (Wenger, 2003, p.81) This seems akin to the idea of engagement. If individuals are interested and engaged in what they are doing, they will be more likely to seek out or come across new information that builds upon what is already known within the community.

Next, **Mutuality** is connected to "*the depth of social capital,*" and has to do with the formation of a sense of community. In order for this to be achieved, it is important that community members interact regularly enough to understand the ability of the others, and feel that they can speak truthfully about real problems and how to address them. In other words: "Through receiving and giving help, they [individuals in a community] must gain enough awareness of the richness of the community to expect that their contribution will be reciprocated in some way." (Wenger, 2003, p.81) As may be evident, the statements made here about mutual engagement are closely linked to the concepts of trust and reciprocity discussed in the previous section as reasons for sharing knowledge. All of this makes intuitive sense. After all, how can anyone learn in an environment where no one is willing to share what they know? Mutual engagement seems to create an environment where people can feel comfortable about receiving, and giving, information about what is known by members of the community, which in turn facilitates the process of learning.

Lastly, **Repertoire** is connected to *"the degree of self-awareness"* within a community. The repertoire itself has to do with the artifacts, discourse and processes used by the community, such as documents that are produced, common language that is developed, procedures that are followed etc. Then, being self-aware or reflective about the repertoire that the community makes use of can enable the community to understand "its own state of development from multiple perspectives, reconsider assumptions, patterns and uncover hidden possibilities, and use this self-awareness to move forward." (Wenger, 2003, p.81) So, when re-evaluating the repertoire utilized within a community, its members might discard, for example, procedures that are not working well or, to take another example, draw new artifacts in that may be useful for continuing the community's learning process.

Taken together, Wenger sees these three attributes as producing a well-functioning community of practice, one that is able to develop and learn over time. Examining actor oriented innovation programs with respect to these three attributes may help to identify whether rich learning environments have been established through communities of practice. Over time, re-evaluating and reinforcing these attributes may also help to strengthen communities of practice, to the extent that they have been developed within actor oriented innovation programs. The next question then becomes how these social units of learning, or communities of practice - once they have established positive community attributes internally – can be nurtured so that they develop to their fullest potential? One way that this is understood as being accomplished is by focusing on boundary engagement. (Wenger, 2003) It may seem strange to focus on the boundary of a community, when having just finished a discussion about the importance of internal attributes. However, focusing on boundary engagement is a good way to continually develop the community, providing: new perspectives that can help to challenge previously held ideas; the discovery of new ideas that may contribute to problem-solving within the community; or encountering new artifacts, discourses or processes that can augment the current repertoire of a community to help it in practice.

As may seem obvious, engagement with another community at its boundary is not necessarily an easy or instinctive process. Competencies and experiences more often diverge than converge at boundaries, which may leave individuals feeling confused, or like an outsider, and thus they may only "learn" that they do not belong. However, as argued just above, boundary engagement has great potential for learning, so the key is to understand the conditions under which boundary engagement is likely to facilitate learning. As stated by Wenger "Learning at boundaries is likely to be maximized for individuals and for communities when experience and competence are in close tension." (Wenger, 2003, p.85) I would like to suggest that boundaries where tension exists

(like a magnetic pull) is similar to what both managers and engineers in actor oriented innovation programs refer to as an 'interface,' and that by better understanding the characteristics of an interface, we may gain insight as to the characteristics of 'boundary tension' that can be useful for facilitating learning. Because the word 'interface' itself can mean different things in different contexts (such as engineering or management contexts), let us first look at some dictionary definitions of interface[68]:

1. The facts, problems, considerations, theories, practices, etc., shared by two or more disciplines, procedures, or fields of study: *the interface between chemistry and physics.*
2. A common boundary or interconnection between systems, equipment, concepts, or human beings.
3. Communication or interaction: *Interface between the parent company and its subsidiaries has never been better*.
4. A thing or circumstance that enables separate and sometimes incompatible elements to coordinate effectively.

What for present purposes seems important to take away from this list of definitions is that at an interface, existing problems will be shared. Also, the term interface can be used to describe communication and interaction where effective coordination is possible even though individual elements involved may seem separate or incompatible. It would then seem that finding **common boundaries,** where **problems are shared** with other communities may be a useful forum in which to 'communicate' and develop 'shared theories and practices,' and thus learn in the process of figuring out how to coordinate effectively.

Taken together, communities and their boundaries can act in a complementary way to further learning processes. In Wenger's words: "The learning potential of a social learning system lies in its configuration of strong core practices and active boundary processes." (Wenger, 2003, p.85) Strengthening the internal attributes of a community of practice, as well as finding boundaries with other communities of practice where problems are shared, may usefully create a series of feedback loops that act to strengthen competencies, provide diverse experiences, and generate further inquiry and learning. The communities of practice approach to learning can also be seen as belonging to the organic paradigm of this dissertation, as it describes highly contextual, people-centric nonlinear processes that influence one another over time.

Following this same logic, Davenport and Prusak write that: "Because genuine learning is such a deeply human endeavor, and because not only absorbing but accepting new knowledge involves

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[68] http://dictionary.reference.com/browse/interface. (accessed on: Oct. 12th, 2012)

so many personal and psychological factors, velocity [the speed of information transfer] and viscosity [the depth and breadth of information transfer] are often at odds. What enhances velocity may thin the viscosity." (Davenport and Prusak, 2000, p.103) This would suggest that recognizing and nurturing communities of practice – and their interfaces – is a holistic way to facilitate learning in actor oriented innovation programs, enabling individuals to learn more quickly and richly from each other. To illustrate what can happen when boundary processes are not nurtured, let us briefly examine a story from the organization Aerospace. The scholar Jay Liebowitz tells this story as follows: "Effective mission assurance is critical because space is an unforgiving business – mission failures in the 1990s alone resulted in $11 billion in lost assets. Many of these losses were attributed to the use of non-validated acquisition practices – the 'faster, better, cheaper' approach that became popular after the end of the Cold War." (Liebowitz, 2009, p.99) This example shows that important interfaces, where boundaries were present (between suppliers and Aerospace), and problems were shared (both suppliers and Aerospace had a stake in the products that were being delivered), were not nurtured to learn about products (parts) before they were acquired and tested. Had this been done, both Aerospace and the suppliers could have learned from the experience, thus saving Aerospace money, and making Aerospace return customers for the suppliers. The lesson that we can take away from this story is that although organizations may desire organizational learning in the form of "quick fixes" to help them manage knowledge, the kinds of processes that really facilitate ongoing organizational learning and enhance knowledge within an organization are complex and can usefully be thought of in terms of communities and their interaction.

4.4 Knowledge Management *Obstacles*

Now we move to a discussion of knowledge management obstacles, forwarding the idea that several concepts constitute obstacles to the theoretical development of knowledge management. They are: *tacit knowledge*; *culture*; *conflict, complexity and the discovery of unknown unknowns*, as well as; *size and geographic dispersion*. This is not to say that these concepts always hinder the actual management of knowledge within organizations, and indeed many organizations manage some, or all, of these issues very well. However, organizations looking to knowledge management processes and tools to approach these issues may find their contested nature confusing, and in turn not know where to focus their efforts. My goal in presenting these issues as obstacles to knowledge management is to focus on the discussions that exist around each concept theoretically, highlighting some of the key concerns, and then turn to how they may usefully be understood, and dealt with, within the context of actor oriented innovation programs. This discussion also highlights each of these concepts as part of the natural processes that exist within

organizations, programs and their projects, further suggesting that approaching them in this way can provide opportunities for pro-actively managing knowledge.

4.4.1 The Tacit Knowledge Challenge

As previously discussed in this chapter Ikujiro Nonaka, along with his colleagues, has generated a lot of interest in the field of knowledge management through his focus on the concepts of tacit, and explicit, knowledge. To my mind, this has both positively, as well as negatively, affected the study of knowledge management. On the positive side, it has created recognition of the importance of tacit 'personal' knowledge, as well as recognition for the field of study generally. However, it has also engendered a belief that tacit and explicit knowledge can be separated, which has contributed to predicating the thought that knowledge can be extracted from the individual 'knower,' and stored, for example, in a so-called 'knowledge repository.' Also, because tacit knowledge is not easily accessible, it tends to be thought of as a challenge to knowledge management, and something that needs to be overcome in order for knowledge to be managed well. On the contrary, the message focused upon here is that all knowledge has a tacit element, and by focusing on facilitating the 'tacit-ness' of knowledge (which is present in all knowledge processes), rather than trying to overcome it (with, for example, extensive use of IT tools), organizations will be better able to cope with the natural internal and external organizational changes that occur over time. For actor oriented innovation programs this is particularly important, as there is often a high degree of internal and external change.

In order to more fully elaborate upon these ideas, I will first explicate Nonaka's (1994) four modes of knowledge creation, explaining each component and proposed use. Next, I will discuss Polanyi's (1958, 1966, 1975) understanding of tacit knowledge (which is Nonaka's reference point), drawing attention to the fact that tacit knowledge is a necessary condition for all knowledge. Finally, I will propose that by understanding the importance of 'tacit-ness' within all knowledge processes, knowledge can more easily and usefully be developed – namely where context is rich, and personal interaction is facilitated.

Ikujiro Nonaka's 1994 article "A Dynamic Theory of Organizational Knowledge Creation" has, to date, been cited over eleven thousand, four hundred times.[69] The basic premise of this article is that through combinations of tacit and explicit knowledge, knowledge within organizations is generated. The four 'modes' of knowledge creation are depicted by Nonaka as follows:

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[69] Source: googlescholar.com (accessed on: Feb. 13th, 2013)

Figure 10: Modes of Knowledge Creation
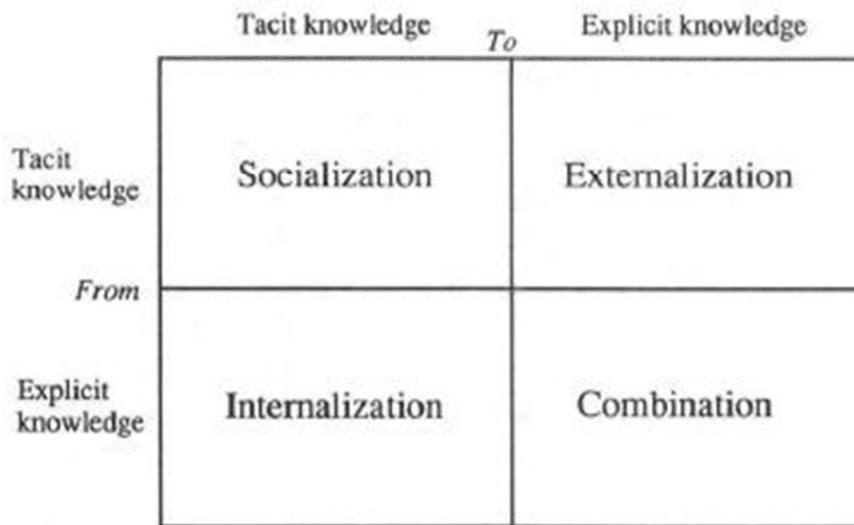
Source: Nonaka (1994)

These modes are seen as able to operate independently, as well as build upon each other in a spiral process. As stated by Nonaka: "While each of the four modes of knowledge conversion can create new knowledge independently, the central theme of the model of organizational knowledge creation proposed here hinges on a dynamic interaction between the different modes of knowledge conversion." (Nonaka, 1994, p.20) In some of his later work (ex. Nonaka, Toyama, and Konno 2000), Nonaka and colleagues call this the SECI process, depicting knowledge as spiraling through the successive steps of (S)ocialization, (E)xternalization, (C)ombination, and (I)nternalization. To start this process, socialization is understood as occurring through *personal interaction*, where experiences are shared, and things like "world views," "mental models" and "mutual trust" are understood and "embedded" within and between individuals. Next, externalization is proposed as a process of making the tacit explicit, by *articulating* internal processes so that they can be understood more widely. Articulation is also seen as providing the opportunity to strengthen, adjust or change these ideas over time, to produce the best actions possible within an organization. Combination is seen as the extension of explicit knowledge. Mainly, this consists of *collecting information* from inside or outside the organization, and putting it into IT networks or databases. In the last step of this process, internalization forwards the idea that individuals can take explicit information (ex. a manual), and then turn it into an internal (tacit) process by following the explicit information – what Nonaka and colleagues call '*learning by doing*.'

It may be true that each of the processes identified in the SECI model are indeed necessary within organizations, and may even be part of processes that facilitate knowledge creation. However there is also a very important problem with this model, specifically related to the above mentioned 'modes' and the concept of tacit knowledge which they depict. More specifically, the idea that tacit and explicit knowledge can ever be separated is refuted. Seeing them as separate is misleading and, possibly, dangerous for our understanding of knowledge and its management within organizations. One problem that scholars and practitioners often face when separating tacit and explicit knowledge is that they focus on explicit knowledge because it seems easier to manage, leaving them with IT systems that don't deliver what they promise. This view is also supported by Tsoukas and Vladimirou, who state very plainly that : "…tacit knowledge is not something that can be converted into explicit knowledge, as Nonaka and Takeuchi (1995) have claimed." (Tsoukas and Vladimirou, 2001, p.975)[70]

In order to understand why this is the case, let us take an example. If we look at the concept of 'Combination,' it is described as a process of explicit knowledge being converted into a different form of explicit knowledge. Written documentation is referred to as one type of explicit knowledge, which is then sorted and put into a repository, which is seen as the other form of explicit knowledge. However, as individuals pick and choose which information will be added to their organizational repositories, those same individuals are adding a tacit element to this process, re-arranging or 'combining' the information in ways that they understand it making sense in their current organizational context. So the actual process of 'combination' is a human, tacit, process that only utilizes explicit information. In addition, the most important element within *each* 'mode' of the SECI model is precisely the tacit and implicit understandings that individuals utilize as they make decisions and take actions that affect their organizations. This concept is well understood by the scholars Brown and Duguid (2001, p.204), who write: "Though knowledge undoubtedly can be usefully articulated and explicated, in use the explicit nonetheless always possesses this other, implicit dimension."

Further, if we explore the literature from which Nonaka has drawn his understanding of tacit knowledge, Polani was clearly also forwarding the idea that all knowledge has a tacit, personal element that can only be achieved by individuals themselves, and through their interaction with others, typified by the fact that his seminal work is titled "*Personal Knowledge.*" (1958) In Polanyi's own words: "*All* knowing is personal knowing – participation through indwelling (emphasis in the original)." (Polanyi, 1975, p.44) For Polanyi, indwelling is precisely this tacit, implicit, element of human nature, where we internalize processes that become second nature to

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[70] See also: (Cook and Brown, 1999; Tsoukas, 1996)

us. As stated by Davenport and Prusak "Tacit, complex knowledge, developed and internalized by the knower over a long period of time, is almost impossible to reproduce in a document or database. Such knowledge incorporates so much accrued and embedded learning that its rules may be impossible to separate from how an individual acts." (Davenport and Prusak, 2000, p.70) To my mind, this statement portrays what Polanyi means by the term indwelling, as well as explaining why it will never be possible to remove knowledge from individuals, which would make it purely explicit. Along the same lines, knowledge has also been compared to an art, because "arts are difficult to boil down into rules and formulations." (Davenport and Prusak, 2000, p.701) So, if we accept that all knowledge has this personal, tacit, element, then managing knowledge should by extension nurture, facilitate, and generally encourage this 'tacit-ness.'

This may not be as daunting a task as it appears. If knowledge is bound to individuals and their personal understanding in a context that has developed over time, then managing knowledge should also involve relevant context, and allow individuals to interact over time. One way to portray rich meaning that contains 'thick description,' (Geertz, 1973) allowing others to gain a deeper understanding of context is by *storytelling*. In terms of facilitating interaction, *mentoring* is another very effective way of placing individuals in a context in which they are able to learn through experience over time. Let us now look at these two specific examples for facilitating the 'tacit-ness' of knowledge in more detail.

One way for the tacit elements of ideas and experiences to be shared between individuals, and within organizations, is through **storytelling**. (Alvesson, 2004) As stated by Tom Kelley, a businessman who runs IDEO - a company that is continually working on innovation projects: "The power of a good story has a few thousand years of history behind it. Storytellers have captured the rapt attention of their fellow humans for as long as there have been evening fires to tell tales around." (Kelley and Littman, 2006, p.242) And what makes stories so good at conveying our meaning? As stated by Dorthy Leonard: "Stories are powerful conveyors of knowledge because they are vivid, engaging, entertaining, and easily related to personal experience. … In addition, because of the rich contextual details encoded in stories, they are ideal carriers of tacit dimensions of knowledge…" (Leonard, 2007, p.64) This idea is further elaborated by the scholar Karl Wiig, describing storytelling as an enabler for building frames, or mental models, to connect concepts in different ways. As he puts it (2004, p.96):

> "Most people seem to find it easier to remember complicated relationships and conditions when they are presented, integrated, and structured in the form of stories. The stories provide both a context and a framework. It is more difficult to remember isolated knowledge items such as principles or rules. As a result, it is more likely that people remember personal experiences as static events or as evolving situations – as stories."

This would suggest that stories, at a very basic level "describe, and by their descriptions they provide categorizations, structure, and frameworks that, when believed and internalized by recipients, allow the building of understanding and mental models." (Wiig, 2004, p.107)

Many stories frame past experiences, providing the opportunity to relate the past situation to current events. This point is well understood by Karl Weick (1995, p.129), who says "Because the story in the repertoire has a punch line, the connection between the old story and the new event raises the possibility that outcomes can be … understood, and possibly controlled." To the extent that past context can be related to a current situation, comparisons can be made about the degree to which situations can be handled similarly. Weick goes on to say that these stories of past experiences can also "reduce the element of surprise; they can act as a forewarning… Although stories may help to manage pressure and improve sensemaking during emergencies, they may be of even more help in the prevention of emergencies." (Weick, 1995, p.131) Here, stories are seen as providing a signal or cue, where "given a particular situation, priming memory brings relevant stories to bear, either as conscious thought or as tacit patterns used to guide automatic actions." (Wiig, 2004, p.107) So, stories describing problems that were identified and dealt with effectively in the past can help individuals to watch for signs that similar problems are arising in the present, and further help them to take appropriate action. The Scholar Liebowitz (2009) similarly suggests storytelling as a mechanism for "lessons learning."

Other stories frame the future in a particular way, and may thus provide the opportunity to explore ways to either attain or avoid the reality that these stories envision. The scholar David Boje, for example, differentiates between retrospective and prospective stories. Retrospective stories that recount past events in a particular beginning, middle, and end (BME) sequence he describes as narratives (Boje, 2008). Prospective stories that posit a particular version of the future, on the other hand, are understood as antenarratives ('ante' meaning 'bet' on what the future may hold). As stated by Boje (2008, p.13) "These fragile antenarratives, like the butterfly, are sometimes able to change the future, to set changes and transformations in motion that have an impact on the big picture." Although both narratives and antenarratives are very important to organizations - and to situating meaning within them - antenarratives may be particularly important for actor oriented innovation programs, where change is particularly important. Antenarratives, in this context, provide a space where "many different logics for plotting an ongoing event are still being investigated." (Boje, 2001, p.4) The 'logics' discussed here can be understood as logistic 'steps' to attaining a desired goal (or storied vision), meaning that antenarratives provide the mental space for change to occur, by exploring different 'steps' to be taken, which could influence a desired outcome. Whether narrative or antenarrative, stories are

well understood as important for accessing the tacit element of knowledge between people, because, as history has shown us: "human beings learn best from stories," (Davenport and Prusak, 2000, p.81) thus making stories an excellent knowledge conduit.

While an individual may usefully be able to portray tacit elements of their knowledge through the telling of stories, at a broader level organizations may usefully be able to convey tacit elements of their collectively held knowledge through **mentoring**. (Liebowitz, 2009) As stated by Davenport and Prusak (2000, p.72): "The traditional apprentice system, so successful in transferring skills in the industrial age, attests to these truths." Additionally, "knowledge is more likely to be absorbed if it adheres to the listeners' sense of ground truth, is delivered with feeling, and is placed in a context or frame that is at least partly shared by its audience." (Davenport and Prusak, 2000, p.82) The great advantage of mentoring and face-to-face communication is that one can observe and probe knowledge that is already embedded in the experience of other individuals, and use the information gained to enhance one's own pre-existing knowledge. Telling someone what you wish you had known in a similar situation may help them, or the person you are talking to may already have experienced what you are telling them, and need other information which you would only be able to give them if you were talking to them directly.

In the context of actor oriented innovation programs, mentoring could take the form of persons from a particular organization mentoring those within a contractor or subcontractor firm who may provide services for them in the future. Like gaining deeper insights into one's own organization, mentoring that takes place between members of different organizations may help work teams "innovate with insight – for example, create deliverables (work products) that are better suited to effective operations elsewhere, improve communications, and create valuable network contacts to deal with future challenges." (Wiig, 2004, p.152) In the rapidly changing markets within which actor oriented innovation programs are seen to operate, providing mentoring for contractors and subcontractors may be particularly important so that products meet specific and changing requirements. With a deeper, more tacit understanding that comes with direct observation and interaction over time, mentoring can be seen as another effective knowledge conduit. When mentoring works well, it will provide an environment where processes and changes are understood from an 'insider perspective,' which may also enable opportunities for co-creation.

Within the field of knowledge management, knowledge is often defined by a dichotomy of that which is tacit, and that which is explicit. While explicit knowledge is seen as being easily transferable, or codified (in documents, repositories, etc.), tacit knowledge is seen as more 'personal' 'sticky' knowledge that is not easily transferred. Although identification of the 'tacit-ness' of knowledge is significant for the development of knowledge management generally, it

should not be separated from explicit knowledge as a separate 'type' or 'form' of knowledge. As I have argued, and will continue to argue throughout this dissertation, knowledge is a strictly human capacity, one that involves both tacit and explicit elements simultaneously. As stated by David Boje: "Explicit and tacit knowledge is a duality. In order to get past it we need to resituate, showing the explicit side of tacit and vice versa."[71] Once tacit knowledge is understood as part of all knowledge, it will allow researchers and practitioners to move away from the idea that knowledge can be 'codified,' and focus their attention on facilitating people processes that recognize both tacit and explicit elements within all knowledge. This section has identified both storytelling and mentoring as particularly useful in this context.

4.4.2 Knowledge Management and the Cultural Dimension

The concept of culture is placed under Knowledge Management Obstacles because it is often thought of as preventing understanding between actors who have different cultures. The general understanding is that: "The closer people are to the culture of the knowledge being transferred, the easier it is to share and exchange." (Davenport and Prusak, 2000, p.100) Scholars studying culture have often focused on national and/or organizational culture as important for collaboration within organizations. However, typical understandings of national and organizational culture do not adequately explain the complexity within each of these categories, nor do they fully explain the wide range of diverse cultural influences that impact each individual. The following will briefly explain typical understandings of culture in business studies, and why these have not been adequate. Next an alternative understanding of culture as a mosaic is explored (as presented by Chao and Moon, 2005) embracing a more holistic understanding of culture. This alternative perspective also puts forth the idea that individual differences can effectively further collaboration, development and change processes, both within management studies generally, and more specifically within the field of knowledge management in the context of actor oriented innovation programs.

 To start, Hofstede (1980, 1994) has popularly categorized national culture using particular dimensions (power distance, uncertainty avoidance, masculine/ feminine, individualism/ collectivism etc.). An individual coming from a national culture thought to have high power distance is understood, by Hofstede, to have difficulty communicating (or sharing knowledge) effectively with an individual coming from a national culture thought to have low power distance, because their basic understandings of superiors, colleagues and subordinates will be different (Hofstede, 1994). Although elements of these dimensions may exist at a national level (and be applied to some extent in interactions within organizations), individuals may also have other

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[71] Personal correspondence: David Boje, January, 2011

cultural identities that are more pronounced, playing a larger role in their actions within an organization at any given time. For this reason, making the assumption that culture equals nation has more recently been criticized as inadequate for explanatory purposes. (Sackmann and Phillips, 2004)

Another "culture" that is often recognized in management and organization literature is organizational culture, gaining widespread attention from the early1980's (Martin, 1982, 1992; Deal and Kennedy, 1982; Schein 1985; Harris and Sutton, 1986; Kotter and Heskett, 1992 etc.). In organizations, particular cultures are seen as emerging as individuals within the organization interact over time. Literature has typically focused on fostering strong organizational cultures for the purpose of achieving greater firm performance (Peters and Waterman, 1982; Deal and Kennedy, 1982; Kotter and Heskett, 1992; Gordon and DiTomaso, 1992; Burt et al., 1994; Sørensen, 2002). However, like the field of knowledge management, there is no generally agreed definition of organizational culture, being described as a term that is 'over used and under-specified.' (Hajro, 2009)

If we want to truly understand the dynamics of individuals who act and interact in organizations from a perspective of culture, looking at national and organizational culture alone does not seem sufficient for two reasons. First, there may be many more dynamics that play into an individual's sense of national culture or organizational culture than have typically been studied. Second, there may be many other cultural influences that individuals draw upon when interacting in organizations, that are not necessarily related to their national or organizational culture. I, for example, was born in the United States of America, moved with my family to Denmark, Europe when I was three and a half, and have been traveling back and forth ever since. Which of Hofstede's dimensions (those relating to Danish or American culture) would apply to me? And I am not a rare or complex case when it comes to national culture. Globalization has meant that not only information and goods transcend national boundaries, but many individuals have as well, making the boundaries between national cultures more and more blurred. According to the United Nations[72], in 2002 175 million people lived outside their country of birth – a number which has undoubtedly increased since then. It has also been found that in many companies "the percentage of host-country nationals exceeds the number of home-country nationals." (Hajro, 2009, p.38)

In terms of the complexity related to organizational culture, Sackmann (1992) describes cultural sub-groups within a single organization, stressing the cultural complexity that exists. If we look at actor oriented innovation programs, where multiple organizations collaborate to bring innovations

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[72] See also: (Chao and Moon, 2005)

to market, this complexity raises exponentially. The Carbon Trust OWA program, for example, is comprised of nine different offshore wind developers to date, as well as the Carbon Trust. In this constellation one could analyze nine different organizational cultures (each of the nine developers), the organizational culture within the Carbon Trust, the organizational cultures of each of the contractors (for example each of the Technical Delivery Consultants typically coming from different consulting firms), as well as the subcontractors (each of the concept owners each coming from their respective engineering organizations) - and let us not forget that each of these may have unique sub-cultures. It is also possible that the Offshore Wind Accelerator project has facilitated the formation of unique working cultures within each of the Technical Working Groups or within the Steering Committee. This particular example is a good illustration of the level of complexity that can exist within an organization, and which does exist within the case study that is being examined in this dissertation.

For the reasons mentioned above, literature on organizational culture or culture in general has always seemed somehow lacking in its ability to fully explain or capture the complexity that exists within and between people. But how, then, do we make sense of this complexity in a meaningful way? The authors Chao and Moon (2005) have drawn from complexity and chaos theories, as well as network theory, to develop an understanding of culture as a mosaic. As they see it: "An individual's unique collage of multiple cultural identities yields a complex picture of the cultural influences on that person." (Chao and Moon, 2005, p.1128)

Mosaics are comprised of colored or patterned tiles. Although all tiles may not seem to match each other perfectly, when viewed collectively, they combine to form a picture. For Chao and Moon, each tile is an element of culture, which when combined, forms a picture of culture for each individual. When individuals interact, they are seen as drawing upon multiple tiles (cultural elements) that inform how they act and react in any given situation. It is important here to recognize that: "Rather than choosing a particular "tile" such as ethnicity or gender … individuals draw on combinations or patterns of tiles such as ethnicity and gender." (Chao and Moon, 2005, p.1129) It is because individuals draw upon a mix of cultural elements, or tiles, that "Cultural behaviors may appear to be chaotic or unpredictable, yet underlying structures within the cultural mosaic can help researchers identify and predict patterns of behavior." (Chao and Moon, 2005, p.1128) Although it does seem plausible that cultural elements (tiles) can identify possible patterns of behavior, the proposition that they can predict behavior as such does not seem reasonable. Individuals may not even be conscious of all of the 'tiles' that they are drawing from at any given time (some tiles, for example, may have become tacit, constituting an unconscious way of behaving, similar to Polanyi's indwelling).

There also seems to be a problem with what Chao and Moon identify as the 'underlying structures' of culture. In a taxonomy, these scholars identify three primary categories: *Demographic* (physical characteristics and socially inherited characteristics from ones family, eg. age, race, etc.), *Geographic* (regional characteristics that can shape group identities, eg. climate, urban/rural etc.) and *Associative* (formal and informal groups that one identifies with, eg. family, employer, profession, etc.). The problem with this taxonomy is that all cultural tiles fall under this last *Associative* category. The point being made here is simply that a) In order to have culture, there must be other individuals for one to associate or disassociate that culture with, and b) there are a very many different groupings of individuals from which to draw culture, not all of which may be known or understood by researchers or even individuals themselves. What *is* understood here as important for collaboration to take place within actor oriented innovation programs is to find similar cultural elements (tiles) upon which understanding can be built, those 'tiles' which can help to build useful common frames in the context of the particular collaboration. Once a common understanding is established (through recognizing similar tiles), other dissimilar 'tiles' may contribute to creating new shared understanding, and possibly new 'tiles'.

Similar to the methodological understanding presented in this dissertation, Chao and Moon also deem it necessary to look at multiple units of analysis (both individual and group level) to understand, in their case, culture. At the individual level, chaos and complexity theories are used "to better understand the complexities associated with the influences of culture on an individual's values through a mosaic perspective." (Chao and Moon, 2005, p.1138) At the group level, network theory is used "as a means by which researchers can better understand the interpersonal dynamics within an organization." (Chao and Moon, 2005, p.1138) For the study of knowledge management, two of the seven propositions made by Chao and Moon (one at the individual level of analysis, and one at the group level of analysis) seem to be particularly important for managing knowledge within actor oriented innovation programs.

At the individual level, Chao and Moon understand the whole (an individual's cultural mosaic) as being more than the sum of its parts (individual 'tiles'), and that examining only one 'tile' (such as national culture) and subsequently predicting behavior denies the complexity that is "integral to true understanding." The environment is also seen as playing an important role in cultural behavior which, drawing from chaos theory, highlights 'sensitive dependence on initial conditions.' (Gleick, 1987; Chao and Moon, 2005) Like the butterfly effect, one slight change in initial conditions can cascade into vastly different outcomes. Contradictory to traditional linear analysis, random error variance is seen as 'neither random nor error.' Complexity thinking is most often missing in the traditional culture literature cited, and could undoubtedly help to

develop this field of study, providing a more realistic understanding of culture within organizations.

Based on these understandings, Chao and Moon propose that on an individual level: "Interpersonal interactions are facilitated by shared cultural identities. Shared cultural identities are localized structures in an interpersonal network, providing common frames of reference, values and behavioral expectations between people." (Chao and Moon, 2005, p.1135) I understand this to mean that when people meet frequently over time, they create shared experiences that can become **shared cultural identities** (and create new cultural tiles). These identities carry with them expectations for particular behavior, which may be enacted when triggered (for example when these individuals meet). Notably, this concept of shared cultural identities, evolving out of having shared 'frames of reference' coincides with the understanding of 'communities of practice' discussed above.[73] For actor oriented innovation programs, developing shared cultural identities over time should then facilitate trust and knowledge sharing within the interpersonal interactions that take place for the purpose of building and sustaining innovations.

On a group level, Chao and Moon also propose that: "Members who share cultural mosaic tiles with members of other groups are more likely to bridge structural holes between these groups." (Chao and Moon, 2005, p.1136) This proposition draws from network theory, and Ronald Burt (1992) in particular, who asserts that "power and influence are likely benefits to individuals who can bridge two groups by building on unique commonalities with each group … [serving] as key linking pins between previously isolated groups." (in: Chao and Moon, 2005, p.1136) These **individuals that link groups together**, I would argue, are similar to the **'boundary spanners'** discussed above.[74] The point to be made here is that by sharing cultural 'tiles' with another group, these individuals are able to find commonalities and draw upon them to elicit understanding and interaction. When this can be done for a common goal or purpose, all groups involved can benefit from this interaction.

Having common goals and purpose can also create a context in which "different cultural interactions can create synergy for innovation and creativity"[75] (Chao and Moon, 2005, p.1136) In other words, the interaction and mix of cultural 'tiles' can also facilitate knowledge through **synergy**. As the scholars Child, Faulkner and Tallman (2005) present in their book on

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[73] See section: 4.3.5 Increased Organizational Learning
[74] See section: 4.3.2 Knowledge acquisition
[75] See also: (Zachary, 2003)

cooperative strategy, it is precisely through discussing differences openly and having partners actively engaged in finding solutions that knowledge is expanded and new solutions are found.

Figure 11: Four options on the management of cultural diversity
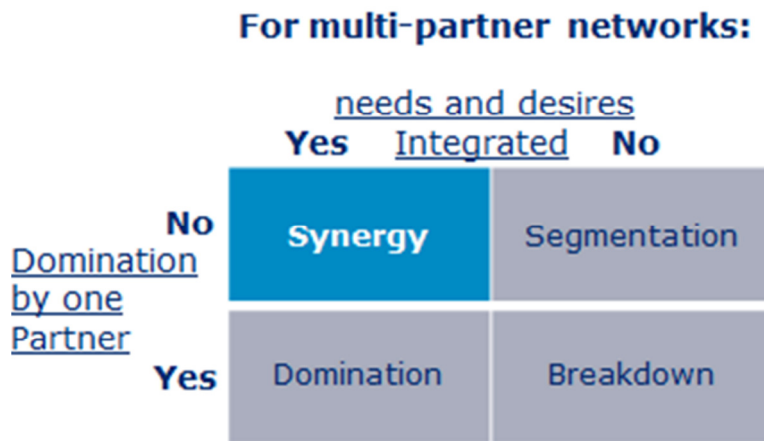
Source: adapted from Child, Faulkner, and Tallman (2005)

Alternatively, if needs and desires of all partners are not integrated, and if one partner dominates the interaction, less desirable outcomes such as domination, segmentation, or breakdown are seen as occurring. Many strategic alliances for example, fail to yield the outcomes that they have set out to achieve, which may be explained by this figure. The idea of synergy is also closely linked to the idea of fusion proposed by Davenport and Prusack. In their understanding (2000, p.60), "fusion purposely introduces complexity and even conflict to create new synergy. It brings together people with different perspectives to work on a problem or project, forcing them to come up with a joint answer." The scholar Leonard-Barton discusses a process of what she terms creative abrasion, where innovation "occurs at the boundaries between mind-sets, not within the provincial territory of one knowledge and skill base." (Leonard, 1998, p. 64) All of these different terms (synergy, fusion, and creative abrasion) signify the same point, that it is not only cultural similarities that allow individuals to be productive, but that differences can also create perhaps the best kind of productivity (particularly in the context of actor oriented innovation programs) – that which combines disparate elements of individual knowledge to create something new. I would also like to propose that finding common boundaries, where problems are shared between groups, discussed above as interfaces,[76] may help to facilitate the process known as synery, fusion or creative abrasion by the respective authors above.

If we think about all of the organizational level interactions that could give rise to different cultures within the Carbon Trust OWA project (as identified earlier in this section), each of these

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[76] See section: 4.3.5 Increased Organizational Learning

could also be seen as a potential interface where synergy could be created. Interfaces could be seen as creating synergy between partners, between the partners and the Carbon Trust OWA team, between partners and contractors, between contractors and sub-contractors, etc. One way to facilitate interaction between these types of groups to create synergy is by holding 'knowledge fairs.' The idea behind this concept is that: "like a trade show or farmer's market, a **knowledge fair** is a temporary gathering of sellers that attracts potential buyers." (Davenport and Prusak, 2000, p.46) **Cross-silo forums**[77] are another way that may facilitate synergy where problems are shared and boundaries are common. In general, identifying critical interfaces, and then figuring out how to facilitate interaction between relevant groups, may help to join cultural elements (tiles) in meaningful ways and create synergy.

Overall, this section portrays culture as more than a specific set of national or organizational identities – reality is much more complex. Further, using Chao and Moon's (2005) understanding of culture as individual mosaics, and modifying it as proposed above, culture can be seen as a catalyst for bring people together rather than something to be overcome. Culture, when understood in this way, can also highlight both individual and collective commonalities and differences in ways that can help facilitate knowledge management, organizations generally, and actor oriented innovation programs specifically.

4.4.3 Conflict, Complexity and the Discovery of Unknown Unknowns

Conflict and complexity have, for many years, been seen as hindering productivity within organizations. Lindsley, Brass and Thomas (1995), for example, describe conflict as predicating inefficacy in organizations, leading to a decrease in work performance and further feelings of inefficacy. Further, books titled "Simplicity Wins" (Rommel et al. 1995), or the K.I.S.S. (keep it simple stupid) model, convey a pervasive underlying assumption of general linear reality (Abbott, 1988), that "in an organization, or an economy, there are a series of clear levers you can apply to cause a known response." (Glass, 1996, p.100) Conflict and complexity, in this context, are seen as preventing smooth processes from following known procedures to attain specific results. They create uncertainty. This is particularly pertinent to the field of knowledge management because "knowledge is the most sought-after remedy to uncertainty. We all try to reach knowledgeable people when we see the need to deliver a solution to a problem." (Davenport and Prusak, 2000, p.24) However, as will be discussed in this section, conflict and complexity are both natural processes that happen within organizations, and especially those that are working on innovations in turbulent markets. As stated by the scholar Kathleen Eisenhardt, "tension between stability and

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[77] Discussed above in section: 4.3.4 Knowledge Sharing

change is an inevitable part of organizational life. Therefore, this tension must necessarily characterize research on work and organizations." (Eisenhardt, 2000, p.704) By understanding conflict and complexity as natural components within knowledge processes in organizations, it may be possible to draw upon the strengths that each provides, and better handle the adverse properties associated with each as well.

First, let us discuss conflict in more detail. Conflict is defined here as: "A state of disharmony between incompatible or antithetical persons, ideas, or interests; a clash."[78] This state of disharmony, I contend, has a very important role to play within knowledge management, as well as within actor oriented innovation programs. Within all organizations, according to Weick, "divergent, antagonistic, imbalanced forces are woven throughout acts of sensemaking." (Weick, 1995, p. 136) In relation to knowledge creation, for instance, the 'unsettledness' discussed by Tsoukas as the first step in his dialogical model for Organizational Knowledge Creation, [79] might usefully be seen as conflict. In this case, there is a problem that signifies the need for change – which may also be seen as an incompatibility between the way things are, and the way they are understood as needing to be, creating conflict. So, for purposes of developing knowledge, conflict can serve as a means to challenge us, to challenge our frames of understanding, and enable us to see things differently. As stated succinctly by Stacey and Griffin (2005, p.10), "conflict is essential for the movement of thought." In practice, this means that "if an initial framework fails, one can try its equally plausible converse, or try a framework that emphasizes different elements." (Weick, 1995, p.137)

The scholar Karl Weick also points out that it is important to remember that argument (which I would identify as a form of conflict) "need not imply ill will or loss of temper as is often implied in everyday usage." (Weick, 1995, p.137)[80] However, this also entails that individuals are open to thinking critically, actively listening to others, and willing to make changes that emerge from this process. If individuals are not open to change when conflict arises, the function of conflict will be to reinforce the order-generating rules, (Beech et al. 2002) or hold steadfastly onto one's own ideas, predicating sameness and possibly also the breakdown of interpersonal relationships (as asserted by Lindsley, Brass and Thomas, 1995). Therefore, if individuals are open to conflict, and approach it by thinking critically and listening actively, effective change, and even knowledge, can be developed. To further strengthen this point, Weick references additional authors such as Hage (1980, p.280) who finds that "power struggles [clashes/conflict] enhance the quality of

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[78] Definition of Conflict: http://www.thefreedictionary.com/conflict accessed: Feb. 20th, 2013
[79] See section: 4.3.1 Knowledge Creation
[80] See also: (Billing, 1989, p.84)

information available to organizations, because each faction challenges the information of the others."

In relation to organizations and their environments, conflict can also be understood as important for development to occur. In fact, it is often the case that organizations favor status quo, ignoring disharmony between the organization and the environment, which in extreme cases threatens the existence of the organization, because organizational members are unable to adapt. Companies - especially those dealing with innovation - can also choose to embrace conflict or 'disharmony' within the environment and approach it proactively by, for example, creating a feeling of 'crisis' to spur innovation. In other words: "Striving for continuous innovation, some companies try to instill a sense of crisis before it exists... Hewlett-Packard's Lew Platt has stated that creating a sense of artificial crisis is one of his highest objectives." (Davenport and Prusak, 2000, p.64) In this case, creating a feeling of conflict (crisis) may be able to pre-empt more extreme forms of crisis later on, by spurring new ideas and knowledge to be generated before it is too late to implement these new ideas effectively.

Next, let us examine the concept of complexity with relation to organizations and their management of knowledge. More and more, scholars, as well as practitioners, are focusing on complexity perspectives of the organization. (eg. Stacy, R., and Griffin, D. and colleagues, 2000, 2005) One reason for this particular focus may be that: "... the traditional function of organizational form, namely to buffer the organization from external uncertainties, is no longer the primary task... as buffering becomes less feasible, we need to offer theories that can help organizations cope with, even embrace, uncertainties."[81] Similarly, Mats Alvesson (2004, p.6) states that: "society has entered a new era, where the epochal shift lies in the turn from stable to turbulent markets and rapid technological change ... and to a focus on uncontrollability, chaos, flexibility and disorganization." This general sentiment is further related to what is understood in this dissertation as actor oriented innovation programs, where increased complexity leads to situations where, in Alvesson's words (2004, p.6), "organizations are transformed into more flexible, ad hoc forms, greatly reducing hierarchy and allowing more space for the initiative and discretion of knowledge-able employees so that these 'intellectual assets' can be used effectively."

The reality that exists within our global economy, and particularly for actor oriented innovation programs, is that complexity is present and prevalent. The problem that both scholars and practitioners today face, as poignantly stated by Kathleen Eisenhardt (2000, p.704), is that:

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[81] Child, John, personal communication with the authors Bahrami and Evans, found in: (Bahrami, H. and Evans, 2005, p. 110)

"Simplicity is elegant but often untrue." Linear, reductionist methodologies are tempting because they are easy to understand, and to implement. However, the neglect of complexity can turn core competencies into core rigidities,[82] leaving organization unable to appropriately understand or interact within the dynamic environment in which they find themselves. Alternatively, understanding and embracing complexity may be able to create awareness of different contextual factors in an area of knowledge, which (particularly in the case of new technology) should help to uncover new elements of a problem, which were important and previously unknown (a.k.a. unknown unknowns – you didn't know that you didn't know it). Stated perhaps more simply, taking a complexity approach can add important awareness to the management of knowledge within organizations generally, and actor oriented innovation programs more specifically. The next question then becomes: How?

From a complexity perspective, the scholars Beech et al. discuss the need for both complexity and conflict, stating: "There is a need to disrupt the rules and routines that preserve the state of affairs. Paradoxically, it may be necessary to find order-generating rules that would enable their own disordering." (Beech et al., 2002, p.473). Weick and Sutcliffe (2007) in discussing high reliability organizations (HROs) give a great number of suggestions for incorporating conflict and complexity (an atmosphere that can lead to the discovery of unknown unknowns) into organizational routines so as to respond to dynamic internal and external events with as much knowledge as possible. Five of these suggestions that seem particularly pertinent for actor oriented innovation programs are presented and discussed here. The first is to "**raise doubts to raise information**." The key understanding here is to "Try to see what your expectations keep you from seeing. It's easier to do this when you work with other people and alert them that this is precisely what you're trying to do." (Weick and Sutcliffe, 2007, p.153) An atmosphere encouraging critical reflection may help individuals to question not only information that is received from others, but also one's own pre-understandings. Asking questions like: why is this helpful; could I be missing something; or, where could I get additional information about this issue? - may helpfully provide new contextual material or information to a problem or process being worked through. This point is reinforced by the above discussion of re-evaluating working repertoires[83] (language, procedures, etc., that have developed over time), in order to make sure that each element of the repertoire works toward desired goals. Re-evaluating repertoires is similar to the concept of raising doubts to raise information in that they both require critical reflection and continual evaluation of one's environment and personally held beliefs. For actor

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[82] For an elaboration of this perspective, see: (Leonard-Barton, 1992)
[83] See section: 4.3.5 Increased Organizational Learning

oriented innovation programs, this process may help its members to identify changing conditions and adapt quickly for the purpose of building and sustaining innovations.

The second suggestion to be discussed, as proposed by Weik and Sutcliffe, is to "**encourage alternative frames of reference**." Building frames of reference happens naturally when we develop knowledge and learn. Uniquely, humans can compare and contrast these frames, connecting information in new ways, developing new understandings, and in some cases, even new frames of reference. In practice, encouraging alternative frames of reference could include "brainstorming or adversarial reviews that encourage people to raise questions and reveal information that is not widely shared. … This discourages simplification and also increases the chance of seeing a greater number of problems in the making," (Weick and Sutcliffe, 2007, p.153).This suggestion encourages both conflict (stemming from problems) and complexity, which, when understood and taken into consideration, may better prepare individuals for inevitable change. By being aware and recognizing changes quickly, these changes can more pro-actively be dealt with, which is particularly important for actor oriented innovation programs because their internal, as well as external, environment is likely to change quickly. The third suggestion is to "**put a premium on interpersonal skills**." The main point here, for actor oriented innovation programs in particular, where goals will to some extent be different, is that if individuals focus on and develop their interpersonal skills, it will be more likely that conflict can be addressed pro-actively, and engender learning and new knowledge rather than bull-headedness and feelings of being threatened (which could also lead to knowledge hording). In terms of how this can be done in practice, Weick and Sutcliffe suggest developing "organizational agreements about how to disagree constructively, propose rules for negotiating differences, and develop[ing] policies that reconcile organizational contradictions (for example, rewarding individuals while supporting the value of collaboration and cooperation)," (Weick and Sutcliffe, 2007, p.153). Fostering peer-to-peer interaction and group cohesiveness[84] may be additional ways to put a premium on interpersonal skills in practice.

The fourth suggestion to be covered is to "**revise assessments as evidence changes**." Because change is enviable, and happens particularly quickly within actor oriented innovation programs, revisions are needed often. The problem is that over time, individuals can become "fixated on their original assessments of the situation and discount or rationalize away discrepant information," (Weick and Sutcliffe, 2007, p.154)[85]. If this is the case, then one remedy can be to find someone else to look at the situation with a fresh perspective, and possibly a new frame. As

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[84] For an elaboration of these concepts, see section: 4.3.4 Knowledge Sharing
[85] See also: Rochlin, Gene I. (1989), pp. 160-162

stated by Weick and Sutcliffe (2007, p.154), "Fresh eyes tend to break up the mind-set that perpetuates fixation. When people resist simplification, they tend to break up fixations." The last suggestion I would like to discuss here is to "**treat all unexpected events as information**." From a non-linear complexity perspective, this is particularly good advice, as small events can have big consequences. Weick and Sutcliffe's word of caution is to: "Be especially mindful of the temptation to redefine the unexpected as normal. That move conceals information and heightens risk." (Weick and Sutcliffe, 2007, p.154). I would argue that this practice is common within much of the management literature using linear equations to predict outcomes irrespective of context, and neglecting seemingly 'minor' differences. By taking this suggestion to heart, organizations may be better prepared for complexity, enabling the identification of unknown-unknowns.

In sum, this section has focused upon conflict and complexity as naturally occurring, and even necessary, for organizational processes of knowledge management. Conflict does not need to constitute a threat, and engender defensive behavior. Rather, conflict can more usefully be understood, in organizational contexts, as providing an opportunity for knowledge generation and change. Further, "Although it is tempting to look for simple answers to complex problems and deal with uncertainties by pretending they don't exist, knowing more usually leads to better decisions than knowing less, even if the 'less' seems clearer and more definite." (Davenport and Prusak, 2000, p.9). Complexity is an organizational reality, one that is particularly pronounced in situations where multiple actors come together to create and sustain innovations. Models such as K.I.S.S. simply do not allow organizations to evolve in dynamic ways and may engender ridged behavior, thus endangering organizational survival.

4.4.4 Increasing Size and Geographic Dispersion

Within organizations and actor oriented innovation programs alike, increasing size and geographic dispersion makes it "especially difficult to locate existing knowledge and get it to where it is needed. In a small localized company a manger probably knows who has experience in a particular aspect of the business and can walk across the hall and talk to him." (Davenport and Prusak, 2000, p.17). Small localized companies, nevertheless, are increasingly becoming the exception rather than the rule when it comes to building and sustaining innovations. This may be because large organizations often have more resources to devote to developing innovations. They are able to sustain a greater number of calculated risks, and shoulder a greater burden of cost in relation to small businesses. In terms of geographic dispersion, large organizations often operate in multiple countries outside of their country of origin. Also, new constellations of actors (such as those within actor oriented innovation programs) are increasingly seen as being formed when cooperation brings the promise of getting new products to market more quickly. However, despite

their growing number and advantages, large and disperse innovation programs continue to magnify one of the main problems with knowledge management generally, namely delivering "the right information within the proper context to address a specific issue at the appropriate time," (Liebowitz, 2009, p.92).

And herein lies the reason for having included *increasing size and geographic dispersion* under obstacles of knowledge management. When actors are not in continual close proximity to one another, they may not know each other exists. They may not have built up relationships that would prompt them to contact each other when a problem arises, or they may not know what knowledge needs others have at any given point in time – so even if there were a desire to share knowledge more widely, it would be difficult to figure out with whom to share it. In relation to knowledge it often happens that "the distance between buyer and seller prevents a transaction from taking place." (Davenport and Prusak, 2000, p.41). Also, March and Simon (1958), as well as Davenport and Prusak (2000, p.41) discuss individuals as tending to 'settle' for knowledge or information that is 'good enough,' rather than seeking out an individual who is located in a different country or even department, whom they believe to have the best knowledge available in relation to a particular question or topic. This is also related to the issue of absorptive capacity, and "the very human limits on how much information people can absorb and how much effort they will expend to get it." (Davenport and Prusak, 2000, p.88).

Now that the issue of increasing size and geographic dispersion has been contextualized, two specific actions that have been identified in academic literature as mediating the particular 'obstacles' associated with large and disperse organizations/ innovation programs will be discussed. The first action deals with the need for *creative space*, which is understood as creating opportunities to innovate. Examples of this may include creating space for: 'alone time' to think through a problem or idea; engaging in one-on-one conversations; having group discussions and/or brain-storming sessions, or holding collective discussions about important topics/ overall direction. The second action deals with *creating common language and 'frames of reference.'* Although introducing new frames of reference was discussed in the previous section as necessary for adapting to change and embracing conflict and complexity, there must also be a base of common understanding or 'frames of reference' upon which to build new perspectives. If no common frames exist, people may easily become confused, which will hinder, rather than encourage, knowledge processes. The common frames discussed here are akin to the need for a 'thesaurus' within information repositories identified above. The basic premise is that people need to agree on what they are talking about, and how they are talking about it, before they can

build upon those understandings, thus providing the opportunity to form new understandings. Both of these actions will now be discussed in more detail.

If the desire is for collaboration to achieve its fullest potential, it is imperative that individuals meet face-to-face on a regular basis. And for actor oriented innovation programs, where many large and geographically disperse organizations may be participating, this point may bear repeating. As already mentioned above[86] scholars such as Tsoukas (2009) and Berger and Luckmann (1966) have specified direct social interaction as the best way to share and generate knowledge. Also: "MIT researcher Tom Allen has found in many studies that scientists and engineers exchange knowledge in direct proportion to their level of personal contact. In this day of … [IT] systems that cover the world, it is easy to forget the need for a common location. There is still a strong need for what the U.S. Army calls 'face time.'" (Davenport and Prusak, 2000, p.88). However, this does not specify the physical conditions under which this direct social interaction is best facilitated. And, as has been suggested within literature on the topic of innovation: "when it comes to companies [and programs] that depend on freethinking, idea-sprouting individuals, space plays far more than a supportive role. Space can become the place where ideas take shape and opportunities emerge." (Kelley and Littman, 2006, p.199).

When individuals travel long distances to meet together for limited periods of time, it may be even more important to provide a space that is conducive to being creative and 'thinking outside the box.' The challenge and the opportunity for creating and maintaining 'creative space,' is understood as being able to "balance private and collaborative space, giving people room to collaborate but also providing the sanctuary of privacy for intensely individual work." (Kelley and Littman, 2006, p.196).

Obviously people need to have the space to talk to each-other in order to collaborate. However, only having open space may not be a good idea either. For example in response to an open-floor plan that was praised by the *New York Times*, one individual using this space was quoted as saying: "Creative people need quiet places to think, and that was something they never planned for." (Kelley and Littman, 2001, p.134) So how can spaces be formed that suit the needs of the individuals collaborating over time?

Amid many examples of how creative space has been created in practice, Tom Kelly, the head of IDEO, a company that has created many innovations, also gives some reference points as to what types of spaces may be helpful for fostering creativity and innovation. I have broken these many

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[86] See section: 4.3.1 Knowledge Creation

suggestions up into four main categories that may help individuals within organizations plan their space to foster creativity. The first suggestion is to have a **brainstorming area**. As stated by Tom Kelley, "a dedicated brainstorming area, with everything from whiteboards and oversized Post-its to robust presentation technology, comfortable seats, and stylish café tables. A place to brainstorm may sound like a small thing, but it can make a huge difference." (Kelley and Littman, 2006, p.199).

The second suggestion is to have a **hub-space**, which offers "the chance to mix with colleagues and get ideas from outside one's own group." (Kelley and Littman, 2006, p.200). This could be what is typically called the "water-cooler" area, where there may be an alcove or a space for people to convene and get something to drink while having a chat. These spaces are also seen as creating an opportunity for 'serendipity,' where something unexpected is learned by chance. (Davenport and Prusak, 2000, p. 91; Bahrami and Evens, 2005, p. 69)

Third, also having at least one "fully equipped **meeting room** with the latest in technology," (Kelley and Littman, 2006, p.200) is typically seen as important. Being able to connect with those outside of the organization and/or group when necessary, give presentations, and convene everyone in one space can have definite advantages for keeping everyone updated and on the same page, as well as for presenting new ideas collectively. Lastly, having the opportunity to meet in new contexts with new individuals is also helpful. This could include being part of an actor oriented innovation program, or going to conferences within ones field of study, or even getting involved in different project groups within the same organization. The basic concept is that "having a **fluid work environment** reduces the chance of people getting 'stuck in a rut,' following the same thought patterns and talking to the same small circle of people." (Kelley and Littman, 2006, p.204).

The basic message is to provide space where individuals can think in a variety of spatial contexts. Although it may be less necessary for individuals to have complete 'alone time' when they meet less frequently, **having a chance to 'sleep on it,'** and then re-convene may also be important. From personal experience, I know that if I am working on a particularly challenging problem, I often wake up with new insight. Supporting this idea, "Recent research… shows that much tacit thinking is also performed when we sleep and dream. We may actually even need to sleep to organize and make sense of new knowledge and perspectives that we have obtained when awake." (Wiig, 2004, p.69). The important message here for actor oriented innovation programs, members of whom may only meet periodically, is not only to be provided with space conducive to knowledge processes, but also to be provided with the time for it. When participating in a

project, flying in and out on the same day may not give individuals enough time to fully process what they have discussed. Stretching meetings over at least a two-day period may give individuals time to critically reflect and respond more interactively to new information that is given or knowledge that is developed (or in the process of developing). In terms of creative space: "Innovation needs teams. And teams need places to thrive and grow." (Kelley and Littman, 2001, p.121) Additionally, having not only *space*, but also *time* to be creative, is understood as important.

This leads us to the second action seen as mediating 'obstacles' related to large and disperse organizations/ innovation programs, namely the use of *common language and 'frames' of reference*. The reason for placing focus on this type of action is that individuals who work together need a common base of understanding before they can collaborate. Common frames are naturally built over time when people work in close proximity, because interaction allows them to observe what each other is doing, and ask questions if they do not understand. This is one of the reasons why mentoring has been identified as a good way to access the "tacit-ness" of knowledge.[87] However, for actor oriented innovation programs, where individuals may not meet on a weekly, or even monthly, basis it is likely that they will develop different vocabularies and working practices, even if they work on similar issues within the same field. Davenport and Prusak find this as also happening within the same organization, where "multiple and sometimes contradictory meanings for fundamental terms exist in many organizations and create barriers to consolidating information and knowledge. Common definitions […] are the necessary common ground of communication across a company [or project]." (Davenport and Prusak, 2000, p.86). The key here is creating 'common ground' upon which further communication can build.

Ikujiro Nonaka (1994) explains the concept of creating common language and frames of reference by using the term **redundancy**. In his words: "creative dialogue is realized only when redundancy of information exists within the team." (Nonaka, 1994, p.24) Redundancy is when individuals reach a point in their interaction where they truly understand each other's frames of reference, which enables them to anticipate what information may be useful to share, or what advice may be helpful when problems arise or are voiced. The usefulness of redundancy for interaction is articulated by Nonaka (1994, p.28) as follows:

> "Redundant information can be instrumental in speeding up concept creation. … The redundancy of information refers to the existence of information more than the specific information required immediately by each individual. The sharing of extra information between individuals promotes the sharing of individual tacit knowledge. Since members share overlapping information, they can sense what others are trying to articulate. Especially in the

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[87] For a discussion about mentoring, see section: 4.4.1 The Tacit knowledge Challenge

concept development stage, it is critical to articulate images rooted in tacit knowledge. In this situation, individuals can enter each other's area of operation and can provide advice. This allows people to provide new information from new and different perspectives."

However, reaching this point, like so many of the other processes discussed in this chapter, does not happen automatically. As stated by Davenport and Prusak: "a significant commitment of time and effort is required to give group members enough shared knowledge and shared language to be able to work together." (Davenport and Prusak, 2000, p.62). This statement also returns to the idea of time, which may require giving people a chance to actively listen to each other, and then reflect on what they have heard (for example by 'sleeping on it') in order to make sense and 'frame' these new understandings in the joint context of which they are part. There should also be a word of caution echoed here, which is that "The goal is to harmonize organizational [or project] knowledge, not to homogenize it." (Davenport and Prusak, 2000, p.86). It is by having common frames of reference that differences can be compared in a way that can be understood by everyone in the group. Although this is an important point, it may be less of an issue for groups that are large and widely dispersed.

Size and geographic dispersion are issues that many organizations and programs deal with on a day-to-day basis. Organizations/programs for which these issues apply may be better equipped to develop and sustain innovation – having more resources at their disposal, and the ability to shoulder greater risks. However, these organizations/programs may also have some major challenges in terms of managing their knowledge, namely getting the right information to the right people at the right time. This section has discussed two ways in which groups of individuals facing these challenges may be able to achieve their fullest potential, namely through fostering creative spaces and creating common language and frames of reference.

4.5 Knowledge Management *Critical Success Factors*

After having discussed *drivers* and *obstacles*, we now turn to a discussion of knowledge management *critical success factors*. Critical success factors describe the many, and varied, ways that organizations/programs have been successful in managing individuals and their knowledge. The topics that have been selected for discussion here are very broad, and the way in which these issues are further specified will be for the purpose of identifying theories and actions that may support knowledge management within actor oriented innovation programs in particular. This is not to say that this is an exhaustive list of critical success factors for knowledge management generally, or even an exhaustive list for knowledge management within actor oriented innovation programs. The aim is to highlight some key issues that can be understood, as presented below, to be particularly important for organizations/programs wanting to build and sustain innovations.

Each organization/program should always critically evaluate the theories and tools that they choose to work with, based on their usefulness within the evolving context that each of these organizations/programs finds itself. The topics that will be discussed as critical success factors for knowledge management are: *social networks; genuine shared goals; experience and action,* and*; engagement.*

4.5.1 Social Networks

Social networks are understood as a critical success factor for knowledge management because "Data and information are constantly transferred electronically, but knowledge seems to travel most efficiently through a human network." (Davenport and Prusak, 2000, p.161). Because of the importance of human interaction within knowledge processes, over emphasizing IT-based networks may actually undermine rather that increase networking, which is important for connecting people so that they can think together. (Alvesson, 2004; McDermott 1999) Literature on networks, like so many other issues discussed here, is extensive, emerging and developing as a field of study "that has spanned many disciplines, including, but not limited to, organizational theory and behavior, strategic management, business studies, health care services, public administration, sociology, communications, computer science, physics, and psychology." (Provan et al., 2007, p.479). With such a broad spectrum of literature available on the topic, it is particularly necessary to start this discussion by defining the term 'network', and more specifically 'social network analysis.' Once this has been specified, both network characteristics and network roles will be discussed, followed by the identification of six conditions found to facilitate knowledge within actor oriented networks. If these network characteristics, roles and conditions are identified and/or created, they may be able to enhance the relationships within actor oriented innovation programs, and further enable knowledge processes and outcomes.

The definition of 'network' that will be used for the analyses presented in this dissertation is one forwarded by the scholars Osborn & Hagedoorn. It has been chosen because it identifies many of the key issues within networks, as well as the requisite complexity that is often overlooked in literature pertaining to this issue. Like the context of inter-organizational (actor oriented) activity presented in this dissertation, Osborn & Hagedoorn are describing networks that are formed between organizations. In this context, inter-organizational networks (Osborn and Hagedoorn, 1997, p.274):

> "are strategically determined, and they emerge as natural by-products of corporate activity. They show the reach of a firm and the grasp of its limitations. They are frameworks for action and action takers. They represent understandings and values shared across organizational or cultural lines … They represent simple deals and complex emergent patterns of behavior."

What is particularly important about this definition is the fact that it draws attention to the critical issues of action, frameworks, and duality. All of these issues are simultaneously present within the evolving nature of inter-organizational networks, and understanding their interrelatedness and development over time can help both researchers and practitioners to evaluate networks in meaningful ways for knowledge processes and the outcomes that knowledge produces. It has further been specified that "distributed networks represent a good model for the study of business networks as they facilitate analysis of complex … flows and … inter-dependencies between firms." (Todeva, 2006, p.141). However, once recognized, knowing how exactly to analyze these issues within networks requires further consideration. One way of looking further into the workings of complex networks is thorough social network analysis.

Social network analysis is defined here, following Boje (2001, p.62), as "a branch of social and behavioral science that tries to understand the complex architectures that evolve from the many social strong or weak ties any individual, group, organization or society maintains." Also, as stated by Newell et al. (2002, p.128), "This kind of network analysis highlights not only the oft-made distinction between knowledge and information, but also the extent to which knowledge circulates *within* … communities." However, social network analysis has also been criticized as reducing complex attributes and actors to a 'bundle of actions and behavior' that is represented in 'either/or categories' such as strong/ weak, present/ absent. (Todeva, 2006, P.21) It is therefore important to stress that a constructionist perspective can also be applied using this type of analysis, where qualitative inquiry probes individual actors for their interpretations about the context and nature of their relationships. In other words, from a constructionist approach, using social network analysis may help us to understand the dynamics between people and their interactions within and between groups and organizations. In particular, there are three aspects of social networks that will be explored here as the basis for further understanding, namely network characteristics, network roles, and knowledge facilitating network conditions within actor oriented innovation programs. The expectation is that examining each of these aspects in turn can contribute to achieving greater insight in relation to action, frameworks, and duality within knowledge processes and the outcomes thereof.

In relation to network characteristics, both *internal and external links*, as well as *strong and weak ties*, apply very broadly to most, if not all, social networks, and are very often studied in relation to social network analysis. **Internal links** describe relationships that are developed and knowledge and information that is circulated within the network. These internal links are important to understand because they can explain both "who knows who" and "who knows what" (Liebowitz, 2009, p.2) which, when put into context, can help form an understanding of how

knowledge flows (or does not flow) within a network. For actor oriented innovation programs in particular, if there is important information that is not being shared with appropriate parties, facilitating these internal links may be necessary. **External links** explain the personal network relationships that individuals have outside of the network. This can be important for understanding where outside influences or input may come from, or could come from if needed. Also, understanding external links may help to form a picture of other networks that exist, and generally get a better idea of the broader context in which the network is situated. In the context where something new is being developed, external links may be particularly important, as conditions may change rapidly, and new information and knowledge may be needed on short notice.

 Strong ties "are based on intensive interactions and routine information exchanges within established and reciprocated relationships." (Todeva, 2006, p.125). If strong ties exist within an actor oriented network, this may constitute a community of practice, where the knowledge of those involved "is not only socially embedded within informal networks but is also cognitively embedded. It is grounded in particular world-views or perspectives which connect and make sense of different kinds of knowledge circulating within the community." (Newell et al., 2002, p.129)[88]   To the degree to which a community of practice has formed within a network, knowledge processes should be enabled. It is also for this reason that many organizations have "organized their previously informal communities of practice into formal networks, with budgets for enabling technologies, knowledge coordinators, librarians, writers, and administrative staff." (Davenport and Prusak, 2000, p.66) In contrast, **weak ties** are seen as connecting "actors that have scarce interactions, and usually are a source of novelty information to each other." (Todeva, 2006, p.125) Eriksson and Sharma (2000), for example, have conducted research suggesting that weak ties can be used as a source of new knowledge when change calls for a need to innovate. Although it may be a good idea to acquire input from weak ties when facing a novel situation (because these individuals may be more able to give a new and possibly useful perspective), it should not be forgotten that the degree of understanding between people may be impaired if they are not willing to actively listen and open themselves to the possibility of changing their understanding as new information is presented. The scholars Boland and Tenkasi describe this process of understanding other community's views as 'perspective taking.' In their assessment, the problem of integrating knowledge does not have to do with combining information or making data available, but instead "it is a problem of perspective taking in which the unique thought worlds of different communities of knowing are made visible and accessible to others." (Boland

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[88] See also: (Boland and Tenkasi, 1995)

and Tenkasi, 1995, p. 359) This coincides with the understanding of conditions for knowledge creation presented by Tsoukas (2009), which requires 'shared sensibility.'[89]

Other network characteristics which may be particularly helpful for gaining insight and understanding regarding the changing dynamics within inter-organizational (actor oriented) networks are 'social circles' and 'cliques,' identifying smaller groups that are often formed within distributed, actor oriented contexts. **Social circles**, also termed 'clusters', are described as "a group of nodes with direct or indirect connections to each other." (Liebowitz, 2009, p.66). Within a network, there may be a number of different social circles that are formed depending on the way that the network is structured. In the Carbon Trust Offshore Wind Accelerator case, for example, one could describe the Steering Committee, Technical Working Groups, as well as the Carbon Trust Management Team as social circles that were formed to serve specific functions within the overall network. Doing so specifies the Carbon Trust Offshore Wind Accelerator case as a project network, meaning that it was "pre-designed and constructed on the basis of clear objectives and pre-set targets, but often with unknown or uncertain outcomes. Participants in project networks are pre-selected and enrolled as contributors with designated roles in order to produce target outputs." (Todeva, 2006, p. 141) If we compare this definition to the information presented in Chapter 3, it seems to coincide well with the structure and function of the Carbon Trust Offshore Wind Accelerator case. Next, a **clique** "is a group of nodes with direct connections to each other." (Liebowitz, 2009, p.66) Unlike social circles, cliques are more closely interconnected, which may be derived from other forms of interaction outside of the network being studied. The advantage of cliques is that they have "stronger and stable relationships between their members." (Todeva, 2006, p. 141) If a social circle consists of weak ties, cliques may act as a stabilizing factor within the network. The down side to this, of course, is that individuals outside of the clique may also potentially feel excluded from activity between individuals within the clique. This point is well made by Newell, David and Chand (2007, p.161) who state "social networks can also have a negative impact on aspects of knowledge sharing, for example in excluding those who are not part of the friendship group." This is not to say that all cliques are necessarily comprised of individuals who would describe their relationship with other group members as 'friendship,' but does serve to make a point about any group of individuals where strong and stable relationships exist between members, namely that the possibility for exclusion exists. Overall, understanding network structures may serve as useful guideposts for examining the complexities that exist within inter-organizational, actor oriented innovation networks. Not only can inquiry in these areas help to discover where knowledgeable individuals

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[89] See section: 4.3.1. Knowledge Creation

are located and how they interact, but it can be important for understanding how and in what ways individuals find shared 'sensibilities' for working, and creating knowledge, together.

In order to describe how networks can be facilitated by the individuals they comprise, we now turn to a discussion of network roles and what they mean for inter-organizational (actor oriented) networks and the management of knowledge processes within this context. The four network roles that will be focused upon are central connectors, liaisons, bridge roles, and peripheral specialists. Each of these roles plays an important part in inter-organizational, actor oriented networks, and as will be discussed, finding or creating these roles within the network may also play a key role in the management of knowledge processes. First let us examine the role of **central connectors.** As stated by the scholar Jay Liebowitz (2009, p.63): "the central connector is the individual to whom people come often for advice. … the central connector can be the 'carrier of information and knowledge to allow the knowledge flows to be fluid. Or on the contrary, the central connector could be a bottleneck if he/she desires. This would inhibit the knowledge sharing process." The importance of this role has several implications for actor oriented innovation programs. One implication is that these individuals may have considerable influence over decision making processes because their opinions are valued and often asked for. Another implication is that it may be important to be aware of the level of group cohesiveness (interpersonal and task cohesiveness)[90] as discussed by Huang (2009), so that central connectors feel more inclined to aid knowledge processes rather than block them.

Next let us examine the role of the **liaison.** The liaison "is the individual who spans between two [or more] groups. … this person may have a fair amount of relationship knowledge, knowing 'who knows who,' to help produce and disseminate strategic intelligence." (Liebowitz, 2009, p.64) These individuals play a critical role in actor oriented innovation programs because they are, by their very nature, widely distributed. Having individuals that can tie important groups together will connect necessary interfaces (where boundaries are common and problems are shared), thus enabling common objectives and goals to be harmonized and approached collectively. This role is similar to the role of 'boundary spanners' described by Dorthey Leonard,[91] and, like the discussion above, it is important that there are enough liaisons present in actor oriented innovation programs to manage all of the important boundaries, thus ensuring that the project stays on track and does not get derailed by diverging individual objectives or tangents. It stands to reason that within actor oriented innovation programs, project managers might also usefully be thought of as liaisons. For example: "The manager of a knowledge project performs

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[90] Group cohesiveness is discussed in greater detail in section: 4.3.4 Knowledge Sharing
[91] See section: 4.3.2 knowledge acquisition

such typical project management functions as: developing project objectives; assembling and managing teams; determining and managing customer expectations; monitoring project budgets and schedules; and identifying and resolving project problems." (Davenport and Prusak, 2000, p.112). Being able to know who to bring together for what purpose, what overall objectives should be put on the agenda, and resolving any potential problems are all characteristics that coincide well with the above definition of a liaison. Therefore, it may be important for actor oriented innovation programs to make sure that individuals managing the network are consciously preforming a liaison role for the network.

The third network role that I would like to discuss is the **bridge Role.** As stated by Newell, David and Chand, "specialist bridge roles can be assigned to coordinate and ensure that each sub-team is working to the agreed specification" (Newell and Chand, 2007, p.160). Individuals in these roles should be very technically skilled, so that they can identify when sub-teams are or are not working to specifications. Also, these roles may also require quite a bit of relationship knowledge to know how to motivate or discuss with sub-teams as needed. As stated by Davenport and Prusak "Good knowledge workers at any level should have a combination of "hard" skills (structured knowledge, technical abilities, and professional experience) and "softer" traits (a sure sense of the cultural, political, and personal aspects of knowledge.)" (Davenport and Prusak, 2000, p.110). While this is admittedly asking a lot of individuals, having this 'total package' of traits may be particularly important for individuals fulfilling bridge roles within actor oriented innovation programs. The fourth, and last, network role to be discussed here is that of the **peripheral specialists**. Libowitz (2009, p.64) states: "The peripheral specialist is either a newcomer to the organization or perhaps an expert in a particular field." For any organization/project that aims to build and sustain innovations, it is a pretty safe bet that the knowledge needed to make these objectives a reality will not be contained within one project network, or even one organizational network. For this reason, peripheral specialists are seen as particularly important, because they can add input in vital areas with their specialized expertise. It may also be advisable for networks to put some time and effort into figuring out which peripheral specialists are needed when, and where they might come from. If they are not already attached to a network, peripheral specialists may also need incentives to contribute their expertise to a network.

Within knowledge management, networks are understood as playing a very important role, as they are composed of individuals who interact for particular reasons. Within actor oriented innovation programs, inter-organizational networks exist as a means to develop knowledge for the purpose of being able to build and sustain innovations. Within these complex network

interactions, actions are taken, frameworks are formed and reformed, and ever-present duality means that paradoxes occur often within knowledge processes. The hope is that by understanding social network analysis - and the structures and roles involved - the complex patterns of interactions that take place within these networks can be understood, built upon, and nurtured in the interest of positively impacting the knowledge processes involved.

Doing precisely this, the scholars Inkpen and Tsang (2002) present a table that illustrates conditions facilitating knowledge sharing in a variety of contexts (what they term 'boundary types'). In their description of a strategic alliance, they specify "R&D Consortiums" as a type of alliance that is very similar to actor oriented innovation programs, understood by these authors as "involving multiple firms." Each of the conditions listed under "strategic alliance" supports the overall understanding that is presented in this dissertation, and may further inform the type of decisions that are made in relation to the management of knowledge within actor oriented innovation program networks. As understood by Inkpen and Tsang, conditions facilitating knowledge sharing for strategic alliances (including R&D consortiums) are: (Inkpen and Tsang, 2005, p.155)

- Strong ties through repeated exchanges
- Multiple knowledge connections between partners
- Noncompetitive approaches to knowledge sharing
- Goal clarity
- Cultural diversity
- Strong shared vision (shadow of the future)

In relation to the way in which network ties are structured, **strong network ties** are understood as being necessary for knowledge sharing to occur (Inkpen & Dinur, 1998) as well as facilitating a high degree of learning (Kale, Singh, and Perlmutter, 2000). Strong ties are understood to be supported by prior partner relationships and repeated transactions (Gulati, 1995), and are seen as able to promote long-term perspectives, trust and reciprocity (Larson, 1992). It may therefore be most important for actor oriented innovation programs to promote strong network ties between members of social circles, so that they are able to act cohesively towards common objectives. It may also be important to identify any cliques that may have formed, because these groups may be able to be mobilized for joint action and rally the rest of the members within their social circle. In relation to network configuration, the idea presented by Inkpen and Tsang draws on work from Inkpen and Dinur (1998), proposing that having **different contexts in which to share and exchange personal and professional knowledge** "provides an avenue for managers to gain

exposure to knowledge and ideas outside their traditional organizational boundaries, and each creates a connection for individual managers to communicate their alliance experiences to others." (Inkpen and Tsang, 2005, p.157). Liaisons may be able to play a key role in facilitating these 'multiple knowledge connections,' deciding when, where, and how different actors may be usefully brought together in different contexts.

In terms of keeping a network stable, having **a noncompetitive approach to knowledge sharing** is seen as important. This is because in an alliance "dependence can be a source of power for the firm controlling the key resources… If the attitude toward learning is non-competitive, however, destabilizing forces will be less likely and greater symmetric learning may occur." (Inkpen and Tsang, 2005, p.156) This is similar to the idea above of creating synergy for multi-partner networks,[92] where needs and desires of all partners are integrated, and there is no domination by one partner. (Child, Faulkner and Tallman, 2005) This would also present a case for social circles having strong ties, as well as other strong ties throughout actor oriented innovation programs, so that individuals can understand and help one another. Then, because strategic alliances involving many organizations will have different goals, the point is not to have the same individual organizational goals (which would be impossible), but to have **goal clarity**, so that everyone involved understands the needs of the others, creating an environment that is conducive to providing knowledge when and where it is needed, and working in areas where consensus can be reached. As stated by Inkpen and Tsang: "When the objectives and strategies of an alliance are clearly stated, a foundation of common understanding and the means to achieve the collaborative purpose is established among the partners."[93] (Inkpen and Tsang, 2005, p.157).

Next, because participants in complex, actor oriented, alliances come from different organizations with different cultures and practices, the goal, as understood by Inkpen and Tsang is **cultural diversity**. By combining different frames and mental models, new knowledge may be generated. Phan and Peridis (2000) for example, propose that incorporating differences between partners promotes and supports learning processes. Inkpen and Tsang also agree that for actor oriented alliances "cultural diversity should be beneficial to knowledge transfer." (Inkpen and Tsang, 2005, p.158). Lastly, it is proposed that trust can be facilitated within multi partner alliances by having a **strong shared vision** (what the authors refer to as 'shadow of the future'). This concept of 'shadow of the future' comes from Parkhe's (1993) work, where it is also suggested that

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[92] For a discussion of synergy, see section: 4.4.2 Knowledge Management and the Cultural Dimension
[93] See also: (Das & Teng, 1998)

opportunism is constrained, and cooperation is promoted, when time horizons are long, and there is high behavioral transparency.[94]

Each of these six *conditions facilitating knowledge sharing* can, and should, be understood as supported by the network structures and roles discussed above. Collectively, this section has identified not only ways in which to understand structures and roles within networks, but also how these structures and roles can be positively enacted to facilitate knowledge processes within actor oriented innovation programs. It should also be noted that these interrelationships are complex and do not always yield positive outcomes. How to prioritize scarce time and resources for joint collaboration will inevitably require tradeoffs, where time spent in one important area detracts from another important area. Cliques created outside of the actor oriented innovation network may positively or negatively influence decision-making processes. Conflicts between particular network members may or may not be resolved, particularly when there are many members, and voicing differences in opinion is encouraged. However, by examining the network in which one is operating, it may be possible to make more informed decisions about frameworks that are chosen, dualities that exist, and actions that are taken, for the purpose of building and sustaining innovation.

4.5.2 Genuine Shared Goals

As stated by Inkpen and Tsang, "Shared goals represent the degree to which network members share a common understanding and approach to the achievement of network tasks and outcomes." (Inkpen and Tsang, 2005, p.153). The main reason that having genuine shared goals is highlighted as a critical success factor for knowledge management is simple: any constellation of individuals working together, whether described as a network, organization, or program "needs to know what it wants in order to have a good chance of getting it." (Davenport and Prusak, 2000, p. 58) For actor oriented innovation programs, this is particularly important because many organizations (which are likely to have divergent company level goals) are pooling their resources. In this context, having shared goals means being able to find common ground where it is possible to work towards achieving the same objectives. Conversely, if goals are not genuinely shared, the ability to agree on actions may be seriously impaired as each actor seeks to fulfill their own needs, at which point coordination and cooperation are likely to break down, thus making the entire project ineffective. This section will discuss longer term, visionary goals, as well as shorter term goals, as both are important for the management of knowledge. Each of these two types of goals plays a different, and I would argue equally important, role in terms of providing the necessary structure for building and sustaining innovations.

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[94] Shadows of the future are described in more detail below, in section: 4.5.2 Genuine Shared Goals

Let us first examine the importance of longer term, visionary, goals. For multi-partner collaborations (such as the actor oriented innovation programs discussed here) it has been established that "without a shared vision and striving for the desired future, a company [project or program] will not move forward." (Ding et al., 2009, pp.21) One advantage of a common vision may be that it facilitates the ability of individuals to work with rather than against each other, allowing them to move forward, rather than in different directions which would cause efforts to be diffuse. Another reason that these actor oriented innovation projects may not move forward if shared vision is lacking is that some participants may have little interest in completing some of the particular tasks related to the project. The non-participation of a few members may cause others to follow suite and lose interest because they feel that the project is not taken seriously in general. Having a shared vision can provide everyone in the project with a strong sense of purpose that might not otherwise exist, which can inspire participation even if the task at hand is difficult or not very exciting.

The fact that not having shared vision can lead to lack of participation by project members is similar to what is referred to in the above discussion of knowledge sharing as freeriding,[95] when individuals do not do the work and still expect to get the collective reward. Freeriding behavior is a type of opportunism, where individuals are thinking about their own short term benefit rather than the benefit of the whole project, or the desired actions and outcomes that having a vision can inspire. This concept of vision is termed "shadow of the future" by Parkhe (1993), who postulates that having a strong and compelling vision of the future is seen as reducing opportunistic behavior in the present to the degree to which future benefits are desirable and anticipated. In his words: "Cooperative performance is better promoted the longer the shadow of the future, or the thicker the nexus between current moves and future consequences, since forward-looking expectations of gains hold in check proclivity toward agreement violations." (Parkhe, 1993, p.799). This would suggest that individuals will not 'free ride' or display other opportunistic behaviors if the end goal or vision is perceived as giving sufficient reason to cooperate to the degree one is able. In an eloquent reading of Parkhe's work, Inkpen and Tsang state that **shadows of the future** "can be lengthened by long time horizons, frequent partner interactions, and high behavioral transparency."[96] This combines future visioning that creates 'long time horizons' with concepts of interaction and behavioral transparency, which are also described above[97] as strengthening trust relationships in relation to knowledge sharing, suggesting a synergy between these concepts.

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[95] See section: 4.3.4 Knowledge Sharing
[96] This understanding of Parkhe's work is presented in: (Inkpen and Tsang, 2005, p.158)
[97] See section: 4.3.4 Knowledge Sharing

A case could also be made for the importance of envisioning what the future could hold being conceptually similar to David Boje's idea of antenarrative – that organizations 'bet' on what the future will hold, and through this articulation, they help to achieve that future by coming up with creative ways to get there. Having a common vision can help to create a collective effort to 'think outside the box' and come up with creative ways to achieve difficult objectives. Scholars Isaksen and Lauer (2002, p. 84), in their examination of most and least creative teams, find that the most creative teams have clear and common goals, which, in addition to being clear and compelling are also open and challenging. Particularly for projects where innovations are being developed (requiring the creation of new knowledge in the area), the presence of visionary goals may help to propel individuals to think up new and creative solutions to problems that will inevitably arise.

It may go without saying, but top management support is also required if visionary goals are to be taken seriously and prioritized by networks, organizations and programs alike. This is supported by many scholars including Goffin, Koners, Baxter, and Van der Hoven, who state that: "managers also need to recognize that top management encouragement, supplemented by suitable reward and recognition, is essential to create a learning culture." (Goffin et al., 2010, p.51). By senior management's prioritization of visionary goals—and support of actions toward those goals accordingly—all actors involved become confident that these goals are actually prioritized, and not just a slogan used to generate good will and good press for any particular organization. **Senior management's commitment** combined with **vision** is also important under the often rapidly changing conditions that actor oriented innovation programs are faced with. For example, if developing innovations yield undesirable outcomes, or if environmental conditions shift quickly and require adaption, this combination can help to: 1) face the facts as they are, rather than as we would like them to be, 2) act quickly, and 3) focus attention on generating workable solutions. (Bahrami and Evans 2005, p. 79) Especially the second and third point may require commitment at a senior level, so that corrective actions can be approved and acted upon quickly.

Now let us turn our attention to the shorter-term goals. Incremental goals are just as important for achieving outcomes as visionary goals, because without them, the 'big picture,' or vision, remains unattainable. This is akin to the old saying that the way to achieve a seemingly insurmountable task is to take 'baby steps.' By breaking up larger goals into more manageable pieces, the task no longer seems as challenging, but instead small successes are made while keeping the 'big picture' in mind.

It is perhaps for this reason that Tom Kelley identifies the key to innovation-team success as being to "start with a clear goal and a serious deadline." (Kelley and Littman, 2001, p.69). Most

people know that deadlines can be a powerful motivator, giving us the extra push that we need to complete a task. Tom Kelly also reiterates this sentiment by stating: "Pressure can help you get it out the door." (Kelley and Littman, 2001, p.76). In general, visionary goals are great for inspiring people and directing general behavior over time, but in terms of 'getting things done,' smaller goals can be easier to execute, and provide the opportunity to set deadlines for task completion, which is also of utmost importance. The scholars Homa Bahrami and Stuart Evans understand this importance very well, and use the phrase 'low and high hanging fruit' to describe two types of smaller goal setting that can be helpful, particularly for organizations and projects that need to be flexible as conditions change and develop quickly.

Low-hanging fruit describes tasks or goals that are relatively easy to achieve, and are understood as being the first type of goal that a project group should aim to complete together. The idea is that by accomplishing some of the small tasks first, it gives a group of individuals working together a sense of accomplishment. As stated by Bahrami and Evans (2005, p.103): "Quick wins build the core team's confidence, generate credibility among the critical stakeholders, and provide the foundation for taking on the tougher challenges." In other words, successfully completing small goals gives working groups a feeling of joint accomplishment that can help their confidence and moral when having to tackle tougher challenges.

Next, although still relatively small in relation to the overall visionary goal of an organization or project, **high-hanging fruit** describes the tougher challenges, the more difficult tasks or goals. These goals require more time and effort to accomplish. It may be particularly important that strict deadlines are set for goals described as high-hanging fruit because they require more energy to be exerted, and probably also require some creative thinking. If these goals are left with undefined timeframes, they may be overlooked because of the allure of other, seemingly easier tasks that come along. By setting a serious deadline for these challenges, individuals may be spurred to act rather than to wait, or to try a variety of different solutions in the hope that one will work by the time the deadline is reached. As stated by Tom Kelley, "When the hurdle is high, there's a tremendous sense of achievement in getting anything done by the deadline." (Kelley and Littman, 2001, p.71). In other words, for high-hanging fruit, deadlines may help to get things moving in situations where answers are not immediately apparent.

Mapping the easy and difficult tasks in this way—particularly when participants of the project may come from different organizations – is seen as particularly important because it "gives different stakeholders a common perception of reality and 'keeps them on the same page.'" (Bahrami and Evans, 2005, p.103). By identifying up front what will be easy to accomplish, and what will take longer to achieve, all members of the project may be able to avoid being frustrated,

disappointed or discouraged when tougher challenges take longer to achieve and require more general effort. It also gives everyone involved a chance to plan a strategy that is more realistic in terms of time horizons, recognizing that some things will just take more time. Of course not everything will go exactly as planned (it never does), and some deadlines may need to be extended, or new options explored, but in general, trying to identify *low and high-hanging fruit* can help to understand what it will take to meet particular goals.

For the field of knowledge management, acknowledging the importance of genuine shared goals is vital, because of the alignment of people processes that it entails. In relation to long term goals, visionary goals are important because: "A shared awareness of corporate goals and strategies gives individuals cues for directing their own work toward a cooperative goal and makes them feel that their work is meaningful as part of a larger aim." (Davenport and Prusak, 2000, p.49). It has also been emphasized that in order for these visionary goals to be effective, senior management needs to actively acknowledge and reward work that is done to support these goals. In relation to shorter term goals, low and high-hanging fruit were also identified as vital for groups working together. Once confidence is built through successfully accomplishing smaller goals (low hanging fruit), and working routines are in place, tougher goals, or high-hanging fruit can be met with a confident attitude that has been built upon understanding not only what it takes to succeed, but how the group functions to achieve its goals. Identifying low and high hanging fruit can also help to keep people on track, as well as helping to ensure that everyone involved stays on the same page. For knowledge processes, this type of goal clarity can engender understanding.

4.5.3 Experience and action

Managing knowledge is not an easy task, and one of the reasons that it is so difficult is that: "We simply can't represent some knowledge effectively outside the human mind." (Davenport and Prusak, 2000, p.71). Much of what has been discussed thus far deals precisely with how to represent what we know in ways that other individuals can understand and build upon. This section will discuss *experience* and *action* as critical success factors for knowledge management, precisely because they create and demonstrate knowledge in ways that can be directly observed. Put another way: "At the most basic level, knowledge is a personal thing. Our training and experience allow us to understand; from that understanding, we are able to chart a course of action." (Liebowitz, 2009, p.92). Also, gaining experience and taking action almost never happen in isolation. When groups of individuals share experiences and act together, these actions create very specific frames for joint understanding, which can facilitate knowledge processes and the management thereof. In the following, first experience and then action will be discussed,

proposing how each contributes necessarily to knowledge processes. An iterative recalibration process will then be examined, as proposed by scholars Bahrami and Evans. It integrates both experience and action, suggesting how semi open innovation programs can utilize experience and action to build and sustain innovations.

We begin by examining the connection of experience to knowledge. On a very basic level, it is important to always keep in mind that: "One of the prime benefits of experience is that it provides a historical perspective from which to view and understand new situations and events. Knowledge born of experience recognizes familiar patterns and can make connections between what is happening now and what happened then." (Davenport and Prusak, 2000, p.8). This quote exemplifies the process orientation of knowledge over time. The extent to which individuals can take past experiences and apply them to current events is one way in which knowledge is 'represented outside the human mind.'

Also, experience can display some of the more 'tacit' elements of what we know–those elements which we may not be able to articulate. Tsoukas and Vladimirou (2001) describe experience over time as creating a situation in which routine tasks can become second nature, enabling us to focus our attention on new aspects of what we are doing, and thus gain new knowledge of a task at hand. In the words of Tsoukas and Vladimirou: "as we learn to use a tool, any tool, we gradually become unaware of how we use it to achieve results... We make sense of experience by assimilating the tool through which we make sense… [This process] enables the individual to expand his/her awareness of the situation he/she encounters and thus to refine his/her skills." (Tsoukas and Vladimirou, 2001, p.982-3). Polayni (1962, 1975) describes this process of assimilating 'tools' that we use to complete tasks as 'indwelling.'[98] Similarly, Jay Liebowitz has identified that "some people have a sixth sense and an intuitive feeling for how things should work. Getting this 'gut feeling' can be difficult and often requires one's knowledge base built on experiential learning and facts." (Liebowitz, 2009, p.59). The overall idea here is that when 'tools' (physical or theoretical) become second-nature and tacit through experience, a higher level of skill is available for application to the task or challenge at hand. If questioned about how it was possible to execute this skill, the answer might not be readily available, and be equated to a gut feeling, because the processes involved have become second nature. Under these circumstances, mentoring[99] may be a good way for individuals to understand how skills acquired through experience are executed, as it will provide the opportunity to observe first hand, and ask questions to help make sense of specific situations in context.

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[98] For a more complete discussion of indwelling, see section: 4.4.1 The Tacit knowledge Challenge
[99] For a more in depth discussion of mentoring, see section: 4.4.1 The Tacit knowledge Challenge

In connecting experience to action, Tsoukas and Vladimirou state that: "knowing how to act within a domain of action is learning to make competent use of the categories and the distinctions constituting that domain."[100] (Tsoukas and Vladimirou, 2001, p.978). This statement suggests that learning to make use of categories and distinctions can be accomplished through experience, as actions are taken. Yet, because of the complex and evolving nature of space, time and change (i.e. no two situations are exactly the same in space and time due to change), adaption is also needed with each new action that is taken. Perhaps it is precisely for this reason that experience is understood as allowing individuals to make *inferences* about how to behave in present situations based on past occurrences. In other words: "In action, an improvisational element always follows it [organizational knowledge] like shadow follows an object." (Tsoukas and Vladimirou, 2001, p.988). Even seemingly routine tasks may require slight variations (the type and kind of which may be informed by experience). However, when discussing actor oriented innovation programs, where the purpose is to build and sustain innovations, the need for improvisation may increase exponentially because individuals are likely to be doing something that they have not done before in an environment that may also be new or changing rapidly.

In an unpredictable business environment, it is simply not possible to 'de-risk' strategies without action. The most detailed plans and elaborate analysis will not prepare an organization for the reality that they will face when testing an innovation. As stated by Bahrami and Evens: "It may also be difficult to establish the technical feasibility of a novel idea, or the viability of executing a new initiative, through "theoretical" planning. By engaging in action, new information can be brought to light, and unforeseen limitations and new possibilities, identified." (Bahrami and Evens, 2005, p.93). The type of action that Bahrami and Evens suggest for bringing new information to light, and identifying unforeseen limitations and new possibilities, is a process which they term *recalibration*. Their conceptualization for recalibration is depicted as follows:

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[100] See also: (Wenger, 1998)

Figure 12: The Recalibration Process
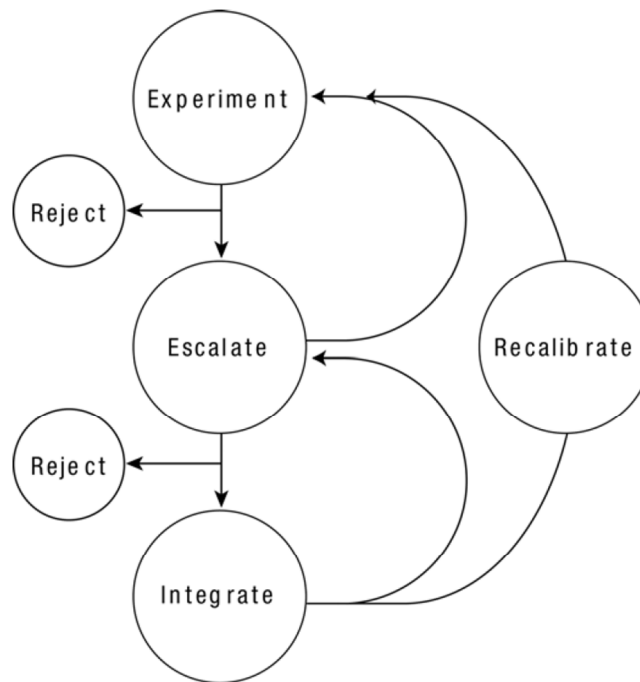
Source: Bahrami and Evans (2005)

As becomes apparent by looking at this figure, the recalibration process is iterative, providing points at which to reject or integrate new information as it becomes available. The idea behind the recalibration framework is that, in situations where time frames are compressed and decisions have to be made quickly in changing environments, it "generates factual feedback from concrete action, and enables teams to revise plans and intentions as new realities unfold. A major trade-off is how to be consistent, yet remain flexible and responsive to emerging realities." (Bahrami and Evens, 2005, p.102). In order to understand what is meant by each of the elements in this figure, they will each be explained in turn, followed by a discussion of the overall usefulness of this model for actor oriented innovation programs.

First, during **experimentation**, the overarching objective "is to clarify intentions, develop capability, and create viable options." *Clarifying intentions* can be seen as coinciding with conditions under which synergy can be formed,[101] and is important because it allows all involved actors to understand what they can work together to achieve, giving them 'common ground' upon which to build their collaboration. In terms of creating viable options, it may be important to cast a 'wide net,' so that promising opportunities are not overlooked. In order to achieve this, it is also understood that "Effective experimentation requires a small, dedicated, team of thinkers and doers, who can act and engage cohesively, and who do not have to co-ordinate their actions with

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[101] See section: 4.4.2 Knowledge Management and the Cultural Dimension

a broad range of stakeholders." (Bahrami and Evans, 2005, p.98). This *small cohesive group* seems particularly well placed in terms of taking action, because there is less of a chance that they will get bogged down by complex reporting mechanisms that would slow decision making processes, as well as being in a better position to form consensus (which may become less likely with larger groups). Also, with a large number of choices to be made, it is particularly important that consensus can be formed, so that the process can move forward quickly. One way to form consensus is to identify low and high hanging fruit.[102] Further, by accomplishing some of the low hanging fruit, or small goals first, confidence and moral can be built within the group, as well as generating confidence for involved stakeholders.

Next, during **escalation**, resources should be concentrated on selected options. "This stage represents concerted efforts to select and refine the most promising options… the primary objective is to build momentum, to 'put the foot on the gas pedal'…" (Bahrami and Evans, 2005, p.99) What seems important to emphasize here is the word 'options' – that even though the number of original selections may be drastically reduced, it is still a good idea look at *several options at once,* and not put 'all eggs in one basket.' This way, if one option fails for some reason, there are still other viable alternatives left to rely upon. Setting up parallel pilot projects is also identified as a way "to accommodate different internal factions." (Bahrami and Evans, 2005, p.105) This stage typically has executive attention, and organizational resources will have been committed. It is also typical that in this stage "review triggers are built in to assess and monitor progress made in implementing pre-defined milestones." (Bahrami and Evans, 2005, p.100) So, escalation may require *additional organizational funding*, and should be tied to *pre-defined milestones* to assess the progress as the project moves forward (which may result in major or minor revisions of the action plan.) The escalation phase is also understood as needing individuals who can play *'hub roles'* [103]- individuals who have extensive networks and can manage diverse stakeholders and tight deadlines. These individuals are particularly important during escalation because they can either be "major bottlenecks" or "critical catalysts."

Then, during **integration,** the new initiative "goes live," at which time: "A critical task is to devise organizational arrangements that can integrate the new activity into the mainstream organization." (Bahrami and Evans, 2005, p.100) *Symbolic changes*, such as name changes, location changes or leadership changes, are also understood as useful during this stage, to signify that the project is no longer in progress. The objective of these symbolic changes is to emphasize the need for transition and *new arrangements*. So, in integration, symbolic changes can be used as

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[102] For a discussion of low and high hanging fruit, see section: 4.5.2 Genuine Shared Goals
[103] Hub roles are also termed 'boundary spanners' by Dorothy Leonard, and 'liaison' in relation to networks. These terms are discussed in greater detail in section: 4.3.2 Knowledge acquisition, and section: 4.5.1 Social Networks

a trigger for actual, more significant, changes that are needed, integrating new initiatives into the business structure of organizations that can utilize them. Lastly, and perhaps most significantly, **Recalibration** is something that can and should happen throughout this process. Recalibration is based upon: "guided intentions, spontaneous developments, tangible feedback, and swift revisions … The deciding criterion is practical "relevance" and factual feedback rather than theoretical elegance and informational consistency." (Bahrami and Evans, 2005, p.92) It is necessary, during recalibration, which can be seen as a *revision process*, to remove the stigma of failure and harness alternatives up-front. For example, during recalibration, "what-if" worse-case scenarios and contingency plans may also usefully be developed (for example, what if: development takes longer, key talent is lost, there are problems during set-up, etc.).

Revisiting each of the elements of the recalibration process on a regular basis may be particularly important for the rapid change experienced by actor oriented innovation programs. In this context it will be even more necessary to continually *recalibrate* making sure that common objectives remain the same, that the options being explored are still the best options available (and if they are not, they should be amended, discarded or new options should be brought in). It is also important in this context to make sure that the small team(s) of 'dedicated thinkers and doers' remain dedicated and able to take action, and that they have adequate support from individuals in 'hub roles.' Then when projects are being finished, they need to be advertised and integrated in ways that make them useful for the organizations that may require them. It should also be kept in mind that: "Project management capabilities as well as stakeholder buy-in and commitment, are equally crucial in launching new initiatives." (Bahrami and Evans, 2005, p.106) This recalibration model is based on the premise that "in fast-moving knowledge-based arenas, feasibility and relevance are critical for success." (Bahrami and Evans, 2005, p.107) When viewed in its entirety, it seems as if this recalibration process was designed specifically for actor oriented innovation programs, and for this reason, the concepts described in this model are understood here as playing a key role in designating how combined experience and action can be used in this context as a critical success factor for knowledge management.

4.5.4 Engagement

The final topic that has been selected for discussion under the heading of critical success factors for knowledge management is engagement. Engagement is considered to be fundamental for successfully managing knowledge because without it, nothing is learned, no new knowledge is created or shared, and projects do not develop useful outcomes. In relation to projects lacking engagement, Davenport and Prusak (2000, p.152) state, "A few visionary – but lonely – individuals championed these projects." Also, Isaksen and Lauer identify the worst type of team

as one in which "team members are not engaged and feelings of alienation and apathy are present. The team lacks direction, members lack interest in their work, and interpersonal interactions within and without the team are dull and listless." (Isaksen and Lauer, 2002, p.80) This is obviously quite the opposite of what is desired from actor oriented innovation programs, where the purpose of collaboration is to pool resources in order to develop and sustain innovations. Without engagement from involved actors, resources being shared are unlikely to be useful and collaboration is unlikely to be fruitful. This then begs the question: If engagement is so important, how do organizations/programs elicit engagement from their members? This section discusses urgency, rewards (explicit and intrinsic) as well as trust and reciprocity as triggering engagement in important ways for the management of knowledge in actor oriented innovation programs. Further, it will be argued that high levels of engagement provide the additional benefit of creating an environment in which serendipity can occur.

Engagement is particularly important for actor oriented innovation programs, where individuals often participate in these activities in addition to many other organizational tasks. In this environment, it is of utmost importance that all actors are engaged in the activities being carried out, because if they are not, there is little chance that the project will yield results that are useful to anyone. As stated by scholars Newell, David and Chand: "Practices, when persons are mutually committed to them, provide a basis for strong bonds of social cohesion…"[104] (Newell and Chand, 2007, p.160). This would suggest that being 'mutually committed,' or *engaged*, can also elicit 'strong bonds of social cohesion,' or communities of practice, which have been identified earlier in the chapter[105] as providing a more nuanced understanding by all participants of the strengths that particular members within a group have, and how individual members may be able to help, and learn effectively from, one another. However, knowing what is desired and being able to achieve it within organizations/programs are two different things. Therefore it is suggested that important triggers for engagement within actor oriented innovation programs consist of urgency, rewards (explicit and intrinsic), trust and reciprocity.

For example, without a sense of urgency, there may be little incentive to get things done. One reason for this is that **urgency** is often equated with importance, which may lead one to ask, "what task needs my attention most urgently?" From this perspective, urgency can also be seen as connected to engagement, where individuals who perceive a project as urgent may be more inclined to engage in the activities of that project. Another reason that urgency is important for engagement is time–there simply is not enough time to do and be engaged in everything. Time has been called "the corporate resource most likely to be begrudged to knowledge activists. It is

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[104] See also: (Rawls and David, 2005, p.491)
[105] See section: 4.3.5 Increased Organizational Learning

the scarcest of all resources, the one impossible to replicate and yet most essential to genuine knowledge generation." (Davenport and Prusak, 2000, p.67) This means that individuals need to prioritize their time, and engaging in only those activities that they feel are important, or urgent, is often a reality for many busy professionals. Not only time resources but also money resources may be a reason why urgency is important for engagement. Imagine an executive making a decision about where to dedicate scarce resources. What is going to motivate this executive to give money to one project rather than another? The answer may well lie in urgency: What is most important to develop right now and what can wait? A sense of urgency may well be the deciding factor for executives to favor one project over another, and engage by committing financial resources.

Rewards, both explicit and intrinsic, can also elicit engagement. *Explicit, monetary, rewards* have traditionally been the way that employees have been compensated for their engagement within an organization or project. This is because "people rarely give away valuable possessions (including knowledge) without expecting something in return." (Davenport and Prusak, 2000, p.26) Providing ones knowledge through engagement - although extremely necessary for knowledge processes and outcomes - is not only difficult to put a price on, but may not be sufficient when the knowledge activities fall outside of explicit employment contract specifications (which may be the case for participants of actor oriented innovation programs, or other knowledge initiatives for that matter). Although direct payment and other financial benefits may be necessary for basic levels of engagement within organizations, Davenport and Prusak ask the question: "what kinds of payment exist in the knowledge market." (Davenport and Prusak, 2000, p.31) Their answer is threefold, consisting of reciprocity, repute and altruism. Because reciprocity is discussed along with trust just below, repute and altruism will be discussed here, leaving a more detailed discussion of reciprocity to follow. *Repute* means being known as an individual with valuable expertise to share on a particular subject or subjects. Having ones opinion respected and desired may be a particularly advantageous position within actor oriented innovation programs because when consensus has to be formed, this individual's idea may be most highly prioritized, which will be good for the objectives of that individual. Also, being known as a source of knowledge may also mean that other individuals are more willing to share what they know in the hope of getting some information in return, meaning that a positive feedback loop of information exchange and knowledge creation is often created for these individuals.

Altruism is a very interesting subject in relation to engagement. *Altruism* means being motivated by some unselfish concern, whether it is a love for a subject, a desire to 'do good' for one's

organization, or just a basic wish to help others. This, of course, is something that organizations do not have any direct control over in terms of creating it; however, there is a possibility for nurturing it within organizations/programs. Davenport and Prusak state, for example, that "Knowledge altruism is real and can be encouraged. It flourishes in organizations that hire nice people and treat them nicely. We constrain it, though by increasing demands on the time and energy of employees…" (Davenport and Prusak, 2000, p.34) If altruism is desired as a means of engagement, then this statement would suggest the need for giving people the time to develop knowledge in an atmosphere conducive to doing so. Nurturing altruism may be important for actor oriented innovation programs, where traditional monetary rewards are not always an option (due to limited funding or individuals who participate as an 'extra activity' that has been added to their work load). The basic point of discussing explicit and intrinsic rewards in relation to engagement is that: "People want to be recognized and/or rewarded for displaying … knowledge sharing behaviors." (Liebowitz, 2009, p.5). It is for this reason that when individuals feel positively 'recognized' and 'rewarded,' whether explicitly or intrinsically, they are likely to be more engaged.

Trust and reciprocity are also examined here as triggering engagement. The problem within any organization or project in relation to engagement is that "… people may prefer to be knowledge hoarders rather than knowledge sharers. Why would an individual want to give up his/her 'competitive edge' that he/she developed over many years of experience? The answer comes down to a trust issue. "… people are generally willing to share their knowledge if they perceive reciprocity in the future from the knowledge recipient." (Liebowitz, 2009, p.4) Earlier in this chapter, [106] reciprocity is described as part of trust, because in order for individuals to trust one another, they have to believe that they will receive something in return for what they give (and that they will not be taken advantage of). In relation to knowledge sharing above, continual interaction and transparency were further described as eliciting trust within groups. The desire here is not to describe trust or reciprocity again, but rather to explain why they are of such vital importance for engagement.

Trust is particularly important for engagement to be present in actor oriented innovation programs because the actors who are collaborating in an innovation program context may be competitors in other contexts. In this situation "the risk with inappropriate knowledge sharing [a form of engagement] is that once knowledge has been shared, control over it is lost and it may be used for purposes other than intended." (Liebowitz, 2009, p.5) Although this may be the case any time knowledge is shared in the form of information, potential competitors may have more of an

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[106] See section: 4.3.4 Knowledge Sharing

opportunity to use what they know or learn against each other. For group collaboration in this context, low levels of trust may therefore drastically decrease the desire for members to engage in group activities.

Trust also has very interesting and important implications for top management in actor oriented innovation programs. According to a study by the scholars Becerra, Lunnan and Huemer (2008), trust is related to risk-taking, where high levels of trust reduce the perceived risk between partners. As they put it: "only when perceptions of partner trustworthiness are sufficiently high, will partners be willing to accept the risks that may exist in collaborating with an alliance [or actor oriented innovation program] partner." [107] The reason why I suggest that this is particularly important for top management engagement is because innovation projects invariably include a degree of risk – this is the nature of innovation. However, if high trust is present between partners, this is understood as reducing the perceived risk of opportunistic behavior from other actors, and may help to *decrease the level of perceived overall risk*, causing top management to condone more engagement (be it time or money) with a project. For example, Inkpen and Tsang identified that "when trust is high, firms may be more likely to invest resources in learning…" (Inkpen and Tsang, 2005, p.158). Basically, trust is seen as a risk-reducer, and lower risk is understood as increasing levels of engagement. On a more general level - between group members - Davenport and Prusak (2000, p.25) assert that the presence of trust has the effect of measurably improving the "honoring of commitments." This suggests that trust can facilitate a higher level of engagement, where people will "do what they say."

For actor oriented innovation programs in particular, high levels of engagement are also seen as producing the opportunity for serendipity. As stated by Bahrami and Evans (2005, p.69): "when engaging in high-risk activities, serendipity, luck and freak occurrences also play a role. For example, innovations often go through several "knot-holes" before crystallizing into workable products." Because outcomes may not be known in advance and processes need to be developed along the way, serendipity can play a substantial role in outcomes. Examples might be the right people talking to each other at the right time or coming across something new and useful by chance. Without high levels of engagement, these important but unplanned encounters may be overlooked or discarded as useless. Although serendipity cannot be constructed per say, high levels of engagement should provide the best chance for its occurrence.

Overall, engagement is seen as necessary for managing knowledge within actor oriented innovation programs because it is through engagement that ideas and information are exchanged,

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[107] see also: (Mayer et al. 1995)

and action is taken. This section has discussed concepts of urgency, explicit and implicit rewards, and trust and reciprocity as helping to answer the question: How can high levels of engagement be achieved within actor oriented innovation programs? Urgency can create an atmosphere of importance and purpose for tasks at hand to be completed. Both explicit and implicit rewards for engagement make people feel that what they are doing is worthwhile. Additionally, trust and reciprocity reassure individuals who engage with each other that their efforts will be reciprocated, and not used against them in the future. Feelings of trust and reciprocity may also help top management to take a chance on initiatives within actor oriented innovation programs because the perceived risk is decreased. Serendipity, which often occurs in innovation, is also seen as facilitated through high levels of engagement, providing further benefit for actor oriented innovation programs.

This concludes the discussion of knowledge management *drivers*, *obstacles* and *critical success factors*. Each of which has been discussed in turn. All of these knowledge processes will now be summed up, proposing a new metaphor for the management of knowledge, before turning to the empirical analysis.

4.6 Knowledge Processes: summing up

The purpose of this chapter has been to restructure and extend concepts that are often presented in literature regarding knowledge management. The re-categorization of main concepts into drivers, obstacles and critical success factors is meant create a road-map of sorts, describing how current literature may more usefully be navigated. This entails recognizing processes that are rarely strait forward or automatic (which may be the assumption for those relying on the computational paradigm).

This final section will proceed as follows. First, a brief description of the clarity that each section in this chapter has provided will be presented, followed by a table listing each topic of discussion and what each of the conceptual findings can be used for within organizations and programs generally. Next, the theoretical contributions of this dissertation will be revisited, describing a shift in focus away from explicit codification, and recognizing instead the existence of knowledge conduits that facilitate knowledge processes, which do not, and cannot, ever deliver 'knowledge' in a 'pre-packaged' or finished form. To conclude, and drawing from the organic paradigm used to describe knowledge management, the '*knowledge and learning tree*' will be presented as a new metaphor for the management of knowledge within organizations. The purpose of this new metaphor is to provide a visualization of the way that knowledge flows within and between organizations and networks.

In section 4.1 Knowledge Management: Origins and Underpinnings, knowledge management is described as a field of study gaining wide recognition over the past forty years, and particularly within the last twenty. Knowledge management is also identified as a field of study in a pre-science state (McAdam and Gallagher, 2005), and an organic paradigm is suggested as a means to clarify the assumptions upon which theories related to managing knowledge rest. In section 4.2 What is Knowledge?, past definitions of knowledge are discussed, leading to a new definition of knowledge as *understanding achieved through processes of combined personal and shared information and experience*. This definition has two main implications for the study of knowledge management: knowledge is personal, held within the minds of knowers, implying that knowledge management should be people focused (rather than IT focused) and; knowledge is social, being developed through interaction, implying that the management of knowledge necessitates the facilitation of interaction.

Section 4.3 discusses *drivers*, or typical 'selling points' of knowledge management. In section 4.3.1 Knowledge Creation, focus is placed on Tsoukas' 2009 *Dialogical model for Organizational Knowledge Creation in Direct Social Interaction*. This model usefully describes the way in which individuals create knowledge when working together, along with situations that may prevent the creation of knowledge. The need for personal interaction and sufficient time provided for knowledge generation is also highlighted in this section. Next, 4.3.2 Knowledge Acquisition describes sources of knowledge that come from outside an organization. Nurturing networks of relationships outside of an organization is understood as a good way to gain new insight and understanding. Following Leonard (1998) scanning broadly, providing for continuous interaction, nurturing technological gatekeepers, and nurturing boundary spanners are forwarded as particularly important for acquiring sources of knowledge from networks of relationships. Knowledge acquisition is also seen as an area of study that may expand in the future, as more actor oriented organizations/programs emerge to meet the challenges of the twenty-first century.

In section 4.3.3 Knowledge Capture is seen as the generally enticing concept that knowledge can be extracted from the minds of 'knowers,' made explicit, and stored in repositories. Knowledge capture is therefore labeled as a misnomer, while IT is still understood as being able to convey meaningful information, thus facilitating the knowledge process. A number of IT tools are examined, on a spectrum from codification to personalization (covering: *information repositories, expert networks, group discussion systems, email, telephone calls, teleconferencing,* and *videoconferencing*), and the use of each is briefly discussed. It is also stressed that in order for IT tools to be useful, each should be carefully selected to fulfill a specific need for an organization/program. Section 4.3.4 Knowledge Sharing, discusses knowledge sharing, also

known as knowledge transfer, as another concept often concentrated upon in the literature. The fact that knowledge sharing is not an easy or automatic process is stressed, and the idea that knowledge can be 'transferred' like an object is understood as false. This section also describes reasons why people may choose to share or hoard their knowledge, highlighting face-to-face interaction as necessary for sharing what we know most effectively. In addition, types of behaviors, types of teams and types of processes for effective knowledge sharing are discussed. In terms of behaviors facilitating knowledge sharing, those related to trust are highlighted. In terms of team characteristics, peer-to-peer interaction and group cohesiveness (as opposed to 'group think') are highlighted. Lastly, in relation to types of processes, having basic terms and working knowledge in common as well as 'cross-silo' forums are highlighted as helping actors to better understand each other and share what they know.

The last topic covered under drivers of knowledge management is 4.3.5 Increased Organizational Learning. Learning is described as necessary for knowledge to exist, and organizational learning is understood as comprising a wide field of study, much like that of knowledge management. Learning is defined in a social context, and communities of practice (Wenger, 1998, 2003) are seen as key enablers of learning processes. The three dimensions that contribute to well-functioning communities of practice are seen as: enterprise, mutuality, and repertoire. Further, communities of practice are conceived as being able to learn from other communities of practice where interfaces exist or, in other words, where boundaries are common and problems are shared.

 Next, section 4.4 discusses *obstacles*, or typically disputed issues within knowledge management that have made conceptual development difficult. In section 4.4.1 The Tacit Knowledge Challenge, tacit knowledge is put forward as being a part of all knowledge processes. Rather than separating it from explicit knowledge (as is done, for example, by Nonaka) tacit knowledge should be understood as something to be facilitated, and not 'overcome.' Both storytelling and mentoring are explored as ways to usefully access the more tacit elements of knowledge within individuals. Then, in 4.4.2 Knowledge Management and the Cultural Dimension, culture is understood as a complex mix of socially constructed identities that are drawn upon in a given context. Contrary to looking at culture as national traits to be overcome, or organizational traits to be created, cultural elements that are similar (creating common frames and a foundation for working together) as well as cultural elements that are dissimilar (creating new perspectives, new ideas, and possibly new cultural elements or new knowledge) are seen as necessary for knowledge processes. Forming shared cultural identities (similar to communities of practice), and individuals that link groups together (similar to boundary spanners) are highlighted as facilitating cultural processes for individuals working together. Synergy is also discussed in this section as

occurring when cultural differences are combined for a common purpose. Knowledge fairs and cross-silo forums are argued to be environments for creating synergy, and thus facilitating knowledge processes.

In section 4.4.3. Conflict, Complexity and the Discovery of Unknown Unknowns, conflict and complexity are seen as natural processes within all organizations, processes that are not necessarily bad and do not need to generate defensive behavior, and can in fact help knowledge processes. Within innovation programs, for example, these processes can help to discover new and important aspects of a project (a.k.a. unknown unknowns). Following Weick and Sutcliffe (2007), five suggestions for incorporating conflict and complexity into organizational routines are given, for the purpose of responding proactively to dynamic internal and external environments. These are: 1) raise doubts to raise information; 2) encourage alternative frames of reference; 3) put a premium on interpersonal skills; 4) revise assessments as evidence changes, and; 5) treat all unexpected events as information.

Section 4.4.4 Increasing Size and Geographic Dispersion discusses a problem that is not widely debated in the literature, but is none the less one that most organizations have (especially large and geographically disperse organizations), that of getting information to the right place at the right time to enable knowledge processes. Providing creative space and creating common language and 'frames of reference' are put forward as actions that can help to mediate the obstacles associated with increasing size and geographic dispersion.

Lastly, section 4.5 discusses *critical success factors* of knowledge management, describing some of the many and varied ways that organizations/programs have successfully managed individuals and their knowledge. In section 4.5.1 Social Networks, networks are described as naturally occurring within organizations and programs, and strengthening particular network characteristics, roles and conditions are suggested as a means to further knowledge processes and outcomes. In relation to network characteristics, internal links, external links, strong ties, weak ties, social circles and cliques are described and discussed in relation to the part that each can play within knowledge processes. In relation to network roles, central connectors, liaisons, bridge roles and peripheral specialists are discussed in terms of their usefulness for social networks that comprise actor oriented innovation programs. Lastly, this section discusses six knowledge facilitating conditions for actor oriented innovation programs, namely: strong ties through repeated exchanges; multiple knowledge connections between partners; noncompetitive approaches to knowledge transfer; goal clarity; cultural diversity, and; strong shared vision (shadow of the future). All of these elements within networks are meant to inform decisions about frameworks that may be chosen for furthering knowledge processes, while also highlighting the

fact that tradeoffs will sometimes have to be made, and positive outcomes will not always be achieved within networks of interaction.

 Section 4.5.2 Genuine Shared Goals discusses both macro-level visionary goals, as well as micro-level incremental goals as necessary for knowledge processes to achieve desired outcomes because they can align people's expectations and actions. Contrary to having identical company goals, actors within actor oriented innovation programs may more usefully discuss actions that may be taken jointly for particular and specific outcomes to be achieved. Visionary goals are also described, as 'shadows of the future,' and senior management commitment as well as vision is highlighted as important for these goals to successfully aid knowledge processes. Shorter-term goals are described as low- and high-hanging fruit. Short-term goals (low-hanging fruit) are understood as being able to foster a sense of accomplishment once the goal is successfully reached. Middle term goals (high-hanging fruit) can facilitate knowledge processes by creating drive to reach a deadline and 'get things moving.' Then, in section 4.5.3 Experience and action, experience is understood in a historical perspective, drawing upon past experiences to inform current events, and as a resource that may usefully be passed on through mentoring. Action is understood as particularly important in innovation contexts, where reality will always be different than what was planned for. Bahrami and Evans' (2005) *recalibration process* is very useful in explaining how actor oriented innovation programs can enhance knowledge processes by combining experience and action thorough experimentation, escalation, integration and recalibration.

Section 4.5.4 Engagement is the last critical success factor of knowledge management discussed in this chapter. Engagement is understood as critical for managing knowledge because without it, nothing can be learned, shared, developed or created, thus stifling knowledge processes. This section focuses on ways that organizations and programs can elicit engagement, namely by creating a sense of urgency (creating a sense of importance for task completion), explicit and intrinsic rewards (giving individuals a sense that what they are doing is worthwhile), and trust and reciprocity (reassuring individuals that they are doing the right thing and helping top management to feel more secure in 'taking a chance'). Serendipity is discussed as another positive outcome that high levels of engagement can produce.

In order to add cohesion to the extensive knowledge management constructs, as discussed in this chapter, the following table is meant as a type of visualization, identifying each of the main topics discussed, and what they might usefully contribute to organizations or programs in deciding how to manage their knowledge to the best of their ability.

Table 4: Knowledge management *drivers, obstacles* and *critical success factors*: topics/ application

Knowledge management concepts	Conceptual findings can be used for the purpose of:
Drivers	
Knowledge creation	Understanding knowledge creation as a complex process that requires personal interaction and sufficient time to be adequately developed
Knowledge acquisition	Furthering overall goals and objectives by strengthening external networks, and keeping updated on external changes that may affect the organization or project processes and outcomes
Knowledge capture	Discarding the notion that IT systems can fill knowledge gaps in an organization or project by themselves, and selecting IT tools based on actual needs of the organization or project, which can then provide useful information
Knowledge sharing	Avoiding 'reinventing the wheel,' allow diffusion of best practices, and enabling problem solving by: having basic terms and working knowledge in common; fostering trust; and encouraging peer-to-peer interaction within teams
Organizational learning	Strengthening competencies, providing diverse experiences, and generating further inquiry and learning by nurturing communities of practice and identifying interfaces where problems are shared
Obstacles	
The tacit knowledge challenge	Being better able to develop knowledge and adapt to change by embracing the tacit element in all knowledge processes, and therefore focusing on context rich information and personal interaction
Knowledge management and the cultural dimension	Enhancing the ability to work together by finding cultural similarities to build common frames, and creating synergy when different cultural elements are shared for the purpose of reaching a common goal.
Conflict, complexity and the discovery of unknown unknowns	Responding proactively rather than defensively to dynamic internal and external change
Increasing size and geographic dispersion	Getting information to the right people at the right time by for example providing creative space
Critical Success Factors	
Social networks	Making more informed decisions and enhancing relationships by understanding network characteristics, roles and conditions
Genuine shared goals	Aligning actors' expectations and actions to produce desired outcomes
Experience and action	Creating and demonstrating knowledge in directly observable ways, and helping to ensure feasibility and relevance of actions taken
Engagement	Providing impetus for ideas and information to be exchanged and action to be taken ,and providing an environment for serendipity to occur

Source: Madsen, (2013)

4.6.1 Revisiting Theoretical Contributions

Let us now revisit the two theoretical contributions of this dissertation as identified in chapter one. First and foremost, this theoretical analysis adds to knowledge management literature by highlighting a need to look beyond knowledge as information or data that can be stored in a repository. Although it is common to describe knowledge as more than information, scholars (and even those referred to in this chapter) such as Davenport and Prusak, Liebowitz, Nonaka and Takeuchi, etc. still spend considerable time focusing on ways in which knowledge can be codified and made strictly explicit. The reason that this approach is misleading and possibly dangerous for those organizations/programs wanting to better manage knowledge processes is that it often leads to organizational "quick fixes" which do not actually address knowledge processes in a holistic way, but rather look at one small part of the process (usually related to information and IT), and assume that this will be sufficient. The section covering *drivers* of knowledge management, for example, looks specifically at some of the typical "quick fixes" put forward in the literature, and then suggests how they may be more usefully understood, incorporating an understanding of people processes, and how these processes can be useful for "managing knowledge" and getting things done.

Providing further support for knowledge as more than information, knowledge is presented as a process of understanding – one that cannot occur outside of the individual knower. The hope is that this will facilitate an understanding of knowledge management as a holistic process within organizations, programs and projects – a process that is intrinsically linked to the function of, action within, and outcomes produced by these entities.

The second theoretical contribution of this dissertation is to recognize the existence of a wide array of knowledge conduits that facilitate knowledge processes. **Knowledge conduits** are defined in this chapter as *a facilitator of knowledge, and not knowledge in and of itself.* The reason why this distinction is so important is that knowledge does not, and cannot, ever be delivered in a 'pre-packaged' or finished form. However, the concept of knowledge conduits may help scholars and practitioners to escape the trappings of knowledge as a 'thing that can be attained,' and allow us to discuss the many and varied sources of knowledge, without falsely assuming that knowledge resides anywhere except in the minds of individuals. The term knowledge conduit has been previously discussed in literature pertaining to knowledge management,[108] although only in very specific contexts. This dissertation takes into account the fact that there are many different forms of knowledge conduits that can be identified within organizational and program contexts generally. Significantly, reclassifying knowledge

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[108] See for example Maznevski and Athanassiou (2007, P. 70) who describe networks as knowledge conduits.

repositories and knowledge capture as knowledge conduits may, returning to the first theoretical contribution of this dissertation, help scholars and practitioners to move away from the idea that knowledge can be codified, and toward the understanding that IT systems only facilitate knowledge processes to the extent that they are understood and used by individuals. As stated by Liebowitz, it is important to: "Make sure the technology works for people, not vice versa." (Liebowitz, 2009, p.51)

4.6.2 A New Metaphor for the Management of Knowledge within Organizations: The Knowledge and Learning Tree

To conclude this chapter, let us return to the organic paradigm chosen for describing the field of knowledge management generally, and propose an organic, dynamic environment metaphor for knowledge and learning specifically, that centers on the organization as a tree in this environment. Organizations, like trees, exist all around the world, and play a large role in sustaining life as we know it. Organizations have many visible aspects, such as a central physical structure (a trunk in the case of a tree), varying numbers of divisions (or limbs in the case of a tree) which help the organization to produce products and/or services and thus 'bear fruit.' However, perhaps the most important part of the organization is not directly observable, but lies beneath the surface, namely knowledge. Knowledge processes, like the processes in the roots of a tree, are what supports the organization, allowing it to survive.

 Although standing on the ground and observing a building that houses an organization physically may give some indication of the relative size of an organization (just as observing the trunk of a tree may give a relative idea of the size of the tree), it cannot provide an accurate picture of the processes and actions within that support and sustain it. Within an organization, the support system can be understood as individuals who hold, share and develop knowledge as they learn and take actions on behalf of the organization. For a tree, the roots absorb nutrients in the ground and grow to support the tree. A drastic reduction in the size of an organization's workforce, just like cutting away a section of a tree's roots, is likely to have dire consequences for the survival of the entire organization/organism. Without support for important sustaining and developing processes, survival is unlikely.

The Carbon Trust OWA program is described in this dissertation as an external network. External networks can be understood within this organic dynamic environment metaphor as gatherings, much like the clouds in the sky. They form and disperse, and reform in constantly changing formations. When they disperse, the individuals comprising the networks, like precipitation, provide sustenance for the knowledge base of their organizations, allowing the organizations to

"spread their roots" and grow. If joining networks is discouraged by an organization, it may risk 'drought' – a lack of knowledge flowing into the organization – thus stifling development. When knowledge is understood in this way, it seems to make sense that "Knowledge management coexists well with business strategy, with process management, with staying close to your customers, and so forth. It can help the members of an organization do a variety of things they are already doing, better. Ultimately, knowledge management work needs to be blended in with these other activities or it's unlikely to be effective." (Davenport and Prusak, 2000, p.163)

Chapter 5: Empirical Analysis

Up to this point, the perspectives presented about knowledge management have been theoretical, building primarily upon the work of academic scholars, and attempting to carry their work farther, thus offering a view of knowledge management that extends beyond information repositories, and includes individuals interacting in a dynamic environment that impacts the way in which information is exchanged, and knowledge is gained and put to use. To carry this conceptualization further still, chapter five presents a case study analysis of the Carbon Trust Offshore Wind Accelerator program. This empirical analysis is meant to ground theory in action, and identifies how this actor oriented innovation program has selected resources and tools, adapted to challenges, and gained insight into what it takes to succeed in the dynamic, developing, and quickly changing industry of offshore wind.

As noted in chapter two, the Carbon Trust Offshore Wind Accelerator (OWA) program is recognized as uniquely qualified for the study of knowledge management for several reasons. One reason is that this case can shed light on the complex interactions and knowledge processes that happen in the context of actor-oriented organizations (Fjeldstad, Snow, Miles and Lettl, 2012). This is a particularly important area of research as existing organizational structures become more specialized and complex, operating across technical and geographical boundaries for the purpose of building and sustaining innovation. This case also offers insight into the area of super-flexible organizations (Bahrami & Evans 2005), with adaptive structures built into management approaches to maximize organizational learning and knowledge sharing throughout dynamic innovation processes. Lastly, this case also provides research into the way that knowledge flows in the context of semi-open innovation (Ulhøi, 2004), where knowledge processes exist in a mixture of private and collective innovation, adding further complexity to the context of knowledge management. Viewed as a whole, the Carbon Trust OWA program is an excellent case for studying knowledge management in the types of innovation contexts that are becoming ever more prevalent in the 21st century.

In order to get both a broad and deep understanding of the processes that exist within the Carbon Trust OWA program, interviews were conducted with the members of four primary groups: 1) the Carbon Trust OWA Management Team (seven interviews), 2) Steering Committee (nine interviews), 3) Foundations Technical Working Group (nine interviews), and 4) the Twisted Jacket Foundation group (eight interviews), many of which also included informal conversations and observation of working practices. In order to discuss the knowledge processes within the Carbon Trust OWA program in as transparent a manner as possible, information obtained from each group will be discussed roughly *in turn* (where it makes sense to do so) for each issue

presented, rather than randomly combining information from different groups, which would quickly become chaotic. Supplementary interviews were also conducted with individuals who support one or more of these groups, and this information will be added to the discussion of these groups where appropriate.

The semi-structured interview guides used to direct discussions with respondents in each group revolved around three main issues: 1) work orientation, to gain understanding about their work with the Carbon Trust OWA program; 2) their social network within their organization and the OWA program, and; 3) knowledge processes related to their work for the OWA program. For conceptual clarity, interviews were coded into the topics related to *drivers*, *obstacles* and *critical success factors* of knowledge management, directly reflecting the sections and subsections in the previous chapter. This structure is meant to provide conceptual clarity for understanding the intricacies of each of the concepts presented in the theoretical analysis, while in actual fact many of the issues discussed directly relate to - and are interrelated with - one another in practice. The understanding gained from this division can be used to focus the way in which theoretical concepts related to knowledge management are understood and applied from a more practical standpoint, and will be used to answer the research question and sub-questions in the concluding chapter of this dissertation.

5.1 What is Knowledge?

In chapter four, knowledge is defined as *understanding achieved through processes of combined personal and shared information and experience.* When asking respondents what knowledge meant to them, many of the elements of this understanding were presented. For example, a member of the Carbon Trust OWA management team specified that:

> "Knowledge is maybe more than information, more than data – it's processing data and understanding data in a certain way to form some opinion of something, to do something with this data, to enable me to make judgments about something."[109]

Similarly, a TWG member stated:

> "Information is purely factual. So there's some level of interpretation in the knowledge term."[110]

Identifying judgment and interpretation as necessary for knowledge is in line not only with the definition of knowledge that is presented here, but is also in line with the organic paradigm chosen for this dissertation, focusing on people-centric and tacit elements of knowledge. Another

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[109] Carbon Trust OWA Manager, Jan 17, 2012. Recording time: 1:15:40
[110] Foundations Technical Working Group member, May 22, 2012. Recording time: 44:25

statement identifying knowledge as being in line with the organic paradigm was made by a Foundations TWG member, stating:

> "[Knowledge] doesn't necessarily have to be something that you have to agree on. If you have personal experience, it can also be knowledge for you…"[111]

Here, knowledge is not only seen as personal, but also contextual, related to the specific experiences that an individual has had.

Several members of the Keystone Twisted Jacket project also identified knowledge as the ability of individuals to adapt information for use in a specific context. For example, a Keystone Resource Manager stated:

> "Knowledge is the ability to apply information to a task."[112]

A Keystone Structural Engineer also stated that:

> "Information goes in one ear and out the other …[knowledge is] not just ingesting something and getting rid of it is soon as possible, but being told something, or seeing something, and finding some sort of relationship with that in your brain."[113]

Similar to this, a Wake Effects TWG member related knowledge to an individual's internal processes of reasoning and understanding when he said:

> "When I get given a report that is turned out of a list that's information, but for it to become knowledge I've got to really assimilate it, understand what it's talking about, and also its implications, and then how I can implement that to realize the benefits or the learning from that report."[114]

And the Keystone General Manager for Offshore Renewables said:

> "It's kind of like that old statement – give a man a fish and feed him for a day, teach a man to fish you feed him for life. … I think knowledge is the ability to go use resources to get a job done."[115]

All of these statements by Keystone members, as well as the statement from the Wake Effects TWG member, point to tacit elements of knowledge, the human element that allows individuals to connect information in a particular way to achieve a desired outcome. The last statement above also pinpoints the importance of interaction, which can create multiple levels of understanding that other forms of acquiring information may not. Teaching a man to fish is also

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[111] Foundations Technical Working Group member, Dec. 12, 2011. Recording time: 51:55
[112] IBGS Foundation Resource Manager, Keystone, Feb. 9, 2012. Recording time: 42:20
[113] IBGS Foundation Structural Engineer 2, Keystone, Feb. 8, 2012. Recording time: 1:03:40
[114] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 51:45
[115] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time: 26:25

related more specifically to knowledge management, where *knowledge processes are facilitated,* in this case through the act of teaching.

As the above statements show, organic, tacit, and people-centric elements of knowledge were identified throughout the interview process, lending further support to the conceptualization of knowledge and knowledge management presented in this dissertation. Next, we turn to the specific aspects of drivers, obstacles, and critical success factors of knowledge management, each of which will be discussed in turn.

5.2 Knowledge Management *Drivers*

Throughout interviews conducted with members of the Carbon Trust OWA program, a number of factors were articulated that directly relate to typical catalysts, or "selling points" of knowledge management, spurring organizational actors to seek knowledge management resources and tools.

5.2.1 Knowledge Creation

Knowledge creation is recognized in chapter four as becoming popular in large part due to Nonaka's Dynamic Theory of Organizational Knowledge Creation. Although the premise that tacit and explicit knowledge can be separated is refuted here, this line of reasoning has helped the field of knowledge management to place focus on tacit (internal human) processes of knowledge creation within organizations, which has arguably contributed a great deal to the field. The specific process of knowledge creation that is focused upon in this dissertation as aiding actor oriented innovation programs is that of *dialogical knowledge creation* (Tsoukas, 2009).

Dialogical knowledge creation is understood as going through a series of successive steps to create knowledge through direct, face-to-face personal interaction. Within this context, a very important key element is described as **being open to thinking critically**. This is also something that the Carbon Trust OWA management team considers in detail, resulting in the selection of individuals who are particularly engaged in particular projects for feedback:

> "…in the Foundations Technical Working Group right now what we started to do is create sub-groups. So if there's one project that is of particular interest to certain people, we'll focus on them for feedback with the direction of that project, so they would get more regular updates and they would be asked to participate in more conference calls and such, if they were interested in that… that's started to work well, because there's so much going on in the Foundations Group right now."[116]

This statement shows that the Carbon Trust management team considers which individuals would be open to thinking critically based on their interest in particular projects, and then involves those

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[116] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 21:10

individuals in more of the activities of those projects. This would seem to be a particularly good way to make sure that each project more actively includes those relevant individuals who are open to thinking critically, thus helping to create knowledge for each project on a more individual basis. Within the Steering Committee Group, Technical Working Groups were identified as an excellent setting for facilitating critical thinking. One Steering Committee member said:

> "You know, if you get a bunch of engineers around a table, they will VERY quickly start talking about the problems and solutions and comparing notes and cross-fertilization like I said – that's exactly what we want… they will thrash things out, and if one of them is having particular problems and another one has identified particular solutions, great."[117]

Another Steering committee member identified that Technical Working Groups:

> "…are both giving information, and bringing their opinions, but they are also forming their own opinions, at least partially, based on information that they get in the Technical Working Groups."[118]

This was reiterated by a Technical working Group member who discussed a question someone raised as a possible problem by saying:

> "we took it out, and got involved in that, and everyone put a lot of thoughts in , and it wasn't actually like a work package of stuff, but lots of people bottomed out lots of ideas, and we came to some conclusions, and people were pretty happy…"[119]

These statements identify that Technical Working Group members are not only willing to listen to what each other are saying and offer advice, but that they are also open to thinking critically about their own understandings, and possibly shift or change them based on the information that is presented by other members, which is necessary for knowledge creation.

Steering Committee meetings are also identified as a place where individuals can be open to thinking critically:

> "…in the last Steering Committee meeting they were coming up with different business cases where I think there was a lot of discussion, but I think that's good. I mean, I really like these type of meetings, where there are a lot of dynamics, and a lot of discussion. Where you don't agree immediately… there have been some meetings where the Carbon Trust is REALLY trying to get something out of us, and many times it has been very, very hard. And those meetings aren't very fruitful, I have to admit."[120]

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[117] Steering Committee Member, April 24th, 2012. Recording time: 27:50 and 42:56
[118] Steering Committee Member, May 5th, 2012. Recording time: 18:40
[119] Wake Effects Technical Working Group Member, Jan. 13th, 2012. Recording time: 44:45
[120] Steering Committee Member, May 11th, 2012. Recording time: 41.45

This statement not only identifies Steering Committee members as thinking critically, it also reiterates the point that if individuals are not open to thinking critically, meetings are not very "fruitful."

A Wake Effects sub-contractor also described thinking critically to solve problems as a common practice that members of his company are faced with on a regular basis:

> "Sometimes the software doesn't work quite as anticipated, we have some difficulties of that form - we scratched our heads, we talked to colleagues, we brainstormed, and we found a way around it… it's just typical of things we get on a routine basis." [121]

This quote emphasizes the fact that for organizations that deal with new innovation on a regular basis, therefore creating something new (knowledge creation), being open to thinking critically is a well-established part of the process of finding solutions to problems as they arise.

In addition to being open to thinking critically, **personal interaction** is another, if not the most, important aspect of dialogical knowledge creation. In 1966, Berger and Luckmann asserted that it is only when individuals are face-to-face that other individuals become 'fully real.' For creating knowledge, where it is important to question one's own understandings and be open to changing and co-creating new understandings, it would make sense that this would be easiest and most possible when you can fully sense, question, and thus most fully understand, others.

Within the Carbon Trust OWA program, the need for personal interaction is well understood, and accommodated despite the very busy schedules and large distances between the members participating. For example, when describing the main way that knowledge is created within and between groups participating in the Carbon Trust OWA program, a Carbon Trust OWA management team member stated:

> "Decisions are usually taken in person. I think it's always better in person. I think that's where you have the most valuable discussions. … I think meetings are best because that's where you get the discussions, and people build on each other's ideas, and that stuff doesn't happen over email. And not really on the phone either."[122]

This statement supports and exemplifies the idea that people are able to communicate better in person, more easily being able to discuss and build upon each other's ideas. In terms of the Carbon Trust OWA management team's interaction with the Steering Committee, it was stated that:

> "The Carbon Trust probably needs to have some more face-to-face meetings with the Steering Committee members, to really understand what their agendas are, and what they're planning

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[121] Wake Effects Sub-Contractor, Dec. 15, 2011. Recording time: 11:45
[122] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 14:10 and 14:50

to do in the next couple of years as well. So we're going to plan some more face-to-face meetings in the next couple of months."[123]

This statement further supports the important point that face-to-face meetings are the best way to fully understand the perspectives of others.

Both the Foundation's TWG and the Wake Effects TWG were cited by their members as having about the right amount of face-to-face interaction, which occurs on average every other month. Although this was generally expressed throughout all interviews, one example from each TWG will be presented here. For the Foundations TWG, it was stated that face-to-face interaction:

> "is probably about right … some stages where there was a lot of decision making and a lot of formative work going on, we did meet more often … Generally, I think the right balance is being struck because if too many face-to-face meetings are being called, people just won't show up because the industry is so busy generally, and under resourced with the level of work that is being attempted to be met due to the government goals in UK round 3."[124]

This statement not only identifies time and work load constraints as an issue for members of the TWG when deciding on the number of face-to-face meetings to hold, but also it indicates that more face-to-face meetings are needed when 'decision making' and 'formative work' (a.k.a. knowledge creation) is taking place. For the Wake Effects TWG, face-to-face interaction is seen as occurring:

> "… I think regularly enough. Because it's a whole day, and you end up going to London, and then you have a good amount of time to just catch up and chat to people which is really useful. Sometimes it's more useful than the actual meetings, because you get some interesting stuff coming out."[125]

This statement would suggest that understanding the perspectives of involved individuals is enhanced through the OWA TWG meetings because of the personal interaction that they engage in on a regular basis. It was also established throughout conducted interviews that it is important for TWG members to have personal interaction with the Steering Committee members of their organizations. As one Foundations TWG member expressed:

> "I think that is a very important part of the [TWG] role as well; that's probably the most important thing is to make sure the people within the organization, that we adequately disseminate the information that's being gained from the studies… So, typically if [our Steering Committee representative] has got a Steering Committee meeting, then I will help him prepare for that, I will provide feedback into that maybe about a week before."[126]

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[123] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:37:50
[124] Foundations Technical Working Group Member, Jan. 13th, 2012. Recording time: 19:00
[125] Wake Effects Technical Working Group Member, Jan. 13th, 2012. Recording time: 35:20
[126] Foundations Technical Working Group Member, April 27th, 2012. Recording time: 07:40

Personal interaction is important for all knowledge creation processes, without which opportunities to create new knowledge can be lost. This was the case for Keystone, when they were not provided the opportunity to interact with fabricators and installation contractors:

> "The phase where they hired the fabricators and the installation contractors, I thought that was a total waste of their money in my opinion, because that was where you could refine fabrication of the concept. That was where you could have gotten input from fabricators on "how easy is this going to be to assemble?" … And then if you had more detailed discussions with the installation contractors about what they liked, and what they didn't like, and how to do that, that's where you could have innovated our concept."[127]

This statement identifies the importance of personal interaction, as well as what is at stake, and what can be lost if this opportunity is not given. In this case, the chance to create new knowledge about further innovation of an offshore wind foundation concept was lost. To conclude this discussion of identifying personal interaction as important for knowledge creation, another quote from a member of Keystone is presented, identifying why it is so important to present new innovation concepts to potential customers in person:

> "Interaction – personal interaction, face-to-face is extremely important to present ideas and concepts. You cannot do it remotely… it's the facial expressions; it's knowing that you've actually communicated. I'm talking, but unless I can see your facial expression – a little nod like you just did – I don't have the actual confirmation that I've made my point. And I think that's absolutely critical. I mean, we humans communicate a lot with a wink or a nod, as we do with language. And the body language and the way people respond when you're talking, that all helps you understand. And what's important is, if you've not made your point, if you can recognize that you're not getting your point across, and then you can say more, you can expand, you can try to work around it."[128]

The final element of knowledge creation that will be highlighted here is **time**. The time that is needed to make new distinctions is often overlooked as busy professionals race from one meeting to another, constantly moving on to the next task, and the next. However, for processes of mental framing and re-framing, processes that are required when creating knowledge, time to reason, reflect and consider different alternatives is of utmost importance. Time is identified by a Steering Committee member as important and necessary for achieving desired results within the Carbon Trust OWA program:

> "What we mostly needed was flexibility in terms of time because things just took longer than we initially estimated. … If we would need to choose between finishing now and having a result which we do not fully think we like, or let it take a bit longer and go for the result we are really looking for, then we would always take the second option."[129]

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[127] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 21:50
[128] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 47:00
[129] Steering Committee Member, April 24th, 2012. Recording time: 34:45 and 35:15

At the Steering Committee level, it is well understood that the amount of time partners put into the Carbon Trust is necessary to achieve a return on investment:

> "We are putting all this money in, and we need to make sure that we spend adequate resources to make sure we get what we're paying for, but also it deserves more time from us. So we are always lobbying the guys above us, to make sure that this is done."[130]

Despite this realization, members of both the Steering Committee and the Foundation's Technical Working Group find that it is difficult to devote enough time to the Carbon Trust OWA program. As one Steering Committee member put it:

> "In general, we should have spent more time on preparations for meetings, and also in the Working Groups I guess. We should have spent more time on it… But it's difficult to prioritize when you're at home, and have the projects that you are working on, and this Carbon Trust OWA work is often prioritized a bit lower."[131]

Another Steering Committee member stated that knowledge flow could be improved by:

> "…making time, and making sure there are regular feedback sessions between members, especially the Steering group members… So it's something that should probably be more structured than it is at the moment."

Both of these statements identify the need for more time spent on understanding the material that is distributed within the Carbon Trust, so that the knowledge that is created through this program is as useful for the partners as possible. A similar perception is expressed by a Foundations TWG member, who, when asked about whether they were lacking any information or knowledge, responded:

> "I think this question is not so much about the OWA as it is about me, and my ability to find time to get this information I'm afraid. It's about how involved we manage to be, or I manage to be. I would say that information is there when I request it. At least that has been my experience."[132]

Time was also mentioned as needed in processes of knowledge creation, such as those that happen during TWG meetings. When discussing preparation for TWG meetings, it was generally re-iterated throughout the interviews conducted that the meeting agenda needed to be distributed at least one week ahead of time so that material could be properly reviewed before meetings. One example of this is a Foundation's TWG member, who stated:

> "That's the key to the success of the meetings, often, is early circulation of the agenda and meeting material for review. …If the material isn't circulated early enough, I can't read it and review it, and get a consolidated approved opinion on that material, to then take to the

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[130] Steering Committee Member, June 4th, 2012. Recording time 1:01:05
[131] Steering Committee Member, April 18th, 2012. Recording time: 46:10
[132] Foundations Technical Working Group Member, May 22nd, 2012. Recording time: 50:35

meeting and present [our] input. And that's key. So if it arrives on the day, I've got to just turn up and take a punt really, or stand back a bit more, and not give as good input as I otherwise could on our behalf, if I don't have time to get a review from the senior level."[133]

More time was also identified by a Foundations TWG member as needed when evaluating novel Foundations designs:

"We had 114 concepts, and I think each of the utility companies had two weeks to evaluate them… all the ingenuity, and all the ideas that are in those folders [with foundation designs]. You know, it's five big folders… there is so much innovation, and new ideas there, available… So the Carbon Trust, in my opinion, neglected the evaluation period a little bit. It was too rushed. We didn't have enough time… You know, those two weeks should have been two months instead." [134]

As illustrated here, a very large number of new innovations (and new knowledge) needed to be evaluated, and this process could have benefited from a greater amount of time to appreciate the level of detail inherent to the foundation design concepts, which could also have contributed to the knowledge of the engineers who were evaluating these concepts.

One area where time for reflection was built into the process was after the installation of the Keystone Twisted Jacket foundation. As stated by the Keystone General Manager for Offshore Renewables:

"I was supposed to fly out Sunday… to go to this 'lessons learned' meeting for the demonstrator, and all the issues that we faced – Remember how I told you all those people came down here one time? That whole group are going to meet back again in London and just go over the whole project and do a lessons learned … everybody involved in the project, to figure out how we can streamline things next time and better work together internationally as well."[135]

This identifies one way that time for reflection has been built into the Keystone Twisted Jacket demonstration project. Time is also very well understood, and planned for, by other sub-contractors for the Carbon Trust OWA program. As stated by a Wake Effects sub-contractor:

" So every challenge is different, every challenge is handled differently, but within some general rules of: time to think, time to discuss, time to look around at the literature, and assessing the priority of this with regard to everything else, because we're all working in an environment where we're balancing many demands on our time."[136]

The above statement concludes this section on knowledge creation nicely by identifying a problem causing unsettledness, being open to thinking critically about what is known, the

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[133] Foundations Technical Working Group Member, Jan. 13th, 2012. Recording time: 6:00
[134] Foundations Technical Working Group Member, Dec. 12th, 2011. Recording time: 9:35
[135] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time:15:35
[136] Wake Effects Sub-Contractor, Dec. 15, 2011. Recording time: 21:50

information available, and acquiring new information through not only reading, but also personal interaction, in addition to the time that is needed for adequately accomplishing this process. Next we turn to the issue of knowledge acquisition.

5.2.2 Knowledge acquisition

In section 4.3.2 it is argued that knowledge acquisition is relatively less focused on in the literature. Reasons for this may be a 'not invented here' mentality leading organizations to be wary of knowledge coming from external sources, or may stem from skepticism of new or unproven technology. It is also suggested in chapter four that networks are an excellent source of knowledge acquisition, particularly when relationships are strengthened beyond immediate ends, thus developing social capital where mutually beneficial relationships develop. Within this network context, the scholar Dorothy Leonard (1998) gives four suggestions for acquiring knowledge from outside an organization, which are 1) scan broadly, 2) provide for continuous interaction, 3) nurture technological gatekeepers, and 4) nurture boundary spanners. While chapter four focuses on explaining each of these concepts and how they can contribute to acquiring knowledge within an organization, the present task will be to connect each of these concepts to the Carbon Trust Offshore Wind Accelerator program, in order to ascertain whether/how these concepts are applied in the case of an actor oriented innovation program, for the purpose of building and sustaining innovation.

Scanning broadly is akin to the saying "don't put all of your eggs in one basket." Keeping not only deep, but also wide relationships within a network can have the added benefit of being aware of new possibilities, which is likely to benefit performance. (Leonard, 1998, p.157) Scanning broadly would appear to be a core competence of the Carbon Trust OWA program, one that is facilitated in several ways. As stated by one Steering Committee member:

> "I think actually one of the strengths of this program has been the [Foundations] competition [through a call for] tenders. I think that's a very efficient way of working in terms of gathering knowledge and concepts and ideas from the market, and trying to de-risk, and evaluate and assess all that in a common environment… And then that delivers some estimates on what the value [of each concept] would be."[137]

One way that the OWA program has been particularly successful in scanning broadly is by having competitions in the working areas (Foundations, Access Systems, Electrical), where a call for tenders is sent out to acquire unique and innovative knowledge about the concepts that each working area deals with. To date, these competitions are attracting more and more submissions (104 for Foundations, 450 for Access Systems), and innovators have been very engaged with

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[137] Steering Committee Member, Dec. 14th, 2011. Recording time: 31:05

members of the Carbon Trust to advance their ideas. One reason for the success of these competitions is that the Carbon Trust makes a clear intellectual property (IP) promise to innovators, assuring all innovators that their intellectual property remains their own. Another reason why these competitions have been so successful is that it gives innovators exposure to what is now a group of nine potential customers.

Another way in which the Carbon Trust OWA program can be understood as scanning broadly is by introducing new players to the market. When asked about the end goal of the OWA program, a Steering Committee member said:

> "I really hope that we get an establishment of some new companies, based on the work done in the Offshore Wind Accelerator. Maybe not immediately after, but as we're going forward, that we are able to see new companies, or established companies using or applying or producing new technology coming out of the Offshore Wind Accelerator. I'm optimistic… we are now introducing new players onboard, and I hope that we can see that more materialized after the Offshore Wind Accelerator."[138]

This shows that the Carbon Trust OWA program is scanning broadly by promoting new innovation, and helping new ideas to get to market. This will allow all nine of the partner company developers to gain unique access to, and knowledge about, these innovator companies, which from a theoretical and practical perspective would be the desired outcome of scanning broadly for the developers involved in the Carbon Trust OWA program. Scanning broadly is also perceived as possible through taking a longer-term perspective and being more aggressive. This is evidenced by the statement of a Steering Committee member who stated that in order for the Carbon Trust OWA program to reach its goals, it will need:

> "a slightly more aggressive approach, which means taking a slightly longer term view. There has been a little bit of a flavor of 'let's focus on the nearer term things that we can do that will get to market in the next few years and make a difference for the first few phases of Round three.' And that's absolutely correct and fine, but now given the scale of the challenge, we have to add to that 'well here are these other ideas that might actually take a few more years to come to fruition, but could further drive down costs.' And we need to do that with a slightly more aggressive position, I'd say."[139]

This statement identifies precisely one of the points that was made in the theoretical analysis, namely that it is important not only to look to immediate needs and return on investment, but also to expand networks with the view of future, long term success. In the case of the Carbon Trust OWA, success is related to the success of the industry as a whole, in addition to the success of each individual offshore wind developer company.

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[138] Steering Committee Member, May 11th, 2012. Recording time: 44:00
[139] Steering Committee Member, April 24th, 2012. Recording time: 21:10

The Technical Working Groups also find ways in which to scan broadly, drawing in technical expertise from outside their respective groups when necessary. For example, a Wake Effects TWG member acknowledged that:

> "The Technical Working Group members are the one's "asking the questions, but sometimes we get people in to inform us about the questions that we might need to be asking, if that makes sense… so we're doing this measurement campaign, where we basically went out to the industry – and academia primarily – and said 'if you could have any information to make our models better, what information would you want?" We have our views on what we think would be useful, but then we needed to get the expert's views on what the best way to measure that was, and what REALLY are the key things that they think you need to have in your models in the next 10-20 years." [140]

This shows that within the Technical Working Groups, members actively consider not only what they do know, but also search for what they do not know, and try to access outside sources to draw in new knowledge where needed. This provides further support for the argument presented above, that the Carbon Trust OWA program has a core competence in scanning broadly.

The next suggestion put forward by Leonard in order to facilitate knowledge acquisition is to provide continuous interaction. Because changes can occur quickly, particularly in the area of innovation, and more specifically within actor oriented innovation programs, it is necessary not just to work with "blinders" on, but instead to keep up with changes happening in the broader environment through continuous interaction. One way that the Carbon Trust OWA management team provides for continuous interaction is by putting innovators into contact with each other:

> "For example, I was speaking to [an innovator] last week, and he's the one who designed [an Access System]. And he's always designed it looking at monopiles, and so he was asking about some information about Foundations, about Jacket Foundations, so I put him in touch with [someone] from Keystone because it probably makes sense that innovators work together as well."[141]

Here, innovators are seen as taking the initiative and seeking interaction with the Carbon Trust OWA program to keep up to speed on new innovations. This also directly connects with the theoretical analysis, identifying that through continuous interaction, innovations do not become outdated and unusable while working to complete a design. Providing continuous interaction to acquire knowledge also occurs within the Technical Working Groups, where interaction can improve the quality of results for specific projects. When discussing a particular work package, a Wake Effects TWG member said:

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[140] Wake Effects Technical Working Group Member, Jan. 13th, 2012. Recording time: 1:16:55 and 1:17:35
[141] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 28:05

"We've got a garrison who are on board throughout the whole process to overview and review our work at all the different stages… we'll guide it, and we'll say 'what we actually want is a deliverable.' But they'll just make recommendations to improve the quality of the work throughout. So yes we do bring the knowledge to the table, but also it's important to know when you don't know something and get experts in."[142]

This shows a high level of continuous interaction for a specific project with a party outside the Technical Working Group, which is able to positively impact the quality of the work delivered.

The Carbon Trust OWA program can also be seen as an outside source of innovation knowledge for members of partner organizations who are not directly involved in the Carbon Trust activities. For example, as stated by a Technical Working Group member:

"…as I say, part of my output process is to tell people what's going on with the Technical Working Group. And that includes people who may be on the same team as me but would never get involved in the actual technical process of the Technical Working Group… Sometimes people on the team will come and ask me if I've got any suggestions on how they might do a cost estimate for ABCD or something. And I'll point them in the direction of some of the information we've got from the Carbon Trust projects, and that gives them a good place to start. There's a lot of good baseline information that has come out of [the OWA] that we do distribute and use internally. And used by people who aren't directly involved in the Technical Working Groups."[143]

This quotation demonstrates that the Carbon Trust OWA program facilitates continuous interaction between TWG members and partner company members not directly involved in Carbon Trust activities. This is important for partner companies because it draws knowledge into their organizations about not only new innovations, but also processes for dealing with new information and knowledge.

The third suggestion for knowledge acquisition put forward by Leonard is to nurture technological gatekeepers. Technological gatekeepers in the case of the Carbon Trust OWA program refer to Technical Working Group members – 'outstanding technical performers' who keep others in the organization up to date on what is happening in their area of expertise. Particular importance should be placed on the relationships formed between TWG members because they are all in a similar position with similar problems, within their respective organizations, and therefore stand to gain a great deal from each other if appropriately nurtured.

The Wake Effects Technical Delivery Consultant did a good job of pinpointing TWG members as technological gatekeepers when he said:

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[142] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 1:17:35
[143] Foundations Technical Working Group Member, May 1st, 2012. Recording time: 27:15

"[TWG members] also, if I can say another thing about them, they're also a bit of a conduit into other parts of their organizations. Sometimes we need additional skills, and we can usually find someone to talk to within their organizations. So, for example, if it's not aerodynamics, but its meteorology, they might have a meteorologist that can contribute."[144]

Here, TWG members are identified as being a key for identifying and drawing upon a wide variety of resources when needed. The importance of relationships being formed between TWG members is also made apparent through a statement made by a Steering Committee member:

"the technical experts are engaged in the Technical Working Groups, so they are briefing their opinions there, but I am sure they also get, they are also colored by the knowledge and opinions and so forth of the other members… so they are both giving information and bringing their opinions, but they are also forming their own opinions, at least partially, based on information that they get in the Technical Working Groups… and that's of course part of the game as well, that they learn things."[145]

Because Technical Working Group meetings provide the grounds for knowledge sharing and learning to take place, nurturing TWG members outside of these meetings will ensure that their interaction in the meetings is as fruitful as possible. The two main ways that TWG members can be nurtured outside of the Technical Working Group meetings are by actions of the Carbon Trust management team (including TDCs), and by Steering Committee members (or other senior managers within respective partner organizations). One way that the Carbon Trust management team nurtures TWG members is by identifying individuals who are particularly interested in particular work packages, and focusing on just those individuals for feedback, so TWG members are not overwhelmed by the sheer amount of information that is available. Describing this situation, a Carbon Trust OWA management member said:

"since there's so many projects going on in the Foundations Technical Working Group right now, what we started to do is create sub-groups, so if one project is of particular interest to certain people, we will focus on them for feedback with the direction of that project… that's started to work well, because there's so much going on in the Foundations Group right now."[146]

Another way that the Carbon Trust OWA management team nurtures TWG members is by giving induction presentations when new partner organizations join the OWA. As stated by a TWG member:

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[144] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 41:20

[145] Steering Committee Member, May 5th, 2012. Recording time: 18:40

[146] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 21:10

"I think looking back, the introduction was pretty good. The first introduction was through the Carbon Trust SharePoint site, and so we were all given an introduction to that and how it was structured. So there was quite a lot of reading to do just on our side just to get up to speed."[147]

Not only are new members shown how to use the resources that are available, they are also made aware of what is important for them to know. Although new partners coming into the Carbon Trust get a structured induction, this is not the case when partner organizations change the individuals who participate in the Technical Working Group meetings. As stated by one Foundations TWG member:

"One of the difficulties is maybe, in some developers the lack of continuity with personnel… I think it's up to the individual developers… to make sure that if there are changes then there is sufficient overlapping."[148]

Another Foundations TWG member identified having this precise problem when he said:

"it took me a long time to be honest, nobody really explained it to me at the time and I was struggling to work out exactly what was going on when people were talking about these things – that's kind of quite a key thing to make sure everybody understands what's going on [in the TWG]…"[149]

While some partner companies have perhaps not nurtured their TWG members as much as necessary, other partner companies do a very good job of it. This was pointed out by a TWG member who discussed frequent interaction between TWG members and Steering Committee members in her organization:

"[Individuals sitting on the Steering Committee] are sitting next to me – with the work, so… So if it's something special I raise it, and we discuss it. Or if there is some question in the Steering Committee, they come and ask 'what happened in the Foundations group?' What do you think?"[150]

This quotation shows the other end of the spectrum, where TWG members are nurtured to a very large degree within their organizations. The degree to which these TWG members are nurtured also heavily impacts the amount of prioritization that is given to the work of the Carbon Trust OWA program, and this also varies greatly between companies:

"If management within [my organization] had set higher goals for me, or higher demands, I would have performed differently, because it was pretty much left to everybody to put the effort into it that they wanted to. And I can feel that from the other utility companies as well. Some of them, for instance, would always start the meeting by saying there's an error in the

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[147] Foundations Technical Working Group Member, May 22nd, 2012. Recording time: 48:30
[148] Foundations Technical Working Group Member, May 22nd, 2012. Recording time: 22:35 – 23:45
[149] Foundations Technical Working Group Member, May 1st, 2012. Recording time: 21:15
[150] Foundations Technical Working Group Member, April 19th, 2012. Recording time: 28:25

agenda – this that and the other thing, and a spelling mistake. Some people put a lot of effort into it, while others did what [we] did, you know, just winged it."[151]

Similarly, a Steering Committee member, when asked if Technical Working Groups have a clear understanding of direction from the Steering Committee group, this individual responded:

"Probably not… not always I would say. That's one of the things that can be improved."[152]

These statements illustrate nicely why TWG members need to be nurtured from within their organizations. If Carbon Trust OWA projects are not set as a priority internally, then participation within TWG meetings will suffer because clear direction is not given, and internal company projects take higher priority.

The fourth and last suggestion for knowledge acquisition within networks that was put forward by Leonard is to nurture boundary spanners. In the context of the Carbon Trust OWA program, boundary spanners are understood as the Carbon Trust OWA management team (including TDCs). These individuals need to be able to understand the needs and desires of a very wide range of actors, and then 'translate' those needs and desires between the different actors in order to achieve desired outcomes. This can be a particularly difficult job, as the needs and desires of a wide range of actors are often contradictory. If there are two few boundary spanners present, major bottlenecks will arise (Leonard, 1998).

The Carbon Trust OWA program can be understood as effectively managing it's bottlenecks over time, as well as increasing its number of boundary spanners to manage the increasing level of activity undertaken through this program. In identifying just how important the Carbon Trust OWA management team is for the program generally, when asked what the most important element was for coordinating with so many actors, a Foundations TWG member responded:

"Undoubtedly it's the role of the Carbon Trust. Without very clear direction from them, nothing would happen on this, and it's as simple as that. Because when you've got different developers all over the place, with their own motives and their own priorities, you've got to have people that are very strong and organized in the middle to pull that together in a very deliberate way, and harness the opinions… this is critical to keeping the whole thing working."[153]

This role of boundary spanners is in part nurtured (to a greater or lesser degree depending on the working stream) as well as held, by Technical Delivery Consultants. This is nicely explained by a Foundations TWG member who described the TDC role as:

[151] Foundations Technical Working Group Member, Dec. 12th, 2011. Recording time: 1:14:40
[152] Steering Committee Member, June 4th 2012. Recording time: 56:35
[153] Foundations Technical Working Group Member, May 1st, 2012. Recording time: 28:25

"a very similar role, in some ways, to the Carbon Trust [OWA management team]. There's a lot of overlap with what the Caron Trust does and what they do. Obviously the Carbon Trust sit above them, they employ them and are the overall director, but with certain aspects of work the Technical Delivery Consultant will assist with planning the work, where it is going, advising, all that type of thing. It's almost support to the Carbon Trust in that respect."[154]

Particularly in early stages of the Carbon Trust OWA program, TDCs played a strong role in not only helping with the management of the TWGs, but also with technical issues included in each of the work packages. This relationship between the Carbon Trust OWA management team and the TDCs is also, when it works well, a reciprocal relationship where both parties nurture each other on a regular basis. The relationship that the Carbon Trust OWA management team has with the Wake Effects TDC is one such relationship, as can be seen by this statement from the Wake Effects TDC:

"I do speak to them [the Carbon Trust OWA management team] quite frequently. Definitely once a week, sometimes every day, sometimes all day every day… so I have quite a close relationship with them."[155]

This is reiterated by a member of the Carbon Trust OWA management team who gave an example of working together with the Wake Effects TDC:

"We're trying to get everybody's approval on a discretionary project that would start in a couple of weeks, but we don't have it… so it's a new person that's joined [the Technical Working Group], so he maybe isn't as up to speed with everything. So we want to work together to figure out what to tell him in order for him to make a good choice on whether he wants to participate on this discretionary project… I guess that's kind of an example of how we support each other."[156]

It has also been explained by members of the Steering Committee that it would be a good idea if the Steering Committee would support the Carbon Trust management team more during the process of writing business cases:

"I think if we are working more closely – the partners and the Carbon Trust – I think this is a good way of sharing knowledge, and at the same time making business cases which are more viable and interesting for us as partners within the Offshore Wind Accelerator… we are the ones coming up with the ideas, and they are trying to put this on a sheet of paper, and trying to make it more substantial. But I clearly see that we need to work more closely in developing these business cases… because you really want to end up with business cases which are relevant, and this may be a good arena to meet."[157]

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[154] Foundations Technical Working Group Member, Jan. 13th, 2012. Recording time: 2:40
[155] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 22:25
[156] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 52:48
[157] Steering Committee Member, May 11th, 2012. Recording time: 47:50 – 49:40

This statement clearly identifies an area where the Carbon Trust OWA management team could be supported to an even greater extent by the Steering Committee members. Technical Working Group members also mentioned helping the Carbon Trust OWA management team throughout the interviews conducted. As stated by a Foundations TWG member:

> "[Our company] tell them [the Carbon Trust OWA management team] what our technical issues are, the things that we'd like to see addressed, we provide technical support if you like, when they're looking for our views on things that are concerning us most about the industry. And then also, on a more practical basis, I always try to provide very constructive input when we're reviewing tenders for them, when recommending who they should appoint to do their studies…"[158]

Support by Steering Committee and TWG members is imperative for the Carbon Trust OWA to function, because the OWA management team has to manage the needs and provide interaction opportunities for nine different offshore wind developer companies (comprising one hundred and seventy-five plus people), and five hundred plus innovators and designers. The way that knowledge acquisition has been handled over time in this actor oriented innovation program is extremely fascinating, a process that has been managed very carefully and, I would argue, successfully. Success is indicated by increased commitment to the program over time in the form of increasing contributions given to the program from the partners, increasing the number of partners participating, increasing the number of Carbon Trust OWA management team members working in the core management team, and increasing the number and complexity of projects worked on over time. When looking at the Carbon Trust OWA case in comparison to the theoretical analysis, it is easy to identify elements of scanning broadly, providing for continuous interaction, nurturing technological gatekeepers (TWG members), and nurturing boundary spanners (Carbon Trust OWA management team members) within this program. One area that might be improved is the level of engagement from senior managers, and another is internal communication within each of the partner companies, which would undoubtedly strengthen each partner's opportunities for knowledge acquisition from the Carbon Trust OWA program even further.

5.2.3 Knowledge Capture

Knowledge capture is the popular idea that that knowledge can be made explicit, and thus be 'captured' in some form outside of individuals, typically in what are called "knowledge repositories." (Liao, 2003) This idea, although enticing for purposes of simplicity, is thoroughly reject in this dissertation. Instead knowledge is understood here as a process that happens within and between individuals, one that always contains a personal, tacit element in order to be acted

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[158] Foundations Technical Working Group Member, May 1st, 2012. Recording time: 7:50

upon. This does not mean, however, that information technology (whether it be repositories, emails, teleconference meetings, etc.) is not important for gaining knowledge. On the contrary, the information age has exponentially increased the ease and speed by which information can be shared, which has a large impact on individuals' ability to gain knowledge. The importance of information to the conveyance of knowledge was well articulated by a Foundations TWG member who said:

> "If knowledge is there, information will be the way the idea is conveyed…"[159]

Also, further building upon the idea of IT tools as useful for conveying information, a Steering Committee member stated:

> "You probably could not do this work today without those kinds of tools. Well, it would be a different game. But perhaps that's true of all work today."[160]

For this reason, information technology is an extremely important part of many knowledge processes. However information repositories and other information technology, instead of being thought of as synonymous with knowledge, may more usefully be identified as *knowledge conduits* – as facilitating knowledge, and not containing knowledge in and of itself. In chapter four, Figure 8: Spectrum of IT tools that can be used as knowledge conduits places IT tools on a spectrum between codification and personalization. Each of these IT tools will be discussed here in turn, identifying the way in which different information technology is used by the Carbon Trust OWA program, including the usefulness of each for knowledge processes in this context.

The first IT tool discussed in Figure 8 on the codification end of the spectrum is **information repositories**. Information repositories have the advantage of being able to hold a great deal of information in one place. The type of information repository that the Carbon Trust OWA program utilizes most is for storing structured internal information. The system they use is called Share Point, and as stated by a Foundations TWG member, it is:

> "Where all the formal reports are… And there are A LOT of documents. All the reports that are made, the formal reports, and the formal minutes of meetings, they are placed on this website that you need a password to access. And all the partners have access to this."[161]

It was also specified by a Steering Committee member that the SharePoint site should not contain any other kind of information or interim reports, because:

> "if we store more there it might become what we call a 'data grave.' So that's a German expression literally translated. You throw it in and then it's gone – 'daten grab.'"[162]

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[159] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 1:10:00
[160] Steering Committee member, April 24th, 2012. Recording time: 7:05
[161] Foundations Technical Working Group member, Dec. 12, 2011. Recording time: 39:20

One of the main frustrations with using this SharePoint system (which is a common problem with information repositories generally), which has been reiterated throughout interviews conducted, is that the structure and organization of the system is not optimal. As stated by a Carbon Trust OWA management team member:

> "What one person thinks is logical, is maybe different from what somebody else thinks is logical. And then some TDCs just think it's a hassle, so they just put things up anywhere. So I think [there are] varying levels of organization, or logic, behind the organization [of the SharePoint site]."[163]

Because information repositories have the capability to hold such large amounts of information, it is also of utmost importance that they are well structured, and have a good search function, otherwise things will be difficult to locate. Not having a consistent way of classifying all information in such repositories leads to statements like that of a Steering Committee member, who said that the SharePoint site:

> "is very difficult to maneuver around. So this is not really something that we will use."[164]

Despite these difficulties, there are at least two improvements that have been made, in order to increase the accessibility to key documents on the OWA SharePoint site. One improvement, as stated by a member of the Carbon Trust OWA management team, is that they have collected all the final documents in one area, because:

> "It's not always clear where the final reports are. Sometimes there are a lot of different folders, but it's not always clear where the final report is to the Steering Committee member. They're probably not so interested in the interim reports – they just want to quickly find the [final] documents. So [now there is] one place, that is standard across all the different [TWG] research areas, that is where you find the final report."[165]

In addition to putting all final documents in one place, The Carbon Trust OWA management team (with help from the TDCs) put together a document register after each year, or phase of the project. As stated by the Wake effects TDC:

> "At the end of stage one, the Carbon Trust put together – and I supported them in this, and so did the other TDC – tried to put together a cash of everything that's important. So they had a whole bunch of files, and they had a table that provided a key to the files saying this is where it is, this is what it is, and this is its significance. So you had a chance of coming along, and finding it."[166]

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[162] Steering Committee member, April 24th, 2012. Recording time: 44:10
[163] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 28:10
[164] Steering Committee member, April 18th, 2012. Recording time: 13:30
[165] Steering Committee member, April 24th, 2012. Recording time: 30:40
[166] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 52:25

This register was identified as useful by one of the newer members of the Foundations TWG, who said:

> "I found it to be useful when I was just starting in the Technical Working Group because I was able to go in there and look at all the previous reports that had been drawn up… it had the history of all the documentation that was produced as part of year one and year two and it was useful to get a broad overview of the [Carbon Trust OWA] project."[167]

The Carbon Trust OWA program's use of the SharePoint site for storing structured internal information, although it could be more systematic, does seem to serve the overall purpose of storing all important documents produced by the program. This site is also maintained over time, and some changes and additions have been made to improve functionality. In the future, however, it may be necessary to create an even more structured document register (including key words), especially if anyone would need or want to access these documents after the Carbon Trust OWA program has ended.

Next in Figure 8, toward the middle of the spectrum between codification and personalization, are expert networks. **Expert networks** provide a search function to locate people with expertise in a particular area. Although the Carbon Trust OWA program does not currently make use of expert networks, this IT tool was well understood by respondents. In fact, when asked if knowledge management was something specifically dealt with in their organizations, many respondents related this question directly to expert networks. This supports the contention that knowledge management is often thought of as synonymous with IT tools – a fact that is seen here as unfortunate because it neglects the most important aspect of knowledge management, namely people and their direct interaction. However, expert networks can be very useful for finding information about where to locate people (and their knowledge), and can therefore be seen as a useful *knowledge conduit*.

One of the Carbon Trust OWA management team members, for example, described working for an organization where expert networks were very well developed:

> "So if you had a question about the pharmaceutical industry… you could identify everyone who has worked with pharmaceuticals, and everyone who has worked for [a particular company in that industry] and all the different types of projects. So you could pick up the phone to that person, and find out what the key things are that you need to know about a problem that you're facing."[168]

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[167] Foundations Technical Working Group member, May 4th, 2012. Recording time: 24:35 – 25:15
[168] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:17:35

Although this type of expert network might work well for the Carbon Trust organization, as well as OWA partner organizations (particularly if they are geographically dispersed), it is unlikely that it would be very useful or effective for the Carbon Trust OWA program itself. The reason for this is that it is not the intention for partners to share all of their information and personally held knowledge with each other. On the contrary, each partner has different expertise, and it is up to each partner to decide what they would like, or not like, to contribute in the context of the Carbon Trust OWA program. What *is* shared by all of the partners is the information gained through common projects that are sent out for tender. The results of these projects are typically carried out by a third party, and are then commonly shared between, and available to, each of the partner organizations. Because the number of third party contractors in the OWA program is over five hundred, what may make sense is an expert network that could identify which third party individuals have worked with the Carbon Trust OWA project, as well as their organization's name and the work that they have done. One partner company has also begun using an expert network for precisely this purpose i.e., keeping track of which third party individuals have worked with the organization. Drawing a connection between what his company is doing now and what may be useful for the Carbon Trust OWA program in the future, a Foundations TWG member said:

> "We're starting to use CRM – Customer Relationship Manager. So there's a sort of searching facility, if there's been interactions with third parties. So I know SharePoint does have a search facility, so if you want to know about whether a particular consultant has worked across a few Working Groups, you could always do a search on that…What I'm not sure of is whether… a developer who is in [the SharePoint site] has full searching [access]… that might be useful [for the Carbon Trust OWA project]."[169]

Being able to search for who has done what work for the Carbon Trust OWA program may help to identify if these individuals should be used again, what kind of previous knowledge they may have about the program, which TWG may be able to answer questions about previous interactions with these individuals, etc. However, creating such a search function should be a unanimous decision among all OWA partners (agreeing that there is a need for it), and it should also be weighed in importance against other activities.

Next on the spectrum between codification and personalization are group discussion systems. **Group discussion systems** provide a forum for individuals to communicate in written form. If one individual has a question, someone else may be able to provide an answer. However, unlike direct interaction, response time may not always be dependable, and if there is little interest in the system, it will not function as intended. On the other hand, the advantage of a group discussion

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[169] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 28:45 – 30:15

system is that when many users participate, common problems can be quickly identified and solutions given, which can then be used by all other members in the system.

The Carbon Trust OWA program currently has one group discussion system. It was created for the Wake Effects TWG to be able to interact directly with third party software developers who were in the process of creating a new tool that the partners are currently using. As stated by a Carbon Trust OWA management member:

> "We started a discussion board, so that the software developers can connect directly with the Technical Working Group members, because then it's just easier than having emails going back and forth and everybody gets the benefit of the learning."[170]

When talking about this group discussion system (which he calls a user forum), a Wake Effects TWG member said:

> "I think that's going to be really useful… and I think the kind of sharing that we really need to push these things forward. And at the moment, that is kind of limited to who your friends are in the industry. So some of these companies I spend a lot more time with than others, so we tend to share things a bit more through other avenues, where as if we've got a nice user forum, and everyone's contributing, then that's a really good way that you can share between the companies. And I think you get a lot of benefit off that…"[171]

This statement pinpoints both the positive and the negative with this type of group discussion system. On the positive side, it can be a good way of acquiring useful information when it is needed, but on the negative side, it is completely dependent on people with relevant expertise contributing to it.

Also in the middle of the spectrum between codification and personalization is **Email.** Email has become a very quick and easy way for individuals to communicate in written form. One Foundations TWG member compared finding documents in emails as opposed to going into an information repository to find them, saying:

> "I think, and it's probably just a habit thing, I think in my mind it would be harder to find [a document that I was looking for] on any web based system, not just Share Point. My own view would be that I could find it more quickly just by jumping through my e-mails. And that's maybe wrong, but I don't think that's uncommon."[172]

This is indeed a common sentiment, and the majority of individuals interviewed stated that they would first try to find an OWA document by turning to their email, or asking someone else who might have the document, before they would go into the OWA SharePoint site.

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[170] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 27:10
[171] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 29:40
[172] Foundations Technical Working Group member, May 1st, 2012. Recording time: 37:40

The Carbon Trust OWA management team specified that they use email primarily for logistical issues:

> "…decisions are usually taken in person. Over email would be how we would alert somebody to, for example, a business case we are looking at, or a meeting – kind of the more logistical things are communicated over email."[173]

Adding to this, a Steering Committee member said:

> "When I go to a Steering Committee meeting, the material is sent out in advance, or on the day, so we have that in an email… So we would have an agenda and the meeting material on an email."[174]

These statements identify one way in which emails can be very useful – for updating everyone and keeping them on the same page. Another way that emails have facilitated keeping everyone on the same page in this type of actor oriented innovation program is by emailing out a comment log. As stated by a member of the Carbon Trust OWA management team:

> "We do something called a 'comment log.' If we're reviewing a report, where all partners have the option of putting comments in – it's in an excel spreadsheet. And then we'll send that to whoever wrote the report and they will address each of those comments individually, and then send it to everyone."[175]

One of the main problems with email as a form of communication is that it is used so frequently that people can quickly become overwhelmed by the volume of emails received, losing track of what needs to get replied or responded to. A Wake Effects TWG member articulated trying to overcome this problem by saying the following:

> "I think there was quite a big push to make sure that we don't just get bombarded with a thousand different emails every day. … it's a bit of a nightmare because, at least when we're going through the tender procedures for some of the work, it does get a bit confusing with people always updating bits and bobs, so we try to keep it all down to a single email with a big update."[176]

This is also understood and reiterated by the Wake Effects TDC, who said:

> "I actually don't like email as a medium. I think there are far too many emails in the world. So I try not to send more than two emails to the Technical Working Group in a week. I try to make them overall project updates… collect as much information as possible and put it in a single email. Put it as concisely as possible, but make multiple points, have multiple headings,

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[173] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 41:10
[174] Steering Committee member, Dec. 14th, 2011. Recording time: 45:30
[175] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 41:50
[176] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 10:10

and maybe multiple documents. Because I think in their shoes, I would prefer to have a kind of digest."[177]

A probable reason for their being 'so many emails in the world' is that they can send information to a specific recipient or recipients instantaneously. However, as with all other IT tools in the middle of the spectrum between codification and personalization, email requires individuals to actively engage (by reading and responding) for it to be useful.

Now, moving toward the personalization end of the spectrum, we come to telephone calls, which allow individuals to talk to each other directly without being in the same area. In terms of communicating with a staff that is geographically dispersed, a Wake Effects sub-contractor identified the advantage of talking on the phone as opposed to sending an email:

> "I'm more likely to pick the phone… I've been around a long time, I know everybody, and I personally prefer sometimes to have a conversation with them to move things forward rather than just death by email."[178]

The Wake Effects TDC also identified using telephone calls as a way to "catch up" with TWG members one-on-one:

> "We do a fair bit of ad hoc phone calls. From time to time… I used to do this more, but now that the project has grown I find it more difficult. I used to maybe get to Friday afternoon, and say "right, I'm going to call everyone today." And just try to catch up with everyone. It's amazing what people will tell you that's important one-to-one. And maybe they don't think it's important, or… it's just really good to get that lower level communication sometimes."[179]

As these statements make clear, telephone conversations, in addition to being able to get immediate feedback, allow a more personal interaction that can have unexpected benefits in terms of gaining new information. Telephone calls can also be very useful for clearing up miscommunications. As specified by a Carbon Trust OWA management team member, when miscommunications arise, often the best thing to do is:

> "…pick up the phone and explain… I mean often it is actually the person who is communicating that is figuring this out quite quickly because the message he's getting back is not corresponding – It doesn't really tie up. And then you try to explain it again I think."[180]

Particularly for actor oriented innovation programs, where new ideas are being presented and discussed, telephone calls may be useful, but will undoubtedly not be sufficient. When discussing

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[177] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 46:30
[178] Wake Effects Sub-Contractor, Dec. 15, 2011. Recording time: 26:15
[179] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 47:30
[180] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:34:35

the presentation of his Twisted Jacket foundation, The Keystone Managing Principal identified just how important face to face communication is in relation to telephone calls:

"Back early I tried to do the [Twisted Jacket] concept on the Beatrice project, but I couldn't get anybody interested. I tried to talk to people on the phone, but couldn't get anybody interested in even listening to the fact that we had a concept. I think it was because we were trying to do it long distance. If I had to do it over again, I would have flown over there [to present my concept] face to face."[181]

So, although telephone conversations are a useful and well-used form of communication, some knowledge processes (such as understanding new innovative concepts) will still require face to face communication.

Also on the personalization side of the spectrum of IT tools that can be used as knowledge conduits is teleconferencing. Teleconferencing includes a number of people in a telephone conversation at one time, and this method of communication has been used frequently throughout the Carbon Trust OWA program in a number of contexts. The main reason for this is that although face-to-face meetings are understood as better,

"it's obviously a lot more difficult to arrange... face-to-face is better because you can actually have a better discussion. But I think teleconferences can play a part [in the OWA program]."[182]

However, both the Steering Committee and the TWG members expressed frustrations with this method of communication throughout interviews conducted. As stated by a Steering Committee member:

"A teleconference meeting is not always a success, I have to admit… there have been some times when we have not been able to attend regular face-to-face Steering Committee meetings, but if we have to be on the phone, it has not been working at all, and I don't think it will work in the future either, because it's very difficult."[183]

Along these same lines, a Foundations TWG member said:

"I think I always struggle a little bit when we have to have teleconferences. I mean, to be honest I'm not a huge fan of them anyway, but I think when you've got so many people on the line – for example it could be that [Carbon Trust OWA management team members] are trying to get some sort of decision out of the group on something. What I'd find is that that's virtually impossible to do with a teleconference. You tend to get very awkward silences; you tend to get people not really wanting to commit to things on the phone. And I think it's just a

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[181] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 16:00
[182] Foundations Technical Working Group member, May 4th, 2012. Recording time: 18:25
[183] Steering Committee member, May 11th, 2012. Recording time: 29:40

consequence of that medium of communication, I think it's just hard when you're not talking to people properly, to engage correctly and encage sufficiently in a debate."[184]

Both of these statements, by the Steering Committee member and TWG member, do a good job of explaining the level of difficulty with teleconferencing, making it clear that not having the interpersonal interaction that face-to-face interaction provides creates difficulty when trying to maintain a meaningful conversation between what is usually nine or more people. One idea for overcoming some of the difficulty with teleconferences was stated by the Wake Effects TDC, not only describing the problem, but also a solution that has worked for the Wake Effects TWG. As he put it:

> "…practically, you can't really stay in a teleconference call all day… it's just not an immediate enough way of discussing things. But if it's a single topic… so for example, if we have a report from a supplier, and we want to discuss that report with them, then we might prepare a list of questions in advance, provide it to the supplier, and then ask them to talk us through. I think teleconferences work if it's quite a structured conversation. If you're being presented at, and then you get to ask questions back, then it's great."[185]

As proposed here, having a presentation given on a specific topic, and having the option to review the presentation before the teleconference meeting, and then ask questions during the teleconference meeting might be a good way to maintain engagement and provide enough structure to make this form of communication productive.

The last IT tool that will be covered on the spectrum between codification and personalization is videoconferencing. **Videoconferencing** allows people not only to speak to one another, but also to see each other at the same time. Videoconferencing is not something that the Carbon Trust OWA program currently makes use of, and as stated by a Carbon Trust OWA management team member:

> "We could probably do a little bit better at videoconferencing… but we're not there yet."[186]

Many of the respondents who identified problems with teleconferencing also stated that videoconferencing may be a better alternative. One of the main reasons for wanting videoconferencing, as stated by a Foundations TWG member, is:

> "In order to reduce the travel effort that is needed for meetings. For instance, in three months we sometimes have a two-day meeting, and in order to reduce it and still manage the scope, I

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[184] Foundations Technical Working Group member, May 1st, 2012. Recording time: 11:20
[185] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 44:20
[186] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:12:15

would think it makes sense to have some video meetings up front to cover some things which are coverable."[187]

Another Foundations TWG member also expressed the desire to use videoconferencing, and when talking about communication, said:

> "I think it's an industry challenge really. There's an awful lot of traveling that goes on in this industry. And it's not surprising, given where the locations of different companies are, etc. But you know you look at [one of the partner companies] – they've got an outstanding internal communications system. You know, they've got a tele-presence system, and the like, and they use that very widely. I'd love to see an ideal situation where we could have a big sort of conference seamlessly, via some sort of system like that. But I think we're a long way off from that, I don't see that happening in the near future."[188]

Despite the desire for video conferencing, the main problem is that everyone needs to use the same system, and setting it up can be very difficult. As stated by a Wake Effects TWG:

> "There's no chance we would get that working between fifteen people, so you just sometimes have to deal with that."[189]

This would seem to suggest that perhaps sometime in the future of the offshore wind industry, it will be more of a realistic possibility to utilize videoconferencing for actor oriented innovation projects. But even if or when this does become a viable option, it should be cautioned that this will never replace the basic need for face-to-face interaction for this type of collaboration.

To conclude, information technology provides a wide range of tools for sharing information. Because many of these tools have become very popular under the guise of being able to provide knowledge to an organization (being classified as *knowledge management* tools), it should be stressed that these tools are only useful as long as there is a real need for them. Put another way, if there is not a use for them, chances are they will not be used, therefore rendering them useless. This point was expressed by a Foundations TWG member who said, when discussing her company's internal lessons learned repository from past projects, and how this might be applied for the Carbon Trust OWA project:

> "They [the Carbon Trust] should design their own process, how they take care of the information and the learning for future use. But they need to know: what is the goal, and what are the needs." [190]

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[187] Foundations Technical Working Group member, June 13th, 2012. Recording time: 38:10
[188] Foundations Technical Working Group member, May 1st, 2012. Recording time: 39:05
[189] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 34:20
[190] Foundations Technical Working Group member, April 19th, 2012. Recording time: 30:55

This solidifies the take home point for all IT tools – **there has to be a need for an IT tool, in order for it to be useful**. Also, no matter what IT tools are utilized, there will always be a need for interpersonal interaction when knowledge is involved. When discussing various forms of communication, the Keystone General Manager for Offshore Renewables said:

> "Face-to-face just means so much more than talking on a phone, or over the internet, or anything like that." [191]

For this reason, IT tools may be more usefully thought of as **knowledge conduits** – as a means to a knowledge end, and not knowledge in and of itself. As a consequence, IT tools are, and will always be a supplement, and not a replacement, for interpersonal interaction. The reason for this was well articulated by the Wake Effects TDC, saying:

> "… it's the contextual information that's really valuable. It's something that's really interesting, this knowledge management stuff [referring to IT tools]. Because it's tempting to say "we need all that email collateral," but you'd just die. You'd be swamped. What you actually need is an informed and edited point of view. Whether it's written on paper or given verbally even better I think, but that's what you need. So probably if somebody hands over – from one [TWG member] to the next – you need to have a hand-over interview, and even that is far from perfect." [192]

As is made apparent here, knowledge is not something that is easily acquired, and to truly acquire or (more accurately) gain knowledge, there needs to be an element of personal interaction. This understanding leads nicely into the next section covering *knowledge sharing*, where personal interaction is a main component.

5.2.4 Knowledge Sharing

Knowledge Sharing, also termed knowledge transfer, helps organizations to avoid "reinventing the wheel" through cross-pollination of ideas within an organization. Chapter four highlights knowledge sharing as particularly important for actor oriented innovation programs not only to avoid redundancy, but also for the development of new innovations by making personal knowledge available for problem solving processes, reducing time to market, and improving processes for goal achievement. (Chi-Cheng 2009; McNeish and Mann 2009; Cooper 2001) The need for knowledge sharing within the offshore wind industry was well articulated by a foundations TWG member who said:

> "Everyone [in the offshore wind industry] is in some way finding their own solutions and reinventing the wheel, and starting from scratch. Especially for foundations… if the

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[191] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time: 9:20
[192] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 52:25

experiences would be shared, the complete business [industry] would receive big benefit because you would share lessons learned, and say "we used this access system one time," or "we used this boat landing" or "we used this kind of platforms" or "this kind of cranes," and "we had good experiences with that," or "these are the items which you should not consider, or which you should consider," and so on and so on… And this is something which I would link with knowledge, and with things I think should be changed, and with things where I would say yes, this is something where I would really [like to] see a certain amount of sharing…"[193]

Knowledge sharing is not, however, an easy or automatic process and requires time and effort on the part of the individual sharing what they know, thus raising questions about why specific individuals might share what they know. Insecurities related to giving up power and advantages that come along with having knowledge, as well as revealing what one does not know, are common reasons for individuals wanting to hoard, rather than share, their knowledge. For example, a Foundations TWG member had the following to say about TWG meetings when the OWA program began:

"…some guys there have thirty years of experience…[and] often people would sit back for fear of saying something wrong. And that's an issue with group forums I think. … you feel like you're representing your company if you say something wrong."[194]

Both knowledge sharing and knowledge hording have advantages and disadvantages associated with them, and these are weighed by individuals when deciding whether or not to share what they know.

As a member of an actor oriented innovation program, each of the individuals involved in the Carbon Trust OWA must make decisions about what to share in this forum. In order to understand more about the way in which knowledge is shared (or not shared) in this unique context, *behavioral*, *team* and *business process* characteristics will be examined, all of which are understood as impacting this process. (Liebowitz 2009) First, in relation to behavioral characteristics, **trust** is commonly identified in academic literature as influencing knowledge sharing behaviors. When trust is present, it can help to alleviate fears associated with sharing what one knows. The behaviors forwarded in section 4.3.4 Knowledge Sharing as building trust are continual reciprocal interaction over time, as well as transparency. Making information available to others that they may find important, and being open about why it may be important, is likely to build trust between these individuals, making them more likely to want to share their knowledge with each other. In order to specify how processes of continual interaction and

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[193]Foundations Technical Working Group member, June 13th, 2012. Recording time: 54:35

[194] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 3:35

transparency have evolved within the Carbon Trust OWA program, the way each operates in this context will be described in turn.

The Carbon Trust OWA program has many different ways in which it facilitates both **continual reciprocal interaction over time** and **transparency**, as well as many different parties between which interaction and transparency are facilitated. Exemplifying this, a Carbon Trust OWA management team member said:

> "Internally we are talking to each other quite a lot, and then talking to the TDC's. TDC's may talk to innovators. We may talk directly to innovators… and then obviously [we talk to] the partners, and then the partners [are] contacting innovators directly as well… which allows a lot of information to flow quite freely around. And so people know what's going on in a way…For bigger things I think face-to-face meetings are really important, and also in regular intervals to ensure the real buy in from the partners as they really understand what's going on… [as we have had] people in the program for longer time periods, you [get to] know them better, and then you establish a relationship with this person and then you also build up trust I think. And I think that's really helpful. I think that's one reason why face-to-face meetings are pretty important – to build up this relationship, to build up trust."[195]

This statement shows not only the many avenues for continual interaction, but also the way that transparency is facilitated by making sure that the individuals involved "really understand what's going on." Although not all interactions are equal in terms of reciprocity, duration, or level of transparency, overall the program has done a very good job of building trust (through interaction and transparency) between key players within the program over time. In order to highlight the way that trust works within the Carbon Trust OWA program, the following will examine the way the two behaviors of interaction and transparency play out within 1) the Carbon Trust OWA management team, 2) the Steering Committee, 3) the Technical Working Groups, and 4) Keystone (a third party contractor).

Within the Carbon Trust OWA management team, there is an extremely high level of both continual reciprocal interaction, as well as transparency. While conducting interviews at the Carbon Trust headquarters in London, I was able to observe the day to day working procedure of the OWA management team. As I wrote in my observation notes:

> "When I very first arrived at the Carbon Trust, [an OWA management team member] was standing over [another OWA management team member's] desk and they were discussing… whenever one of them comes back to the desk area, it seems that they turn to the others and give updates… All three Carbon Trust OWA management team members said to me that they have a very close working relationship. I was able to observe this relationship throughout the past two days at the Carbon Trust. All three of them sit next to each other, spin their chair

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[195]Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 57:15 – 1:01:05

around and ask for advice, tell each other about the phone calls that they have had with partners, contractors, or subcontractors, etc." [196]

Not only is the communication between the Carbon Trust OWA management team constant and reciprocal, it is also transparent so that each of them knows about all of the activities of the others. As a support for the Carbon Trust OWA management team, there has been varied success in building trust with the Technical Delivery Consultants in each of the five working streams. The Wake Effects TDC can be considered a best practice case, where a Carbon Trust OWA management team member reported that:

"I talk to [the Wake Effects TDC] three or four times a week… we support each other."[197]

Perhaps one of the reasons this TDC has been so successful in supporting the Carbon Trust OWA management team is precisely because of the continual reciprocal interaction and transparency that this individual has displayed throughout his involvement in the Carbon Trust OWA program. One way that the Wake effects TDC engenders communication and transparency within TWG meetings is by giving everyone the opportunity to voice their opinion. As stated by a Wake Effects TWG member:

"By being there [in the TWG meeting] everybody contributes something, because we usually have a whip round at the end and everyone makes comments. But there are definitely some people there that will just sit there and take notes, and take stuff away, where as there is definitely a lot of people that like to show all their cards, and really just hammer stuff out, and just talk about it, and that's kind of like my approach as well, just giving your two cents all the time. And quite a few other players do that as well, and I think that's where you get the most value." [198]

As this statement shows, communication is not one hundred percent transparent or reciprocal, but many of the individuals that sit in this TWG do communicate continually and are transparent with their opinions, practices that are facilitated by the TDC. The Carbon Trust OWA management team has also tried to foster trust with innovators, some of whom have expressed frustration with the fact that the partners (developers) have not been using their concepts for commercial projects. As stated by a Carbon Trust OWA management team member:

"The Carbon Trust is trying to explain to the innovators exactly what the developers want. I mean, why things are taking a long time, and try and be as up front as possible to explain what the next steps should be, and what needs to happen to make the energy companies more accepting of the new technologies."[199]

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[196] Personal observation notes from the Carbon Trust headquarters in London. Jan. 18th, 2012.
[197] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 52:48 – 54:00
[198] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 20:45
[199] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 46:00

This is one way that the Carbon Trust Management Team is facilitating a greater level of transparency about the desires of the partners, in the hopes that greater trust will be built between the partners and the innovators.

Because all of the partners who sit on the Steering Committee and TWG are members of separate organizations, communication and transparency will never be one hundred percent. Each company has its own internal pipeline objectives, current projects under way, etc. In this actor oriented innovation context, it is of particular importance for members to be transparent about what they are going to share and why, so that trust and knowledge sharing can be facilitated to the greatest extent possible. One Steering Committee member expressed precisely this when she said:

> "What will drive the process forward is that everybody needs to clearly state the needs and the limits of what they need and what we can do. Because there might be a certain need for all the utilities… And this needs to be stated very, very clearly."[200]

This statement clearly describes the importance of transparency between partner organizations within the context of the Carbon Trust OWA program. Many Steering Committee members reported that they make a very clear strategy within their own organization about the type of information that they would like to share in the OWA context. As stated by one Steering committee member:

> "[Our organization has] both patents and knowledge and experience. And I think we have made a strategy, and what sort of knowledge and experience that is our competitive edge, and that we should not share with others, and what is more general and non-competitive or proprietary, that we can share with others. So I think we have made that technology strategy, where we have pointed out and sorted what is important for us to compete, and what is not so important."[201]

By making the areas that they are willing to discuss explicit (transparent), members of the Steering committee can then feel free to share information that is not proprietary, thus moving the OWA program forward. This is, to a large extent, accomplished in Steering Committee meetings. As expressed by another Steering Committee member:

> "we are in the middle of a discussion about the third year portfolio, and I think in the last Steering Committee meeting they were coming up with different business cases where I think there was a lot of discussion… I really like these types of meetings where there are a lot of dynamics, and a lot of discussion, where you don't agree immediately… and through all the projects we have. I think there you can see we share some knowledge. And also in the

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[200] Steering Committee member, April 24th, 2012. Recording time: 29:40
[201] Steering Committee member, April 18th, 2012. Recording time: 34:50

priorities discussion, because there you can see that people have the experience and knowledge which has to be shared when we discuss these different topics."[202]

Here we see not only different forms of communication that happen within the Steering Committee, but also transparency that is present when people share their experience and voice their opinions. However, the fact that not everything is completely transparent between partners was also expressed by a Steering Committee member by saying:

"As you'd expect, the partners don't always put all of their cards in front of the others when we're in an OWA setting, or at a Steering Committee meeting. I mean they always question things, and put their views forward, and you've got to read between the lines as to why they're doing that. Which is fair enough in the commercial world that we live in… so we share goals and projections certainly, but perhaps we don't know what other work they're doing on a one-to-one basis."[203]

To my mind, this illustrates very nicely the context of actor oriented innovation programs. There is information that there is a desire to share (and develop collectively), and there is information that there is a desire not to share (and develop privately). However, in order to make the collaboration work, trust (through continual reciprocal interaction and transparency) is needed to move forward in the areas where there is a common desire to do so.

For the Foundations Technical Working Group, interaction and transparency can be seen as having evolved over time. As stated by one Foundations TWG member who has been part of the TWG since early 2010:

"In the early days it was quite stony and quiet [in TWG meetings]."[204]

Another Foundations TWG member, who joined the TWG in early 2011 stated that:

"The industry has a reputation of people sort of protecting themselves, and not being as open as they might be… I've always just sensed that people are being fairly open in the discussions we have [in TWG meetings]. I know I've always tried to be quite open. And rather than beat around the bush, I've always been happy to just tell people, you know, roughly what we're doing… And I think I generally find that works quite well. And a lot of that comes from building up relationships with people in the Technical Working Group. So a lot of the faces that are there now have been there a year ago, and that has helped, because you just start to realize that these people are not going to just disappear, you know, that they're going to be here, and you can get to know them, and realize they're in there for genuine reasons."[205]

As this statement very nicely points out, the combination of being transparent, expressed as "being fairly open," along with continual reciprocal interaction over time, expressed by "seeing

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[202] Steering Committee member, May 11th, 2012. Recording time: 41:45 – 55:30
[203] Steering Committee member, June 4th, 2012. Recording time: 40:50
[204] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 4:35
[205] Foundations Technical Working Group member, May 1st, 2012. Recording time: 53:15

familiar faces" does help to build up trust between the members, and creates a feeling that people are in the OWA program "for genuine reasons."

Finally, when examining Keystone (a third party contractor), trust can be seen as enabled through behaviors of continuous reciprocal interaction over time and transparency, which were in every way part of the team working on the Twisted Jacket foundation. In explaining the interaction within his team who worked on the Twisted Jacket Foundation, one of the Structural Engineers said:

> "I trust and respect them. I trust that they're giving me information I need, on time, that's correct. And I trust they're doing a good job on their end… And I trust that we have a common vision of where we want to go, and so knowing all that then yes, my work is elevated because if we show that type of trust, then they would expect the same from me. It's not only for them, it's for me too, to make quality work… If I didn't trust them, then I'm sure my work would suffer, that's for sure. But I do."[206]

During interviews that I conducted at Keystone, it was very evident that knowledge sharing was greatly impacted by continual interaction and transparency. In the above statement, reciprocity is identified by the statement "they would expect the same from me", and transparency is identified by the understanding that everyone has a "common vision." When asked how often interaction occurred during the time work on the Twisted Jacket project was under way, another Structural Engineer said:

> "Several times a day. We're all very fluid, and try to keep everybody on the same path at the same time… there was pretty much constant communication."[207]

Here, constant interaction is identified, as well as transparency in keeping "everybody on the same path at the same time." Keystone also understood the importance of building trust through continual interaction and transparency throughout their interaction with the other members of the Carbon Trust OWA program, as illustrated by this statement from the Keystone Managing Principal:

> "I thought our interaction [with the Carbon Trust OWA members] was very good. We were given a lot of access to a lot of people. We were pretty proactive. We were probably the most proactive of the innovators. When we went to Europe, we not only went for a Carbon Trust meeting, which was typically chaired by the TDC, and most of the Technical Working Group members were at the meetings along with all the innovators. But then we would spend another week or two in Europe going to visit the individual members on the Technical Working Group to make closer contact with those folks. We also did a lot of trips to meet fabricators,

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[206] IBGS Foundation Structural Engineer 2, Keystone, Feb. 8, 2012. Recording time: 53:50
[207] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 44:40

and installation contractors… We went to several fabrication yards, and tried to see which yards were best suited for building our concept."[208]

This shows a concerted effort on the part of keystone to build continual interaction and display transparency not only with the OWA partners, but also with other third parties that they may be dealing with at a later point in time when their concept was getting built. It also illustrates how the Carbon Trust OWA management team enables interaction with the relevant people within the program. Although further strides can always be made, the individuals involved in the Carbon Trust OWA program generally seem to display behaviors of building continual reciprocal interaction over time, as well as transparency, which has facilitated trust-building and knowledge sharing within this context.

We now turn to team characteristics that may best facilitate knowledge sharing, the first of which is peer-to-peer interaction. **Peer-to-peer interaction** focuses on de-emphasizing hierarchy, and instead coordinating through mutual, dialogue oriented, communication and decision-making practices. This approach is particularly helpful in the context of actor oriented innovation projects because the focus is placed on customized and multi-faceted approaches to *knowledge sharing* that are well suited to rapidly changing environments. Peer-to-peer interaction can be identified throughout interactions between members of the Carbon Trust OWA program, starting with the members of the Carbon Trust OWA management team, continuing within the Steering Committee and TWGs, and moving throughout the program, also being found as the primary mode of interaction within Keystone, and between Keystone and the partners of the OWA program. When discussing the interaction between members of the OWA management team, a Carbon Trust OWA management team member said:

> "I would say between all three of us it's quite informal. You saw where we sit – you can touch each other practically from our desks, and I think they're both wonderful to work with. They're both very approachable and not judgmental. That's another reason why I think it's easy to be somebody new coming into the group, because there's so much you don't know, and they're very nice about explaining things and even if you could find the answer another way, they're happy to answer the question, rather than have you spend an hour looking for the answer through your email. They're both really, really good for that. They're supportive."[209]

Words like "approachable," "not judgmental" and "supportive" all identify aspects of peer-to-peer commitment generation, as opposed to compliance generation. There is also a long list of ways in which the OWA management team has found customized approaches to achieving outcomes within this program, but one chosen here for purposes of illustration is how they have engendered greater commitment within the TWGs, namely through electing *project champions*.

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[208] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 29:10
[209] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 5:45

Instead of asking for feedback from the entire TWG on every detail of the project, the OWA management team has begun to focus on specific TWG members (project champions) for their feedback, and then the rest of the TWG gets a general update at TWG meetings, where all TWG members can ask technical questions to the project champion TWG members. As stated by a Carbon Trust OWA member:

> "And so when we would be having a big Technical Working Group meeting with everybody, I mean most of the questions probably can be answered by the Carbon Trust. …But then there might be some questions that are just too technical [because] we are not civil engineers… So then [the project champion] who was also at the meeting with a smaller subset of the Technical Working Group [and the innovator], he could answer questions, and probably would be really happy to answer questions because he participated in the discussion [with the innovator] and the direction [of the project] and probably asked five other questions in addition to the one the Working Group member is asking."[210]

This is a very good example of how the OWA management team has created a customized approach for knowledge sharing between TWGs and innovators. On a very general level, the OWA management team can also be seen as facilitating dialogue between the members of the OWA program to achieve the best outcomes possible. When asked how change was facilitated within individual projects, another OWA management team member clarified:

> "We are talking a lot to the partners before we cast projects into stone. And I think that helps to adjust things before you really kick things off. But there's not a specific change process in place."[211]

Here, the OWA management team exemplifies the importance of continual dialogue for achieving desired outcomes, as opposed to being focused on procedures.[212] Peer-to-peer interaction is also an integral part of the interaction between Steering Committee members and the OWA management team. When asked how he got up to speed on what was going on in the Carbon Trust OWA program, a relatively new member of the Steering Committee said:

> "It was largely what I picked up as I went on really…Talking to [the OWA management team] – calling them up and annoying them regularly… But yeah, we have a good relationship in that sense; they are always very helpful and quite good."[213]

This shows the type of informal peer-to-peer atmosphere that is suggested as fruitful for actor oriented innovation programs. This same atmosphere is shown between the members of the Steering Committee, where one of its members stated:

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[210] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 25:15
[211] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:14:00
[212] See Figure 9, p.92
[213] Steering Committee member, June 4th, 2012. Recording time: 57:25

"I think generally it is a very constructive discussion climate. And it seems to be that everyone is open to share their views. They're not always the same, but it seems to me that they are sharing similar values in terms of: you express your view, present some arguments and so forth, and I just might not agree… if people don't turn in your direction, if you have a different view from the others, it seems that people share the kind of value that it's the majority that will decide."[214]

This statement also shows Steering Committee meetings as having a dialogue oriented environment where majority rules in an egalitarian manner. One suggestion that was made in terms of a customized approach to knowledge sharing that could be utilized in the future is, as specified by a Steering Committee member:

"Off the record dialogues for the OWA, away from the Carbon Trust setting, to discuss. I mean, I come from the shipping industry, and I worked with oil and gas before I joined renewables, and sometimes they share safety information, for example, which is of benefit to everybody in an open forum, but they don't take any notes, and no minutes are made, but we discuss common issues. Maybe that's something that could come out of this as well, could be applied to renewables."[215]

These off the record dialogues are a suggestion for another customized approach to knowledge sharing, and one that the Carbon Trust OWA program has recently applied within the Carbon Trust setting, in the area of cable installation. Creating peer-to-peer interaction between members of the Steering Committee, as well as between Steering Committee members and TWG members is also something that is seen by a Steering Committee member as developing over time:

"I think there's now perhaps more debate at the Steering Committee [level] than there was before, which is good too. So step-by-step I think the Steering Committee has improved not only itself, but also the working of the Technical Working Groups, by sending stuff back to them… So rather than the big picture goals and a bottom up approach, we actually said "well, here are the things we're focused on as well." And we sent that back down to the working groups. And they didn't always agree, and they came back to us and said "we don't agree, we think we should be focusing on this." But it meant that they had to think about it and come up with good reasons to change our mind. So that's been another part of the process that I think maybe was missing in years one and two. I think that's a bit better now. So that will improve year three."[216]

Here, creating meaningful dialogue about desired outcomes is identified as important between Steering Committee members and TWG members, an interaction that is now being facilitated to a greater extent, thus facilitating *knowledge sharing*. If we now turn to the perspectives of the TWG members, peer-to-peer interaction can also be identified between TWG members and the OWA management team. As stated by a Foundations TWG member:

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[214] Steering Committee member, May 5th, 2012. Recording time: 44:05
[215] Steering Committee member, June 4th, 2012. Recording time: 43:55
[216] Steering Committee member, April 24th, 2012. Recording time: 20:25

"I think the nature of [the OWA program] is flexible. I think it's really going again to, if some new thing comes in, or there is some change in one of the contracts, you do find that [the OWA management team] are very much on top of it. And they'll pull a teleconference together very quickly to discuss it. They'll explain it very quickly in some sort of document as well, which helps us to understand what's going on. So, I think they're set up in a fairly flexible way… and the other thing as well is that we've built up quite a good relationship with them. So you know, we know the guys at the Carbon Trust very well, we find them very approachable, they find us approachable."[217]

Here, not only are customized approaches used for focusing on outcomes (by quickly putting together a teleconference meeting to get consensus on new developments), it also shows dialogue orientation and peer-to-peer, egalitarian interaction between TWG and OWA management team members. Peer-to-Peer interaction is also identifiable when problems arise and things do not go as planned, as the following statement indicates:

"One of the things I mentioned earlier was just one of those studies that didn't go as well as we hoped. And I think we just dealt with it in a very rational grown up way, we just said "look this hasn't worked. Why hasn't it worked? What do we need to do differently moving forward?" You know, I think people are quite frank in the meetings really."[218]

This statement shows dialogue that is outcome focused, rather than trying to point fingers and blame someone. Mutual, organic forms of dialogue-oriented adjustment (Mintzberg 1997) are also found within the Foundations TWG, where a member has stated that:

"The interaction between the partners in this forum, our [TWG] group, I think is very good. And also we have different views. You know, we have one view, but we might change it when we hear other, different views. So it's a place to discuss."[219]

This statement also shows the importance of peer-to-peer interaction, which is the ability to discuss (share knowledge) and re-frame one's own understandings based on new information (generating new knowledge). Within Keystone, the team that developed the Twisted Jacket foundation concept also operates through peer-to-peer interaction. For example, the Twisted Jacket Resource Manager stated:

"Some other engineering firms are more formal. … I think it's easier to interact with the upper management at Keystone, and compared to some other companies, where that's more restrictive… I mean the way you dress doesn't matter. But it has more to do with how you interact with everyone else. Either that can be very easy or very difficult or somewhere in between. I think it's fairly easy at Keystone. [220]

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[217] Foundations Technical Working Group member, May 1st, 2012. Recording time: 34:40
[218] Foundations Technical Working Group member, May 1st, 2012. Recording time: 40:20
[219] Foundations Technical Working Group member, April 19th, 2012. Recording time: 33:50
[220] IBGS Foundation Resource Manager, Keystone, Feb. 9, 2012. Recording time: 5:20 − 7:00

Here, peer-to-peer interaction is identified as providing the opportunity for dialogue between all members of the organization, including top management. The Drafting Supervisor on the Twisted Jacket foundation project also said that within his team, he felt:

> "Very supported. Most of the time I just have to ask them for something – no e-mails, no written request, I just ask them or talk to them. [I am] very supported."[221]

Another statement describing how the Twisted Jacket Foundation team is focused on outcomes rather than formal procedures was stated by the General Manager for Offshore Renewables, who said:

> "I don't make the guys come in at a certain time. I don't make them stay until a certain time. I want them to get the work done that they need to get done and I want them to be comfortable doing it."[222]

In addition, the General Manager for Offshore Renewables also found their interaction with the fabrication yard for the Keystone project to be very peer-to-peer oriented:

> "They were very easy to talk to, very easy to work with. We had a more casual back and forth, which is how we work in America – just give a guy a call, ask him a question, and I encourage all my engineers to take the lead and make their own decisions on stuff."[223]

Here, the General Manager is also identifying commitment generating skills by "encouraging engineers to take the lead," as opposed to generating compliance. Also, in describing their interaction with the Carbon Trust OWA TDC, the General Manager said:

> "He was great. Whenever I needed something from him, or he needed something from us, he was very easy to talk to… We could contact him directly and he was very receptive to our suggestions as well."[224]

To conclude the discussion about peer-to-peer interaction within the Carbon Trust OWA program, including how it relates to the idea of knowledge sharing, a quote from a Wake effects TWG member (when discussing the OWA program) is very telling:

> "They [the Carbon Trust OWA management team] bring it all together. You definitely get a lot more interaction than you would, and again sharing of knowledge, than we would do without the OWA. I mean, there are other forums, and there are other research projects, but not ones that I sit on, or spend that much time on. And yeah, you would still meet these

[221] IBGS Foundation Drafting Supervisor. Keystone, Feb. 6, 2012. Recording Time: 28:25
[222] IBGS Foundation General Manager for Offshore Renewables. Keystone, Feb. 7, 2012. Recording time: 7:30
[223] IBGS Foundation General Manager for Offshore Renewables. Keystone, Feb. 7, 2012. Recording time: 12:50
[224] IBGS Foundation General Manager for Offshore Renewables. Keystone, Feb. 7, 2012. Recording time: 8:05

people at conferences, but we feel comfortable in sharing stuff now, so we get more value out of it from being in the situation that the Carbon Trust has put you in."[225]

As is described above, the Carbon Trust OWA program provides an environment of peer-to-peer interaction characterized by customized approaches that are focused on outcomes through dialogue, which generates commitment and facilitates knowledge sharing.

The next issue that will be discussed in relation to team practices facilitating knowledge sharing is *Group cohesiveness*. Group cohesiveness provides a framework for a multi-dimensional approach to knowledge sharing, as opposed to "group think" where everyone ends up with the same approach. Both **interpersonal cohesiveness** where close proximity and care are present, as well as **task cohesiveness** where individuals agree on end goals and examine multiple pathways to get there, are useful forms of group cohesiveness in the context of actor oriented innovation programs, and will be examined here in relation to the Carbon Trust OWA program.

Although interpersonal and task cohesiveness were built up in the first year of the OWA program, it was then eroded between the winter of 2009 and the spring of 2010, when the head of the Carbon Trust OWA program changed four times. The consequence of this continual change in personnel was that the desire to share knowledge in this forum was compromised. According to a Steering Committee member:

> "I have to admit, it was not fun. And I was really wondering if we should continue or not, because I think it's very important to have this continuity in the project in terms of management, because I felt like we had to start all over again, at least with some of the new entrants on the Carbon Trust side. You know, it takes some time to get knowledge out there, and to get mutual understanding of things as you work, and also how the Steering Committee meetings are going to be run…Now it seems that [the current head of the OWA program] has been on board for quite some time… which I think is very good. And I think it's very important… I think it's also about sending signals, saying that this is so important, this is very fun; I will put priority on this."[226]

When group cohesiveness is lacking, it has very important consequences for knowledge sharing, because individuals are likely to have little impetus to interact and share what they know. Indeed, this program was in danger of being disband when change in key personnel created a lack of "mutual understanding" that interpersonal and task cohesiveness create. However, this situation has, since the spring of 2010 been built up again, and both interpersonal cohesiveness and task cohesiveness can be seen throughout interactions in the Carbon Trust OWA program. It should be emphasized from the outset that this process is an evolving one with many complexities involved.

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[225]Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 1:36:05
[226] Steering Committee member, May 11th, 2012. Recording time: 52:05

The following discussion is meant to highlight some of the more general but highly relevant points that came up throughout the interviews.

First, between the small but dedicated group of Carbon Trust OWA management team members, there is a very high level group cohesiveness. Close proximity on a daily basis helps to facilitate interpersonal cohesiveness between them, as stated by one OWA management team member:

> "...and then because we sit so close together, anything that needs changing, it's just the three of us, so it's pretty easy to communicate."[227]

Task cohesiveness is also facilitated in this group by weekly meetings. Continuing her discussion of the management team's interaction, an OWA management team member said:

> "We start the meeting with what the priorities are for the week… so we kind of set the priorities for other people that support us, and then if there are meetings coming up, we calibrate our efforts so we know what we need to get done, and who's going to take the lead on it, and also it's important to know who's leading in case you can support them in some way, so… that's how it works, week by week."[228]

This shows not only a very high level of task cohesiveness in coordinating their activities "week by week," but also interpersonal cohesiveness in relation to identifying when they might be able to "support" one another. When looking to the Steering Committee group, it was generally understood that group cohesiveness and task cohesiveness, in particular, were high among all of the partners. As one Steering Committee member put it:

> "I think the group is a very unified group… I mean we are all developers, and of course we realize that without reduction in cost, there will be no offshore wind, so I think we have a very clear and common understanding as developers. And that's one of the reasons that this is moving the way that it is. I mean we are making very clear decisions that "this is what we should do, this is what we shouldn't do" and all the time focusing on what can really be reducing cost in the end. So they have a very good way of doing that I would say."[229]

Here, the idea is put forward that by all partners being offshore wind developers, there are enough common interests to focus the program and maintain cohesiveness. And indeed, this does seem to be the case, as levels of group cohesiveness seem to be increasing within the OWA program generally. There was also a word of caution raised by a Steering Committee member in relation to task cohesiveness, namely that:

> "There have been some additional aspects added to the program, additional focus areas like Cable Installation and so forth, that's an important area, and then there have been some more

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[227] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 17:40
[228] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 17:40
[229] Steering Committee member, April 18th, 2012. Recording time: 9:15

now around O&M, and Turbine Manufacturers and so-forth. And these are also interesting things, but what I can see now… we are getting at least close to the limit of what we can manage, to keep the momentum going forward… So generally I think it's all working fine… but if I was to raise a concern, then it's about the scope being too broad, and to get good momentum going forward that is dependent on partners engaging of course. But if in some areas only half of the partners are REALLY engaged, then kind of the core of the program has [been lost. So far] all of the partners have been very active, or at least frequently active, in all of the areas. And I think that has been part of the strength as well – the common goal that we have all had in bringing things forward."[230]

Here, having task cohesiveness is identified as a strength of the program, and one that would be lost if projects extend too far beyond current objectives in moving forward. Interpersonal cohesiveness is also seen as being stronger between some members as opposed to others. As stated by one Steering Committee member:

"I mean, there's some partners you can talk to and they may be a partner on another project with you, but also on an individual level. Some people you can talk to on an individual level off the record, and others are – perhaps because of where they are situated, or where they are based maybe overseas, we may not get the same level of trust and cooperation."[231]

This statement also identifies the importance of close proximity for interpersonal cohesiveness. Within the Foundations TWG, one issue that was brought up by a few of the members is that group cohesiveness can be affected by the coming and going of different partner representatives in the Technical Working Group. As stated by a Foundations TWG member:

"I think that it's better now, because now it's more stable. You know, we know the people in the meeting, and it is more stable in terms of who the representatives are from each company. So we know each other better I think. In the beginning… there were huge meetings. I felt that a lot of people had this meeting, not the next, maybe the next after that. You know, switching people all the time. Then it was like "yeah, but we discussed that in the LAST meeting, why don't we remember what was said?" So it was a bit difficult to go in one direction, because of course you have eight partners now… now it's more the same people."[232]

As is shown by this statement, both interpersonal (not knowing who was going to be at Foundation TWG meetings) and task cohesiveness (not knowing what had been discussed) issues have made knowledge sharing difficult at certain points in the program. One thing that has facilitated greater group cohesiveness in TWGs generally is knowing individuals outside of the context of the OWA. The same Foundations TWG noted that other TWG members are:

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[230] Steering Committee member, May 5th, 2012. Recording time: 6:22
[231] Steering Committee member, June 4th, 2012. Recording time: 42:45
[232] Foundations Technical Working Group member, April 19th, 2012. Recording time: 13:40

"…quite close [geographically]. And we cooperate… we travel the same rout. So we meet in several meeting points outside – not only on the Offshore Wind Accelerator. So those are people that I often meet and know… I know more about their view."[233]

Here, we see interpersonal cohesiveness being facilitated through interpersonal interactions that occur outside of the OWA setting, which was quite common among all respondents interviewed. Specifically linking interpersonal cohesiveness to knowledge sharing, a Wake effects TWG member pointed out:

"… the closer you are, the more benefit you get from the different people, I think. Everyone's an expert, but not everyone's an expert on exactly the same stuff, so you end up with a very good overview of all the issues. Some people are more commercially focused, some people have spent fifteen years studying meteorology… it gives a good balanced approach I think… Because these meetings are all chaired anyway… everyone still gets their turn to talk if they want to… [but] the way you can communicate is still quite dependent on how you get on with the different people."[234]

This statement explains knowledge sharing as facilitated by interpersonal cohesiveness, or "being close" and "how you get on" with the other members in the group. If we now turn to Keystone, the head of the organization (managing principal) is understood by all members of the team that worked on the Twisted Jacket foundation as instilling both task cohesiveness, as well as interpersonal cohesiveness in all team members. As specified by a structural engineer:

"[The Managing Principal] is very, very detail oriented and very, very involved. He's devoted a lot of energy and time and money into this, and he takes it very personally, I think. He likes to see every step of the way, and he's always looking for room for improvement."[235]

All members of the Keystone Twisted Jacket project were not only physically close to each other throughout work on this project, they also showed interest in what the others were doing, and they were all very clearly striving to make the Twisted Jacket foundation concept the best that it could be. Taken together, the interactions within the Carbon Trust OWA program generally suggest that more and more group cohesiveness has been built up between the individuals involved over time, although specific issues related to interpersonal and task cohesiveness show that many of the interactions that take palace are still not as cohesive as may be desired for high levels of knowledge sharing to take place.

Lastly, we turn to an overall organizational process that is understood here as facilitating successful knowledge sharing, namely having **basic terms and working knowledge in common**. Not speaking the same technical and managerial language has been identified as problematic

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[233]Foundations Technical Working Group member, April 19th, 2012. Recording time: 22:05 – 25:10
[234] Wake Effects Technical Working Group member, Jan. 13th, 2012. Recording time: 45:25 & 1:32:05
[235] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 8:25

within single organizations (Davenport & Prusak, 2000), suggesting that these issues need to be clarified to an even greater extent for actor oriented innovation programs, where individuals involved will be coming from different organizations as well as different locations. In order to achieve this, it is suggested by multiple scholars (Nonaka and Takeuchi, 1995; Bahrami and Evans, 2005) that **cross-silo forums** can be useful for facilitating interaction to the extent needed to make sure that basic terms and working knowledge is shared. In some ways, the Carbon Trust OWA program can be seen as a cross-silo forum because it is bringing different organizations together to develop new technology. This understanding was also forwarded by a Foundations TWG member, saying:

> "When we're creating all these reports, reviewing all these reports, we're just building a knowledge base. Each individual company and each individual is building knowledge and hopefully using that to everyone's benefit when we're developing these projects."[236]

As proposed by this statement, creating and reviewing business cases is one way that TWG members create basic terms and working knowledge that they can share and develop. On a more general level within the Carbon Trust OWA program, a desire for having a cross-silo forum between technical working groups was indicated by a number of TWG members. One Foundations TWG member, who, when asked if he was missing any knowledge or information in the OWA program, said:

> "I think it's what I said before about the other work streams. I'd like to know a bit more about what they're doing, how they're approaching the whole thing. Because you know there's no right or wrong way of doing this. We're doing it in a certain way, it would be quite useful to know how the other work streams are actually proceeding toward working toward this goal, how they're focusing on different things. I'm sure they would benefit from talking to us as well. So I think that's something that we could do better is interfacing between the other work streams."[237]

The need and desire to have a cross-silo forum between TWGs was also identified by a Steering Committee member:

> "We've had at least one topic where we should have had better and improved interaction between the Foundations group and the Electrical work group, so that's all around cables and getting the cables in the foundation. And then again there should be more interaction between the Foundations work group and the Access work group, because whenever it comes to access systems, it will, or it might affect the foundation itself. So there should be more interaction and I think we are constantly asking for this as a Steering Committee."[238]

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[236] Foundations Technical Working Group member, May 4th, 2012. Recording time: 38:50
[237] Foundations Technical Working Group member, May 1st, 2012. Recording time: 44:00
[238] Steering Committee member, April 24th, 2012. Recording time: 14:50

This shows recognition at the Steering Committee level of a need to have interaction between the members of different working groups, because the work that they produce will overlap, and therefore understanding each other's work – which is facilitated by having common terms and working knowledge – is of utmost importance. If we look within the single company of Keystone, the need for common terms and working knowledge is also identified. As stated by a structural engineer:

> "Well the fact that we all have engineering degrees is really important; in that there's a language that we can speak, that somebody who hasn't gone through that may not follow. Having that language is very important for communicating ideas and thoughts that may not be as simple as making a sketch. And then having various – the fact that we have different Master's curriculum is definitely beneficial because once you get into that stuff it's all very narrow and focused, and so having… a masters in materials… a masters in construction and fabrication [is beneficial]."[239]

Not only does this statement identify the importance of having basic terms and working practices in common, it also identifies the importance of individual diversification and specification, so that individuals can share their knowledge in their respective areas. One way that Keystone facilitates cross-silo knowledge sharing is through what they call "lunch-and-learns." As stated by a resource manager:

> "if you're working on something, and you come across a new way of doing something, or like a new tool like an installation tool or cutting tool or whatever, you think that would help the other engineers with future projects, you would typically have some sort of lunch seminar with everyone to share that information."[240]

These lunch-and-learn seminars were identified generally by individuals interviewed at Keystone as a way that they stay up to date on new working knowledge that may come along and be of benefit to their team. Within the Carbon Trust OWA program generally, there is a very large number of individuals that have to have basic terms and working knowledge in common. Between the individuals in the Technical Working Groups, between individuals in the Steering Committees, between the Innovators and the partner organizations, between the Carbon Trust Management team and all of these various actors, as well as these actors with each other. For this reason, creating a cross-silo forum where all the internal members of the Carbon Trust OWA program attend may be a very good idea.

If we now return to the concept of knowledge sharing generally, there may be many reasons why individuals will choose to share with or withhold from others what they know. What has been

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[239] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 38:00
[240] IBGS Foundation Resource Manager, Keystone, Feb. 9, 2012. Recording time: 45:30

demonstrated in this section is that although interactions are always complex, issues of *trust*, *peer-to-peer interaction*, *group cohesiveness*, and *having basic terms and working knowledge in common*, all play a role in the desire of individuals to share what they know within an actor oriented innovation program. And this brings us to the last section that will be covered under drivers of knowledge management, namely Increased Organizational Learning.

5.2.5 Increased Organizational Learning

Organizational Learning is another construct that is widely applied within the field of knowledge management. The reason for this is simple: without the ability to learn, we would not be able to know. Therefore, knowledge management implies managing organizational learning. Although there are many approaches to organizational learning that exist within management and organization studies, the theory of communities of practice, as described by Etienne Wenger (2003), is the one forwarded in this dissertation as useful in the context of actor oriented innovation programs. The reason for this is that actor oriented innovation programs can be thought of as a particular type of community of practice, or group of people that share cultural practices reflecting collective learning. There are three attributes of communities of practice specified by Wenger (2003) that can be pinpointed as facilitating learning processes in communities of practice. The first is *enterprise*, or "level of learning energy" identified by an individuals' level of initiative, inquiry, and openness to change. The second is *mutuality*, or "depth of social capital" that can be recognized by an individual's propensity to voice problems and help others. The third attribute is *repertoire* or the "degree of self-awareness" about artifacts, discourse and processes used by oneself and the community. The way that each of these three attributes manifests itself within the Carbon trust OWA program will be discussed in turn, and when viewed collectively will describe a complex yet robust community of practice that has been formed over time and contributes to a rich learning environment for its participants. Also, further organizational learning is enhanced in well-formed communities of practice when communities interact, which Wenger (2003) terms boundary engagement. A discussion of boundary engagement within the OWA program will conclude this section on organizational learning.

Within the Carbon Trust OWA program, **enterprise** (individuals displaying initiative, inquiry, and being open to change) is common among the OWA management members, and mixed among the partners (some displaying very high enterprise, and some very low). To start with, the Carbon Trust OWA management team members understand and try to engender enterprise among TWG members. This was indicated when a Carbon Trust OWA management team member said:

> "If we would just write this scope of work, and then do a project, and then at the end present to [the TWG] what we have done they may not like it. It's very likely actually that they will not like it. But by engaging them – so having conference calls to discuss: "what do you

think?" they are feeling more ownership of the projects and I think that helps too with the coordination as well."[241]

By involving TWG members in the process towards completion, TWG members have the opportunity to take initiative and direct the projects so that they best suit the needs of their organizations. The Carbon Trust as an organization has also tried to engender more enterprise from partners by increasing the contributions given if and when demonstrations go forward. As stated by a Foundations TWG member:

> "In the case of the foundations, we know the Carbon Trust is providing an increased contribution to try and insure that these demonstrations happen, which is positive."[242]

Overall, the Carbon Trust OWA program can be understood as providing the opportunity for partner organizations to have enterprise by taking initiative and being open to change, as specified by a Foundations TWG member:

> "The sense that I have is that the Carbon Trust is really the facilitator. They set up the framework so the utility companies can gain knowledge. And we should make an effort to take that opportunity."[243]

Partner enterprise, or "making an effort," is not only understood as desired but also necessary within the OWA program, and the Foundations TWG member then goes on to state specifically what will happen if partner companies lack enterprise:

> "If the utility companies do not recognize the chance to develop one of these [foundations] and take a chance - that's basically what it's all about. For them to take a chance, and to grow some hair on their chest and say "this is an opportunity, we can do this, we can spend this money, we can gain this knowledge, and we can de-risk this concept by building it." And if they don't do that, they're never going to go anywhere."[244]

Since this interview, two foundations concepts have been built, which shows that individuals involved in this program have built up a certain level of enterprise. In describing their own level of company enterprise, as well as that of the entire Foundation's TWG, another TWG member stated:

> "We are fairly active there [in the OWA program]…there are of course times where we could be better, but I think we take on the responsibility. We have to find the responsibility ourselves, and I think we take it on, not perfectly, but we contribute positively, I think… you

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[241] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 56:05

[242] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 12:20

[243] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 1:08:40

[244] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 1:27:25

have some of those observer types that maybe are a little bit more hands-off- But I would say it's maybe about 50/50. The others are contributing very well."[245]

This statement, which was also reiterated by other TWG and Steering Committee members, seems to suggest that although some partners do show a high level of enterprise, there is still room for improvement within the OWA program in general. One of the Steering Committee members identified enterprise when she said:

"It happened in one case that we put two more people on one specific project. Of course the work load was very high and then we said ok, it is really important that we find people to support it."[246]

Enterprise within the Steering Committee group was also identified by a Carbon Trust OWA management team member, saying:

"With [this Steering Committee member] in particular, he always wants to be on every single mailing list. So he is always aware of when Technical Working Group meetings are and he checks that someone is going to them."[247]

The previous two statements identify enterprise within the Steering Committee, where individuals take initiative and inquire about what is happening in the program to make sure the program is moving in the right direction. If we now return to TWGs, one of the TWGs that seems to have displayed high levels of enterprise among its members from the beginning of the program is the Wake Effects TWG. In describing a specific instance in which enterprise was taken by a Wake Effects TWG member, the Wake Effects TDC stated:

"There are loads of examples [of TWG knowledge sharing], but I'll give you one from our very first meeting. We said around the table "right, does anyone have any experience with any novel suppliers? We want something new, does anyone have any contacts with new suppliers of wake effects methods?" Someone put their hand up and said "well actually yes… We've used them for onshore stuff, and we like them. No one else had heard of them in that context. "We think you should talk to them for offshore stuff." You know, and here we are three years later, and we've been working with them for three years, and they've done a good job. That's a positive outcome."[248]

This statement demonstrates an instance of someone taking initiative, sharing what they knew, and thus displaying enterprise, which had very positive consequences for the entire group, as well as for all partners generally. In looking at the concept of enterprise within the Carbon Trust OWA program, it is seen as a necessary condition for program success. Some partners do display enterprise, while others may

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[245] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 1:23:15
[246] Steering Committee member, April 24th, 2012. Recording time: 30:55
[247] Carbon Trust Offshore Wind Accelerator Manager, Jan. 25th, 2013. Recording time: 19:30
[248] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 8:20

not, and figuring out additional ways to increase enterprise among its members may be a very good way to increase organizational learning within the Carbon Trust OWA program.

Next within communities of practice, let us turn to the issue of **mutuality**, which is similar to the concept of social capital, and involves individuals who voice their problems (so others have a chance to help them), as well as helping others. Helping to create mutuality within the Carbon Trust OWA program, as stated by a Foundations TWG member, is the fact that:

> "The competitive side between those developers, I think is secondary to the communal need to reduce foundation costs. And if we all realize it, that's great. I don't think anyone's primary driver for being in this is to specifically reduce their costs of energy relative to the other developers. I think it's just a general drive to bring down the cost of offshore wind. For example… we have a lot of other energy production methods, from coal to nuclear. And I think we want to bring down offshore wind in relation to them, so its… I don't think there's too much of a feeling of strong competition between the developers on board; I think that's very secondary."[249]

Here, one of the main reasons for cooperation in the Carbon Trust OWA program is presented, namely that the partner organizations participating do actually have a common problem: needing to reduce the cost of offshore wind. Because of this common problem, individuals in the program feel, to a certain extent, that they are "in the same boat," and leading them to both voice problems and help one another. As stated by a Carbon Trust OWA management team member:

> "Another very strong point of the OWA is that people understand where companies, where certain companies have certain expertise and strengths and weaknesses, and they build on each other… So you have a conference call talking about a business case on cable installation and you know that this partner has a real expert in this particular field. So all the other partners are very much listening to him. And you can ask questions. And to a certain extent he's directing this project probably more than some others. And they all have their certain strengths in certain areas."[250]

Reiterating this point and providing yet another example, and further explaining how it leads to knowledge sharing, a Foundations TWG member said:

> "I think we do rely on different members to provide information. I think everyone recognizes that different companies and different individuals that attend on their behalf do bring different expertise to the table, and there are instances where we'll talk about a certain topic, for example installation of jackets, and you might say "Ah, We know your company's just done a huge project, and you worked on it, so care to share?" And it would be pretty much said in that manner, it often is – and they will share some findings."[251]

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[249] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 25:20
[250] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:09:30
[251] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 8:00

Despite these positive statements of mutuality between partners, there are also challenges that are faced. For example, one challenge has been that when a particular TWG has many different projects with different foci, mutuality between TWG members can be difficult to achieve because they have different interests. This was pointed out by a Carbon Trust OWA management team member who said:

> "The Foundations group, I think that group is quite huge. There are a lot of people, and there are a lot of studies that are perhaps more interesting to some people than to others. So maybe the group isn't as cohesive as the Wakes group. But I have found that people in that group, when you hit the subject that is of interest to them, they are very helpful, and happy to assist you, so it's good."[252]

One way that this challenge has been partially overcome is by taking cable installation projects out of the Foundations working stream (Cable Installation became a separate working stream in Sep. 2012). By taking people who focus on cables out of the foundations TWG, it may help the remaining members to feel more "cohesive" and able to share knowledge on their area of expertise. Stressing the importance of face-to-face interaction for mutuality to be developed, a Carbon Trust OWA management team member described the interaction between individuals working on cable issues before it became a separate working stream:

> "If you want to do more activities, using the findings of some of the reports that we've done, we need some more face-to-face meetings. So a classic example is on cable installation. We've got a recommendation that we've got to do three or four different activities to reduce cost of cables, but most of the interaction to date has been by conference call. There has only been one meeting with everyone there. And that means that people aren't as bought-into the project or the findings. And to be effective the Technical Working Group needs to be bought into something, and then recommend it to the Steering Committee."[253]

This identification of the need of "by-in" is similar to the concept of mutuality – that individuals are willing to make an effort to make sure that it succeeds (by voicing problems and helping others). At the Steering Committee level, many of the respondents identified a feeling of mutuality among the group. One Steering Committee member discussed both the need for mutuality, as well the fact that mutuality seemed to be present between Steering Committee members when she said:

> "Everybody needs to tell the truth about their needs. If we don't it will be difficult… From the beginning it was very, very, very open discussion, which I appreciate a lot. So of course we have our ideas about what we can do and what we can't do, but in general the discussion –

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[252] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 12:40
[253] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:33:40

especially when it comes to technology and technology development and all facts around technology – is very open."[254]

Within the Keystone group that worked on the Twisted Jacket foundation, there is a tremendous amount of mutuality between the individuals who worked on the project and interacted with one another every day, having conversations and asking each other questions and helping each other multiple times a day, as stated time and again throughout interviews with accounts like:

"You know you interact with everyone every day so it's easy to work here in that respect."[255]

However, when working with members of the Carbon Trust OWA program, a missed opportunity was also identified, having to do with a lack of mutuality between Keystone and the TDC that impacted subsequent interaction with fabricators and resulted in a lost opportunity for organizational learning. As stated by the Keystone Managing Principal:

"I thought the second one (TDC) just had a… he ran it like a paid project, where he had to produce a report, were these four or five fabrication contractors gave pricing to do these different concepts. But there was no real advancement of the innovation. He didn't run it in a way to advance the innovation. You know, what I was hoping for… I would have loved to have been in a room with the four fabricators, and say, let each one of them start throwing out ideas about 'how is the best way to fabricate? How is this?' And let them in the same room with us, and we ask questions, and try to generate some kind of consensus, where we produce a design that's probably the most efficient for people to fabricate… What they did was like for example, with the installation contractor, they priced it out based on what we gave them, and then they said: "Well, what do you think they should do differently?" And they might write three or four things that they make a suggestion about. Some of them might have been valid, but some of them probably indicated that they didn't understand the concept, which meant that the first number really wasn't that valid. So, I thought that was just a tremendous opportunity lost… What I'm interested in is what I can do to drive my costs down. How can I advance the innovation? That's what I'm interested in. We didn't get that opportunity which I thought was a loss."[256]

This statement provides an excellent example of what happens when someone (in this case a TDC) is lacking mutuality (treating the interaction like a "paid project") in an actor oriented innovation program. It is not just one individual or group that loses out, but many – in this case Keystone, as well as fabricators and installers (and all of the partner companies, who may have ended up with an even cheaper and better foundation option for their offshore wind farms).

Overall, however, interaction within the Carbon Trust OWA program can be seen as having facilitated greater and greater mutuality over time. As well stated by a Wake Effects TWG member:

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[254] Steering Committee member, April 24th, 2012. Recording time: 6:45 – 7:10
[255] IBGS Foundation Resource Manager, Keystone, Feb. 9, 2012.Recording time: 4:35
[256] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 1:34:20

"I think we're starting to settle in – we know our roles quite well, and we're starting to get an appreciation of where people really know what they're talking about for different bits, which is always useful… A lot of it is to do with the people that actually sit around the table, and who they are… we're getting more and more open, and communication is getting a lot better, and a lot easier."[257]

On a more general level, one way to identify that mutuality is present is by the number of concrete advancements that have been made by the Carbon Trust OWA program, which would not have been possible if participants did not share their problems and help one another. These advancements can be understood as a part of the OWA program's **repertoire**, which has developed not only in terms of attracting new partners, but also in terms of making technical advancements in the industry and proving multiple foundation concepts.[258] Conveniently, repertoire is also the next issue to discuss in relating the Carbon Trust OWA program to communities of practice. Access to all of the results that the Carbon Trust OWA has produced thus far (including results from the Foundations Competition, a new Wake Effects tool and access to the results of the Access Competition) as well as interaction with eight other offshore wind developers, was a repertoire appealing enough to attract a ninth member to the list of partners of the OWA program. The reason why this is significant is that, as stated by a Carbon Trust OWA management team member:

"They paid everything since stage one of the beginning of the OWA. But they also have access to every single thing, every result that was ever published in the OWA."[259]

There was also a problem relating to repertoire that was resolved when the ninth company joined the Carbon Trust OWA program, relating to being able to use results produced by the OWA program. As stated by a Foundations TWG member:

"The problem [is] that we're involved in projects, we've got joint ventures, and the joint venture partners are not members of the Carbon Trust. So we have to be very careful about how we use information – so we can't officially use the reports, etc."[260]

Then, when the 9th partner joined the Carbon Trust OWA program:

"It made that problem disappear. I mean it still might happen but I think now that the OWA partners represent seventy-seven percent of the offshore wind consented lands by the Crown Estate. So hopefully that's enough that it will cover most of the bases."[261]

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[257] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 1:28:55
[258] See Table 1: Carbon Trust OWA Timeline of Organizational Change
[259] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 8:35
[260] Foundations Technical Working Group member, May 4th, 2012. Recording time: 7:19
[261] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 9:25

So, because a large number (seventy-seven percent) of participants in the Crown Estate UK Round III have jointed the OWA program, the general problem of not being able to share information with joint venture partners has decreased. Having new members join the OWA program has made communication and organizational learning easier for the companies involved because it gives them not only a physical, but also a contractual environment in which to learn together as projects get completed for the OWA program. One other very positive aspect of the Carbon Trust OWA program has been a clear IP promise that they have made to innovators. As stated by a Carbon Trust OWA management team member:

> "We worked out that what was really important to the Energy companies was that new ideas got to the market. And to get the best ideas, they should keep the IP [Intellectual Property] – not the energy companies, the innovators should keep the IP. And if you look at other research programs that are out there, that run competitions, they typically ask for IP. And that means that you don't always get the best ideas, because the best ideas – they don't want to share their IP with anyone else. So the way that we structure the contracts is that we say that the OWA members will fund the development of the idea, and we won't take any IP, but if the product reaches market, then the energy companies in the OWA have the right to negotiate preferential terms to use the technology. So that could be something like a reduced licensing fee to use a technology on a certain number of units. And the innovators seem to be quite happy with that approach."[262]

This strategy has been an extremely effective aspect of the Carbon Trust OWA program's repertoire, as it has continually and increasingly attracted new ideas to the program. For example, the first Foundations competition that was run attracted just over one hundred entrants from all over the world. Then, the second competition for Access Systems attracted around four hundred and fifty applicants. This shows that the *clear IP promise* supported by the Carbon Trust OWA program does give confidence to innovators that they can put their concepts forward without having to worry about ownership issues, thus allowing the partners to learn from the vast amount of knowledge held by this diverse range of innovators. Overall, the repertoire of the OWA program has been built up over time. For example a Steering Committee member pointed out that:

> "The improvement in terms of the organization has been step-by-step. I mean some of the processes were missing at the beginning. We should have had a process on data, [describing] what gets out in the public. We should have had that at the beginning. Doing it again you'd put that in place immediately."[263]

Another area where the Carbon Trust OWA management team has developed their repertoire is by hiring two new members. As stated by an OWA management team member:

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[262] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 21:25
[263] Steering Committee member, April 24th, 2012. Recording time: 20:25

"We've recently hired a team of people. So before there was just the three of us, and now we have [two more] that are also part of the OWA team… [and] we don't really have fixed job Descriptions, you just work on whatever's the most pressing at the time, and so maybe I'll talk to you about contracting today, and then [someone else] will contact you about contracting tomorrow, and he'll also talk to you about delivery. You know there was a little bit of frustration that people had, you know: "I don't know who to contact when I have to send invoices or when I have a question about this." So we did a bit of a grid for them [the partners], of who was responsible for what."[264]

As this statement reveals, the Carbon Trust OWA program is not only developing its repertoire in terms of increasing the capability to physically manage the program (by hiring new management team members), but the repertoire is also developing in terms of clarity, dividing tasks between OWA management team members and identifying who should be contacted in relation to each specific issue (which is also increasingly necessary with more people joining the management team). Despite all of these developments that have positively impacted the program, increasing the repertoire, a word of caution was also voiced by a Steering Committee member in relation to the scope of the OWA program:

"What I do see… is now my impression of [the program] floating out of the scope, so to say. So there is not only the cable installation, but now there are also talks about O&M [Operations and Maintenance] and so forth and so forth, and that's not in line with my expectations. [I am] not necessarily saying that it's completely wrong always, but along with my initial concern that with a scope that is too broad, we might lose focus, and then momentum and that would not be good… And if you then take it to the extreme where more and more partners choose not to prioritize Technical Working Group tasks, then eventually – well sooner rather than later – you will have an issue with both people considering whether what they're doing is relevant or not, and that effects the actual quality of the work."[265]

The main concern expressed here is that if the scope of projects undertaken by the Carbon Trust OWA program is too extensive, then the partner companies will begin to either lose interest or reduce resource investments to support all of the activates (or both), which would seriously affect the ability of these organizations to learn together and from one another.

Let us now turn to Keystone, and their repertoire concerning the Twisted Jacket Foundation, which was successfully installed at Hornsea in the fall of 2011. In terms of the Twisted Jacket foundation itself, part of the repertoire that supports this foundation is that it has been built previously in the Gulf of Mexico, where it withstood a hurricane:

"without any problems at all, whereas other structures disappeared… we put this in just before the hurricane, and it had no damage whatsoever."[266]

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[264] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 13:25
[265] Steering Committee member, May 5th, 2012. Recording time: 59:15 – 1:02:25
[266] IBGS Foundation Drafting Supervisor. Keystone, Feb. 6, 2012. Recording Time: 10:55

This is one aspect of Keystone's repertoire regarding this concept that can help to insure partners that this concept is durable. Adding to Keystone's repertoire is the knowledge that individuals working with this project have gained by installing their Twisted Jacket concept in the North Sea. As stated by a Structural Engineer:

> "In the North Sea, they have their own way of doing things in comparison to the Gulf of Mexico. And that is knowledge – knowing all that, that experience alone, you go through it once the first time. So that is great, we got that done. Now as a group we know what to expect. We definitely can share that knowledge with each other, like "oh, well, we should do it this way, don't you remember this particular client likes it this way?" and "there's actually this zone of the North Sea. You have to leave from this port at this time and they have this type of problem," or "they have water depths like this." Or "actually in this area of England, the soil is typically like this, so we may have to have piles this length." Those types of things certainly help." [267]

This statement shows a process of organizational learning that took place while building and installing this concept in Europe, which Keystone will be able to use in any subsequent Twisted Jacket foundation installations for any of the partners in the Carbon Trust. The repertoire of the Carbon Trust was also identified by Keystones Managing Principal as being very clear in terms of what they desired from the foundation innovators:

> "[The Carbon Trust] had a pretty good definition of what they wanted. We pretty much tried to give them everything they asked for… the other thing that I think helped us explain our concept was that they had a limit on how many pages was allowed to submit. What we tried to do was put everything we could on pages. We had to make the cartoons really small. But we tried to show that everything we had worked. And we think that helped. That helped the people evaluate and say that this was a game changer, this was something different." [268]

So, despite the problems of mutuality described above with one of the TDCs, overall the repertoire that was built up by the Carbon Trust OWA management team in relation to this foundation concept was robust, and contributed to organizational learning for each of the partner organizations (who learned about the Keystone Twisted Jacket), as well for Keystone (members of whom learned more about European requirements and conditions for building and installing their concept). This would suggest that overall, members of the Carbon trust OWA program have a high degree of self-awareness regarding this community and the organizational learning opportunities that exist and are exploited.

To conclude the discussion about communities of practice, let us briefly turn to what is termed boundary engagement. Active boundary engagement at **interfaces** (where boundaries are common and problems are shared) is understood as facilitating organizational learning through,

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[267] IBGS Foundation Structural Engineer 2, Keystone, Feb. 8, 2012. Recording time: 1:11:45
[268] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 45:00

for example, challenging previously held beliefs, discovering new ideas leading to problem-solving, or creating new and important discourses or processes that help the community *in* practice. For the Carbon Trust OWA program, there are a great number of important boundary interfaces to be considered both within and outside of the program. There are, for example, boundary interfaces between 1) internal company representatives for each partner company, 2) the Carbon Trust Management Team and TDCs, 3) the members of the five TWGs, 4) the nine developers, 5) the developers and the innovators, 5) the different innovators, 6) the innovators and the fabricators, and 7) the offshore wind industry and the oil and gas industry. Rather than describe each of these boundary interfaces in detail here, examples will be given describing ways in which these interfaces are being facilitated, or reasons that they need to be facilitated further.[269] One example of a boundary interface that is being facilitated between the Carbon Trust OWA management team and all TDCs are quarterly TDC meetings. As described by a Carbon Trust OWA management team member, these meetings are becoming increasingly effective for purposes of learning:

> "Rather than having [TDC meetings] every month which I think was a bit exhausting, we're having them just every quarter, and then two of them are face-to-face [and the other two are conference calls], so I think it works a lot better… We still do the updates, but now after the updates we have questions like "what are the things that you like most about being part of the OWA?" because people who have been with the program a long time, they might have some really interesting reasons that maybe somebody else hadn't thought of…and then we also have a section on "what are the problems you're facing right now?" Maybe the Technical Working Group or this forum can help you, because some of the problems happen multiple times… we had one project where getting data from turbine suppliers was really difficult and now that's happening in a second project, so there were good lessons learned to be carried through."[270]

Here, TDCs are identified as able to share positive aspects of the program, as well as problems that they may be having and lessons learned across the working streams. The Carbon Trust OWA program has also positively facilitated the boundary interface between the developers and the innovators through a novel technique, which is explained here by an OWA management team member:

> "So last year we had an innovator workshop… [And] this year… we are going to have seven tables, and each of the innovators gets a table. And then we're going to do like a speed dating kind of set up. So the innovator will stay at the table, and then Technical Working Group members will rotate. The TWG members will get thirty minutes with each table… And then

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[269] For a more thorough description of each of these boundaries, including suggestions for further interfacing activities, please see section: 6.2 Sub-question one: To what degree can synergies be formed for the development of the organizations' knowledge resources?

[270] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 9:25 – 11:40

we figured it would be more engaging for the Technical Working Group because it would be smaller discussions and it would also be two and a half hours of feedback [and discussion] for the innovators rather than thirty minutes [as it had been previously]."[271]

 Not only will there be more personal interaction in this context (between individual TWG members and individual innovators), there will also be a lot more time for innovators to discuss their concepts, because they discuss with different TWG members (for two and a half hours total), instead of all TWG members (for a half hour total), which for these reasons seems to be a positive development in the interface between TWG members and innovators. There has also been recognition of the importance of increasing the boundary interface between members of different TWGs, as was pointed out by a Carbon Trust OWA management team member saying:

> "There is also this interface that needs to be managed quite carefully because you have the Foundation guys that are developing foundations, and then you have Access people who are developing new access systems. And in the end the access system needs to fit on the foundation, and so there are those interfaces – or for the electrical side as well. So if you look at cable installation, can you do it with the different foundation designs? So it's quite important."[272]

In addition, a Carbon Trust OWA management team member identified trying to increase interaction between TWGs when she said:

> "we've also started to invite Technical Working Group members in one group to another group. So electrical and cable, we've tried to get the cables guys more involved in the electrical group and vice versa."[273]

Here we see that the interface between TWGs is acknowledged, and is still in the process of developing to a greater extent. Another interface that also needs to be developed to a greater extent is that between the oil and gas industry, and the offshore wind industry. As stated by the Keystone General Manager for Offshore Renewables (who worked for offshore oil and gas for a number of years):

> "There's a lot of lessons from oil and gas that can be learned for offshore wind as well. We've got the expertise on how to build jackets and how to install them, and hopefully the industry will realize that. Because it seems like we've kind of gotten a nose up in disdain when you mention that you had an oil and gas background, which is a shame because we do – we have a lot of knowledge, like I said, about offshore structural engineering. I mean we're the ones who've been doing it for fifty years."[274]

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[271] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 43:20
[272] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 23:55
[273] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 15:25
[274] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time: 45:10

This shows a potential problem within the offshore wind industry in general, which seems to be a "not invented here" mentality that they need to overcome in order to get as much learning as possible, and thus not make mistakes that could otherwise be avoided.

If we look back at organizational learning within the Carbon Trust OWA program as a whole, it seems to be a good example of one large community of practice (containing many smaller communities) that does collaborate and learn together in order to reach the desired level of innovation and cost reduction. Describing the OWA as a learning environment, and the way in which it is best facilitated, a Carbon Trust OWA management team member stated:

> "One of the benefits for the energy companies is to learn from each other. And they only get that opportunity if they're meeting face-to-face, rather than dialling into a conference call. So I think you'll get a much more focused discussion if you've got a face-to-face meeting, and if you've got all the partners there, then you can learn from each other and come to a common decision."[275]

This is perhaps THE reason that the Carbon Trust OWA management team schedules regular Steering Committee and TWG meetings – precisely to facilitate knowledge sharing and organizational learning. It should also be acknowledged that although organizational learning does take place within this program, it is not always completely open, and people are also cautious about what they say in certain situations. This was well explained by a OWA management team member who said:

> "[Partners] would talk candidly about issues that they would have, like "oh we don't think that this standard is written properly." But they will still be guarded with how they discuss that. They're not going to say which project they have used that type of method for; they will just say they struggle with that method. So we don't have the final outcomes from the Keystone project available to everybody because that's a bit of a confidential thing, and if you didn't pay, and you're not part of that project, then maybe you don't get all the learning from it. So things like that happen. People are careful about what they share, even if they do have good working relationships."[276]

This statement also supports the idea of the Carbon Trust OWA program as an instance of semi-open innovation as argued in chapter three. It would not seem that individuals within communities need to share all information and knowledge that they possess in order to have a well-functioning community. What is important, as discussed in this section, is that individuals within a community build enterprise, mutuality and repertoire, and that they interact at boundaries, where their community meets others, and interfaces (where problems are shared) exist.

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[275] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:30:25
[276] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 22:10

5.3 Knowledge Management *Obstacles*

Let us now turn to the obstacles of knowledge management. As specified in chapter four, the issues that are discussed as obstacles are understood as obstacles to the theoretical development of the field of knowledge management research, and may lead individuals within organizations or actor oriented innovation programs to question whether or how knowledge management might be used effectively. Chapter four also suggests methods for pro-actively dealing with each of the "obstacles" of knowledge management, namely the issues of 1) tacit knowledge, 2) culture, 3) conflict, complexity and the discovery of unknown unknowns, as well as 4) size and geographic dispersion. In this chapter, the methods for proactively dealing with knowledge management "obstacles" will be discussed in relation to the Carbon Trust OWA program, to see whether and how this program has dealt with each of these issues in practice, and the degree to which this case supports conclusions presented in the theoretical analysis.

5.3.1 The Tacit Knowledge Challenge

Ikujiro Nonaka, along with his colleagues, made great strides in popularizing knowledge management with his "Dynamic Theory of Organizational Knowledge Creation." Perhaps the main reason that this model became so popular is the way in which it separated tacit and explicit knowledge, describing processes to enhance each type of knowledge within organizations, both separately as well as together. The problem with this model is that it has led scholars and practitioners to think that explicit knowledge can exist without tacit knowledge, and because tacit knowledge is less tangible, it is seen as an "obstacle" to managing knowledge. This understanding has turned the focus of knowledge management in the direction of information tools and repositories, suggesting elaborate ways for people to share and store what is written down, verbalized or depicted. However, from an organic paradigm perspective, and in line with the scholar Polanyi (who, ironically, Nonaka bases his conceptualization of tacit knowledge upon) all knowledge contains an element of tacit, implicit understanding. For example, the most detailed engineering design still needs to be interpreted by those who turn the design into a structure. Simply put – without individuals and their interaction, knowledge is not possible. If we accept that "tacitness" is a natural and necessary part of knowledge, then the next question becomes, how do we best access or come to understand the tacit elements of what people know?

One way that people can access the tacit elements of what others know is through **storytelling**. The reason that stories have been used for thousands of years to convey rich meaning is that they can be engaging, entertaining, vivid, and easily related to personal experience. (Leonard, 2007) Stories can also be used for building frames, or mental models, that enable us to connect concepts in different ways. (Wiig, 2004) The two types of stories that will be focused upon here (following

the theoretical analysis) in relation to the Carbon Trust OWA program are narratives and antenarratives. Narratives are stories describing *past* events that can aid individuals in the present to identify similar events or patterns and take appropriate action. Antenarratives are stories describing an ante or bet on the future that can provoke new mental pathways or steps to attaining a desired outcome. Respondents interviewed as members of the OWA program told a great number of both interesting and informative stories throughout the interviews conducted.

Let us first examine some of the **narrative stories** that were told in the interviews. In telling a narrative describing how partners in the OWA program feel about being part of the program, an OWA management team member said:

> "I think people, when they go [to OWA meetings] are pretty excited to go. I think if you were a developer, and you were part of this, it would be a perk. Because you're particularly well regarded within your company, and there's a bit of prestige associated with going, I think. So when people go they're excited, it's like they're happy to be there… During one Steering Committee that I went to, one of the partners is there, and he opens by saying what a privilege it was to be sitting on the Steering Committee, and he just liked how it had been run. We had another meeting right before Christmas, and it was actually over the phone, and one of the partners again took a moment to say "you know, I really enjoy being a part of this group, I've learned a lot from everybody, and I just wanted to thank you." It was really emotional, it was strange. But that's my impression, is that it's a real privilege for these people to be asked to be part of it."[277]

Telling stories about how Steering Committee members, and OWA partner members in general, feel about being part of the Carbon Trust OWA program could reinforce positive engagement from current partners, and direct new participants coming into the program to feel similarly, engendering a feeling of excitement about being part of the program, and thus eliciting engagement. One of the Foundations TWG members told a narrative about why knowledge flow needs to be improved in the offshore wind industry:

> "There is a gap between oil and gas, and the ability of the offshore wind industry to transfer knowledge from oil and gas. They have, as I see it, within the wind industry, defined themselves as their own discipline, and they are evolving independently of the oil and gas industry. The problem – the reason that I say this is that the oil and gas industry has been facing a lot of overlapping issues with offshore wind over the last 40 years. And you would, if you were naïve, think that maybe those guys in the wind industry would try to do things the way that oil and gas did, if they didn't know anything else. But that is not happening. And the question is "why is that?" And I think there is something fundamental here that with designers in the wind industry, there are not so much seeing themselves as offshore guys as electricians, if you like. So that means that they do not focus on issues that are quite important… So the way that this information has now been taken in by the wind industry is by making errors. And then they note it down – not to do it the next time. So here there is knowledge or

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experience that is not transferred I don't really know how this is to be improved in a general way... We will just have to do what you do in oil and gas when you are dealing with offshore engineering companies. You write up a contract that is so detailed that you cannot [mess it up]..."[278]

This narrative story expresses frustration about the state of the offshore wind industry, because of a lack of learning between the offshore wind industry and the oil and gas industry. This story also provides one possible solution, which is making very detailed contracts, and seems to invite antenarratives about what could be done in the future to improve the situation when he says "I don't really know how this is to be improved."

The next narrative is about a difficulty that the OWA program has had with fabrication and installation fabricators. As stated by a Foundations TWG member:

"When we were doing the fabrication and installation cost studies what proved very difficult was getting the people who were meant to be giving us the information, getting them to engage properly in the process. They would give us programs for when they were going to do the work, but then they just wouldn't deliver to us, and would almost disappear off the face of the planet. So I think people had a very difficult time trying to work out what they were doing and why we weren't getting the information. So you know sometimes we'd have a meeting and the information we were hoping to have just wouldn't have been produced... it's difficult to get them to engage when you know, for example, for a big fabricator... they're working on, for example, a one hundred and fifty million pound contract to build some foundations. And therefore a ten thousand pound contract to do some cost estimate is not going to be on the top of their list of priorities. This is just something that we find across the board really. It's been difficult to do that. I don't know whether you can change the scope of work slightly to maybe put milestone payments in, that's something we've considered I think, to incentivize them a bit more, maybe having prize funds instead, to get them some sort of reward for actually achieving something rather than giving them a lump sum to do something for us."[279]

This narrative story explains a problem that has occurred within the Carbon Trust OWA program, and saying that it happens "across the board really" may alert people to the fact that the problem might arise again in another area. This story also suggests how it may be overcome in the future, so that the situation does not arise again.

Next, the Managing Principal at Keystone told a very interesting story about new innovative concepts, and the need to have both a good concept to bring forward, as well as good marketing skills. When discussing comments that the Twisted Jacket foundation received from the partners of the OWA program, Keystone's Managing principal said:

"...they didn't know whether we were good marketing or technical people, [and] I think it's both. In order to bring a good concept to market, you have to have a really good basis. I have

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[278] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 1:13:20
[279] Foundations Technical Working Group member, May 1st, 2012. Recording time: 31:00

a really good friend… and he came up with a way of using interchangeable bar lens force for spreader beams for making lifts. And he is a multi-millionaire; he's made hundreds of millions of dollars. He's now building these huge vessels that lift toppled-over platforms out of the Gulf of Mexico. But when he was first trying to get his idea [off the ground], I would see him on the plane going to Euston all the time, and he had, like a cigar box. And he has a bunch of strings, and little pieces of plastic in there, and he would go to different people's offices, and he'd rig all this up, and he'd show how all his little spreader bar stuff works, and that's how he sold his idea. And John has this personality, he's just so bubbly, and he has one of these very outgoing types of personalities, but he's got this mind that's always thinking about new ideas and different things. And you know, that's how he sold his idea, he had a good technical basis for it, but then he had the skill to bring it to market."[280]

This story gives some insight into what it takes for some of the new concepts that are being developed through the Carbon Trust OWA program to get to market.

One last narrative story that will be put forward here has to do with knowledge management, and the reason that personal interaction is so necessary. As pointed out by the Wake Effects TDC:

"This hasn't happened in the OWA, but it's the kind of thing that exercises me. We've evolved in some of the R&T [Research and Technology] projects trying to look at some of this – let say you're designing a new aircraft, and you look at your old aircraft and go "oh, right, there's a widget on there, and it's that size, and it's that shape, and I don't know why it's that size and that shape. So you look back at this old aircraft from 10 years ago, and Mark One had no widget on it, and Mark Two had a widget on it, and Mark Three had a really big widget on it. And you want to know why ten years ago it went from Mark one to Mark Two, and from Mark Two to Mark Three – And just trying to capture that knowledge, because you probably won't find out. If you can't find the guys who actually worked on it, you probably will never find out… If it's something like lightning struck Mark One, therefore we had to put a lightning conductor on Mark Two, it would be in the record. But if you're interested, for this new aircraft, in a particular issue, and actually they didn't even think about it, there is no way that you will find a record that says "we didn't think about…." … I know one big engineering organization – whenever someone retires or leaves the company, they're interviewed, and they record and transcribe everything they say. And it takes a day minimum. They really try to [capture a lot]. The problem is it doesn't work. Because if you say "oh, I really want to know how they did that widget," and he was the guy who did it, great! Well we can look at his tapes, and look at his transcripts, but it doesn't say anything about the widget. Well that's because you didn't ask him about the widget. You know, you can't ask every question. I do not know what the answer is. I mean, you're not going to get the perfect solution."[281]

Although it is a bit lengthy, this story does a great job of describing why information repositories can never replace individuals and their interaction in terms of facilitating knowledge processes. Because people have different experiences and knowledge bases, the elements of information

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[280] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 52:45

[281] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 54:00 – 58:30

they may need to complete a process will undoubtedly be different in some aspect, which requires interaction to be able to learn from others.

If we now turn to **antenarrative stories**, one of the Foundations TWG members did a very good job of envisioning a needed future where technological advancements bring down the cost of offshore wind, as well as identifying what it will take his company, and the other OWA partners, to get there:

> "[Our company's] motivation for being involved is, I think, the realization that the industry is still quite immature, so there is a need for some technological development. And the fundamental driver will of course be the cost of energy. So it's very important to be committed, if you are going to pursue the offshore wind industry, and there is quite a need for solving some of the cost driving parts of it. For example, in my case the foundations are still too expensive, and they are inherited from oil and gas. And oil and gas had quite a different kind of budget. There has not been that much focus on the cost side of it up until now. But you know, I would say the offshore industry started in early 2000, while oil and gas started in 1965, but they were focusing previously on robustness, and sustainability of the structures, and now we need to add the constraint of cost also. So it's there that I hope to see that OWA can provide development if you like. But it's also very important for [our company] to actually follow up on what other players in the industry are doing, and I think it's a good forum for discussing this, because major players are involved in this forum."[282]

In telling this antenarrative, this TWG member is 'betting' on a future where the goal of bringing down the cost of offshore wind energy is reduced by sticking with the goal of developing new, lower cost, technology, and discuss the process of development with other developers in the industry.

Next, an antenarrative told by a Carbon Trust OWA management team member will be presented, one that tells a story of the need for experience sharing within the area of cable installation:

> "One thing that is interesting at the Technical Working Group level – with the Cables group, we started out the year talking about how there's so many Cable problems but a lot of knowledge is just kept within companies and people never talk about it… So we talked about this again, [and] at our last Cables meeting we decided that we would try to organize an experience sharing workshop… there was one partner in particular that has the most experience, the one who has the most to share and the least to gain. I spoke to them in particular about it, and we decided that having some kind of general topics to be discussed, and not talking about a specific project, but just about projects he worked on in general could be interesting. That particular developer asked if he could go last so depending on what he heard, they could choose what they would share, which is fine… So we will be doing this. This is probably one of the first times we've had this kind of lessons learned workshop so I

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don't know how it will go… but it took a lot of discussion to get to the point of even picking a date so I'm quite happy that there is a date for one."[283]

By telling the story (some time ago) of the need for experience sharing regarding cable installation, members of the TWG (including the OWA management team) were able to think about possible steps to share this information, and come up with solutions that would not expose particular companies to bad press, but instead create an environment where developers could learn from each other's experiences.

The last antenarrative story to be presented here is one told by a Steering Committee member, describing how the vision of focusing on "big wins" is reinforced within the Steering Committee group:

> "In looking at the electrical projects… I think there were five projects. So we had scored one a 1, and the rest 3s, which is like forget about it, you know. 5 is discarded, and 3 is sort of "well, we'll have a look at them, and maybe some other time." But somebody had marked the first two as 2s, and the last three as, well, 5, 2, and 1 – which we had marked as 3s. But a very short debate ensued, and it didn't take long before everybody said hmmm… the first two projects are the right ones, and the other's we'll just leave. And that was just, I think, going back to the goals. What is the goal of this, what do we want? And it was around what I said earlier about having a big goal. Because it's alright having the small little projects that are chipping away if you want, or eking away at costs in a good way, but ultimately the Offshore Wind Accelerator, when we go back to our boards at the end of this, and when the Carbon Trust goes back to the government, it needs to have one or two big ticket wins. And I think that message got through today. And within ten minutes everybody agreed. So that was good."[284]

Here, the Steering Committee member describes envisioning the end of the OWA program, and envisioning what will make it successful in the eyes of senior managers and government officials. And this antenarrative also seems to be sufficiently clear to very quickly get everyone on the same page in terms of which future projects to focus on.

We now move from stories, where tacit elements of *individual* experiences may usefully be conveyed by an individual within an organization or program, to **mentoring**, where tacit elements of one or more *groups* may usefully be conveyed by an individual within an organization or program. Mentoring is a useful and necessary process that was identified throughout interviews as taking place within the respondent's respective organizations. Keystone's Managing Principal, for example, was identified by nearly all the respondents I interviewed at Keystone (including some that I did not interview, like a receptionist), as a very good mentor. Perhaps the best

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[283] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 31:45
[284] Steering Committee member, April 24th, 2012. Recording time: 16:20

example of what makes him such a good mentor was identified when asked about what makes someone a good teacher, to which he replied:

> "Communication. Just try to be willing to share the idea, be willing for the student to reach their maximum potential, and be willing to allow the student to take credit for doing that work. And I think understanding when there is a question in a student's mind that you need to assist with, or provide more information about."[285]

These attributes seem very close to what is needed for mutuality in a community of practice (communicating openly, trying to understand the needs of others and be willing to help them), which would suggest that mentoring may be a good way for mutuality to be built between individuals and groups. Within the context of the Carbon Trust OWA program, mentoring has also been used successfully to facilitate interaction and knowledge processes between developers (energy companies) and innovators. As articulated by a Carbon Trust OWA management team member:

> "We've also started doing a bit more informal mentoring between the energy companies and some of the innovators. So in the access competition we're supporting between thirteen and twenty innovators, and we've asked that the energy companies who are most interested in a concept will mentor them – so, give them a bit of informal advice as to how to improve their concept, so that they're getting more one-to-one feedback from the energy companies."[286]

The OWA management team member then went on to explain what has resulted from this mentoring between the developers and innovators, saying:

> "I think there are some good success stories. There's an innovator who has developed a transfer system for offshore wind, and they entered our competition, and they got to the interview stage, but we rejected them in the end, and we said there was an issue with the way they designed their concept. It required the developers to add more kit onto the structures, which was going to add lots of money to their wind farm, so it wasn't a good thing to do. And at first they didn't really accept that, and they said "we're not going to change our design," and we said, "well, we're not going to fund you." But after getting that feedback, they had more interaction with [a developer] who had been a supporter of them for a long time, and they've actually changed their design now, so they've taken it on board. And I think it's because they've got a good relationship with [this developer], so [this developer] can help them understand what the feedback was and explain why it's so important to them."[287]

Here we see not only one of the ways that the Carbon Trust OWA program facilitates mentoring between the different parties involved, it also describes the positive changes that have happened with new innovations because of it. This example, or story, also shows a degree of mutuality

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[285] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 7:20
[286] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 46:30
[287] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 47:10

because the innovator understands the needs of the developers and helps to accommodate those needs to the benefit of all parties involved. In sum, knowledge management is often separated into tacit (personal) knowledge, and explicit (easily codified) knowledge. This dissertation rejects such a separation, and instead forwards the idea that all knowledge is personal knowledge, containing both tacit (difficult to share) and explicit (easy to share) elements. This section has suggested that in order to understand the more tacit elements of what others know, both storytelling and mentoring may be efficient and effective ways to access the more tacit elements of knowledge generally.

5.3.2 Knowledge Management and the Cultural Dimension

The second concept to be discussed under knowledge management obstacles is that of culture. In general, people are understood as being better able to share knowledge when their cultures are the same or similar (Davenport and Prusak, 2000). With this understanding, people having different cultural backgrounds (which is typical for actor oriented innovation programs), would then be expected to understand each other less, making them less able to share what they know, and this is why culture is classified as an obstacle of knowledge management.

Chapter four describes the typical classification of culture (as either national or organizational) as too simplistic, and therefore lacking in its ability to explain or capture the complexity that exists within and between people. As an alternative, it is suggested that culture may usefully be thought of as a mosaic - comprised of a number of different *cultural tiles* (cultural influences) that may not seem to match perfectly, but collectively combine to create a picture (of an individual). The significance of this mosaic analogy for collaboration within actor oriented innovation programs is that individuals need to find a few similar cultural elements (*cultural tiles*) to build common understanding upon, and once this is established, dissimilar *cultural tiles* can contribute to, for example, creating new shared understandings, challenging one's previously held ideas, and possibly even creating something new. There are three aspects that are highlighted in this section (corresponding to the theoretical analysis) as particularly important for effectively managing knowledge between people, with relation to their culture. The first is *the forming of shared cultural identities*, or common frames of reference that, once developed, should facilitate trust and knowledge sharing within interactions (much like communities of practice). The second is the presence of *individuals that link groups together*, who can find commonalities between groups and elicit meaningful understanding and interaction. Thirdly, having a common purpose within an actor oriented innovation program can elicit *synergy*, where a mixture of *cultural tiles* can expand knowledge bases and help to find new solutions to problems. Each of these three aspects will now be related specifically to the Carbon Trust OWA program, analysing the degree

to which these aspects are supported by the case as important for collective understanding (culture), thus facilitating knowledge processes and action.

In relation to the first important aspect of effectively managing knowledge with relation to culture, namely **the formation of shared cultural identities**, the Carbon Trust OWA program has a wide range of shared cultural identities between its members. Perhaps some of the groups where cultural identities have become most shared (forming communities of practice) is in each of the separate areas identified in chapter three, Figure 2: Organizational Structure of the Carbon Trust OWA program, as depicted September 2013. To a greater or lesser extent, shared cultural identities have formed between members of 1) the Steering Committee, 2) the Carbon Trust OWA management team, 3) each of the five Technical Working Groups individually, and 4) each of the many innovators and designers individually. As primary interviews were conducted within each of these four areas, some insight will be given as to the degree of shared cultural identities formed within each, which should also give some idea about the complexity of relationships within the program generally. If we start with the Carbon Trust OWA management team, this team can be understood as sharing a great number of *cultural tiles* and having formed a very strong shared cultural identity, as seen by statements like this one from an OWA management team member:

> "You saw where we sit – you can touch each other practically from our desks, and I think they're both wonderful to work with."[288]

Sharing almost all of the information that each member of the management team has with one other, in addition to physically sitting next to each other on a regular basis, provides a very strong bond of shared cultural identity. If we then look at the Steering Committee, this group of individuals - in addition to meeting in the Steering Committee meetings - has a varying degree of contact with the other members outside of the OWA context. Some of the partners work on common projects, and others meet in other research contexts, but in terms of commonalities, one Steering Committee member said:

> "I would assume that most of the people that are members of the Steering Committee have at least a bit of technical background. And so they have, in a way, a similar culture and this helps… one thing is sure, that the personal relations between the people in the Technical Working Groups, and in the Steering Committee, these will remain. And this will support the industry also in the future."[289]

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[288] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 5:45
[289] Steering Committee member, April 24th, 2012. Recording time: 7:55 – 39:35

This statement identifies a common technical background as an important cultural "tile" that all the Steering Committee members can draw upon, which seems particularly important for a program that is developing technology. Also, it would seem that rather strong shared cultural identities have been built up within the Steering Committee, acknowledged by the understanding that personal relationships between members will persist after the OWA program has concluded. In addition to lasting relationships between Steering Committee members, this statement also refers to lasting relationships between Technical Working Group members. Through the interviews conducted, it would seem that this is a very complex issue, and that shared cultural identities have been built up to a greater or lesser extent depending on the working group. For example, as one OWA management team member related:

> "So Wake Effects – because they are wake experts, they are very focused on their specific field. That's just what they do. They're very blinkered in a way. And on the Foundations you have people who may be addressing a range of different issues… it's more a variety of people looking at different aspects… [Within the Foundations group] if you are discussing a certain area where this person is an expert than this person would talk more. But then other people are listening to this expert so you have this exchange in a way of expertise between companies which is quite useful. This group then is obviously bigger because you have more people… [and] they may be less responsive as well; if I send out an e-mail, a question about a certain aspect then they may say "well I don't know anything about this so I won't reply," where on the Wake side they're all very much behind exactly this particular thing, so they probably will have a higher response rate."[290]

Because of the high degree of technical interests between members of the Wake Effects TWG, it would seem that this TWG is particularly high level of shared cultural identity. Within the Foundations group, interest may diverge somewhat, leading to a group that does not have as high a level of shared cultural identity as, for example, the Wake Effects TWG. This point was reiterated by a Foundations TWG member who said:

> "It's different because… each partner will have its own agenda. Each partner will be developing different sorts of projects. They'll have their own reason for wanting certain pieces of work being done, or certain studies to be done. Therefore you're never quite sure if you're hearing the whole story from each partner. At the end of the day, this industry is sort of notoriously secretive anyway – I think people are quite reluctant sometimes to be too open with certain pieces of information."[291]

Here, reservation in willingness to share knowledge is identified, which may be due to a lack of shared cultural identities. However other members of the Foundations TWG group identified similar cultural elements with one another such as: being partners with one another on projects outside of the OWA program; companies being physically located next door to one another;

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[290] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 5:45
[291] Foundations Technical Working Group member, May 1st, 2012. Recording time: 48:20

being state owned as a similarity between different companies; working in other consortiums with one another; and even having:

> "…the same philosophy on a lot of things, even though they don't always focus on the same concepts – we have the same drive for technology development, I think."[292]

All of these represent different cultural elements or *cultural tiles* that work towards creating a feeling of shared cultural identity between at least certain members of the Foundations TWG. If we now look at Keystone, there is undoubtedly a very high level of cultural identity between members of the team that worked on the Twisted Jacket foundation. This is well represented by statements like:

> "I'd say internally since we're a small group, and we all sit next to each other, someone could answer my question in a matter of minutes and if they couldn't then I would just have to call someone [else from our group] right then, and they could answer my question immediately. And they wanted to. Like I said we were all on the same page. And so this was on their mind constantly, and so, yeah they wanted to make sure it was done right."[293]

Here, cultural identity is demonstrated by the fact that everyone in the group is "on the same page" and willing and able to answer any questions from other group members "in a matter of minutes," indicating shared cultural frames of reference, or *cultural tiles*. Despite this high degree of shared cultural identity within the Keystone Twisted Jacket foundation group, there was not a chance to build any shared cultural frames, or *cultural tiles*, between Keystone and the other companies that worked on fabricating and installing their structure. As stated by Keystone's managing principal:

> "So you couldn't take and merry the engineering and the installation into one team effort. We lost the ability to produce a team effort… there was no real agreement on our side. You didn't have any ability to negotiate what you were going to do, what they were going to do, how it was going to work, who was going to take care of what, how you were going to make this work. So a lot of times we got shut out of what I think were some critical technical decisions, and also how the project was executed. And I'm not saying we could have saved them a lot of money, but… they hadn't worked offshore. And so they were relatively new in this offshore business, and we think we could have helped them even more if we would have had better access… particularly in this demonstrations stuff – new technology. You have to be careful that you don't isolate your engineering from your construction – I think that's a mistake."[294]

This shows not only a lack of cultural identity formation between these parties, but also a need for it particularly in actor oriented innovation programs, in order to share knowledge to the

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[292] Foundations Technical Working Group member, April 19th, 2012. Recording time: 23:25
[293] IBGS Foundation Structural Engineer 2, Keystone, Feb. 8, 2012. Recording time: 38:30
[294] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 31:45

greatest extent possible. What has been described here is just a very small portion of the different cultural elements or *cultural tiles* that respondents identified throughout the interviews conducted. Needless to say, there are many complexities involved.

Now, moving to the next aspect of effectively managing knowledge with relation to culture, **individuals that link groups** together will be examined. In the case of the Carbon Trust OWA program, it is the OWA management team who links groups together, and there are very many ways that they facilitate this. As stated by an OWA management team member:

> "**[1]** Whenever we launch a new project, we provide background material for the Offshore Wind Accelerator to the consultants who are going to deliver the project, and also a brief overview to the Technical Working Group members who are on the project, who might be on it for the very first time. **[2]** Then in terms of sharing the information with senior stakeholders in the energy companies, we have summits every year which summarize the findings over a day. So we have a day's workshop where up to five people from each energy company come and attend, and see what we've achieved in terms of identifying cost reduction. **[3]** We've got the steering group meetings, which have representatives from all the energy companies, plus Carbon Trust, and they're held every eight weeks, roughly. So those are the major meetings that we have to take decisions. And they are normally scheduled in London, from 11:00 – 16:30. **[4]** And then in terms of internal meetings – the Carbon Trust Team… we will have a weekly meeting for two or three hours that reviews the status of the different research areas. And we format actions based on those. **[5]** Then we've got calls with the TDCs on a regular basis… we'll [also] have a specific meeting with a Technical Delivery Consultant about an upcoming deliverable that they're producing, or a Technical Working Group meeting that they're running, or an issue with their delivery, something like that to make sure they are on track. To keep pushing them forward…. **[6]** We had about forty contracts that we ordered last year, so… we meet with the legal team every week. **[7]** And then if we're running competitions, we use our marketing team, so we'll engage with them around a specific competition to make sure that we reach the market as effectively as possible. **[8]** We also have to engage with our IT team quite often, to make sure that all our users can access our SharePoint site… **[9]** Finally, the Carbon Trust gets funding from the Department of Energy and Climate Change, and from the Scottish Government, Welsh Government, and the Northern Irish Government, so we have to provide reporting to them. So we have meetings maybe every quarter with the Department of Energy and Climate Change."[295]

This lengthy statement points to nine different groups that the Carbon Trust OWA management team interacts with regularly, in order to make sure that expectations are aligned, and the project can move forward. Also, when asked about keys to future success, the same OWA management team member said:

> "I think the Carbon Trust is improving the way that they interact with the Technical Working Group, to get a clearer steer from them on what they want to do, and what's important to them. And I think if we continue to build on that, then it will make it easier to get things done. The Carbon Trust probably needs to have some more face-to-face meetings with the Steering

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[295] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 14:00

Committee members as well, to really understand what their agendas are, and what they're planning to do in the next couple of years as well. So we're going to plan some more face-to-face meetings in the next couple of months."[296]

Since this interview, the OWA management team has been highly involved in, for example, the Foundations TWG (as well as chairing these meetings), which should make them more able to connect this group to other groups with similar interests. Also, while I was conducting an interview at one of the partner companies, I saw one of the OWA management team members there as well, suggesting that the OWA management team has also made an effort to talk to partners one-on-one in order to understand their perspectives, to find ways that they can be incorporated into the OWA program. I was also able to sit in on a conference call between the OWA management team and a TDC who, along with his colleagues, was planning a workshop. During this meeting, an OWA management team member was saying:

"We need a clear path forward from [your company,], saying "this is where we are" "this is what we think about each entry [selected from Access competition] – clear recommendations on concepts – clear recommendations on sea trials."[297]

The TDC responded by saying:

"If you could see us now, we are sitting in the room with flip charts, graphs, pie charts, etc. and we will condense this to make it simple and understandable for the partners. In a way, we will have to use a qualitative view of performance [but we will have] seven metrics for evaluating each concept, [and] also an eighth looking at the stability of the connection mechanism." [298]

This statement shows that the TDC [who acts as a type of technical support team for the OWA management team members] is also trying to provide links between the innovators presenting their concepts, and the partners who will then help to evaluate each. This workshop was also viewed as very successful by partners and the OWA management team after it occurred, suggesting that the TDC, together with the OWA management team, was successful in creating links between these two groups in a meaningful way. Overall, the OWA management team members are seen as doing a good job of connecting different groups to the objectives of the program as a whole, creating common frames, or *cultural tiles*. These *cultural tiles* are also created when the OWA management team connects groups to each other (for example, connecting innovators with the partners), to achieve the programs objectives and further the development of the offshore wind industry.

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[296] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:37:50
[297] TDC call regarding Access Systems Workshop, Jan. 18, 2012. Quotation is from notes taken during the call.
[298] TDC call regarding Access Systems Workshop, Jan. 18, 2012. Quotation is from notes taken during the call.

The third aspect of effectively managing knowledge with relation to culture to be discussed here is the idea that having a common purpose can elicit **synergy**, where knowledge bases can be expanded to find new solutions to problems. Within the OWA program, synergy can be identified where different needs are integrated into the work on projects, and there is no domination by one partner (where all partners have a somewhat equal voice). As stated by an OWA management team member:

> "The way decisions are made now is really good, that structure… I think people have a bit of trust in the decision-making process… that their projects – if they have a good case – will get funding, and also that it's kind of open – that anybody can elevate a concern to that level… There's a Steering Committee meeting every couple of months. So I think just that things get addressed, and brought up, and every issue is kind of open. So that's something that I think is good, and it should stay the same."[299]

A Steering Committee member also spoke of the Carbon Trust OWA program as having a large benefit for his organization because of its ability to create synergy. As he put it:

> "There's so much work to be done. And there's no point in us all doing it independently. So being able to identify common core projects – industry led, not led by government or academics, or whatever, but industry led – saying "here are the things we need to concentrate on" has a huge benefit for all of us, because as I said, if it wasn't being done this way, we'd all be paying for it ourselves… And a lot of the debate that goes on in the Steering Committee is really trying to find those sweet spots."[300]

This explains exactly what creating synergy within the Carbon Trust OWA program can mean for the partners.

Next, explaining that synergy seems to be present within the TWGs, as well as cautioning about the need to maintain synergy, a Steering Committee member said:

> "And my impression from what I hear from the Technical Working Group is that there is a generally good participation from the partners and so forth, but it's also that, again, coming back to - we are only going to be as good, and provide as good results and as relevant results, as… it's a function of how much we and the other partners can engage in the working groups. So the minute [our company] can't participate in a particular Working Group, that's bad for [our company] of course because there might not be the relevant things being prioritized because we were not taking an active part; we won't get all the results out of it, because we were not engaging; and also looking at the Technical Working Group, we'll lack one of the partners, and that will make the Technical Working Group weaker as well."[301]

This statement stresses the importance of generating synergy, namely of voicing needs and working collectively to achieve them. If one partner is not participating, it will affect the entire

[299] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 25:55
[300] Steering Committee member, April 24th, 2012. Recording time: 4:25
[301] Steering Committee member, May 5th, 2012. Recording time: 1:02:25

group because they will no longer be sharing equally, and it could lead to other companies' hording rather than sharing what they know, and in the worst case a breakdown of the entire cooperation. Synergy was also identified as the reason for sharing knowledge within the TWGs, as stated by a Foundations TWG member:

> "[The main motivation for sharing knowledge is] the fundamental idea of the fact or hope that there will be a symbiotic evolution of technology… I know that when people get together and share information, ideas will emerge. This is the best way of evolving. No one can sit alone, so it's better. The more you get ideas to spread back and forth, the more likely new ideas will spring out of it. That's why I am there."[302]

Sharing information and ideas for the 'symbiotic evolution of technology' is exactly what is meant by synergy in the context of the OWA program – an actor oriented innovation program. And synergy is found to be present within TWGs. Perhaps synergy is most present in the Wake Effects TWG, where the Wake Effects TDC has noted that:

> "Most of the time [the Wake Effects TWG members] are remarkably consensual. But there have been occasions where there's a disagreement, and we just have a vote… everybody gets a vote, and they discuss it, and you know, there are differences of opinion, and we try to adopt an approach where we only do it if everyone agrees. So there might be six things on the table, and there are only two of those that everyone agrees are worth doing, well the other four don't happen. So that's ok, as long as that leaves you with a substantial project. If it doesn't, or if that leaves you with zero, then you would have a problem, but I must admit, we've never gotten that far. If we did get that far, I'm confident that the Technical Working Group that I've got would find a way to have some common ground."[303]

Despite the large degree of consensus and synergy that is achieved in the Wake Effects TWG, it should also be acknowledged that it can be a challenge to find consensus when there are so many partners involved, each with their own pipeline objectives and levels of knowledge and experience. As stated by a Steering Committee member:

> "I think the drawback is, I mean, we are many parties here. And we have different focus in the different companies in terms of technology, and technology improvement and development, and I think we have to always achieve consensus in order to proceed. And I think in many respects it can be very difficult, and we have many different agendas as companies… I think once you're a lot of developers on board, I think we just have to live with the fact that we have different agendas... I think it's more like a challenge for those that are running this program – the Carbon Trust in this case."[304]

This statement not only explains the difficulty with forming synergy between so many partners, it also identifies the key role of the Carbon Trust OWA management team in linking groups (in this

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[302] Foundations Technical Working Group member, May22nd, 2012. Recording time: 1:04:55
[303] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 14:40
[304] Steering Committee member, May 11th, 2012. Recording time:12:20

case the partner companies) together, so that they are able to form synergy. Two methods for increasing the likelihood of synergy, as specified in chapter four, are cross-silo forums and knowledge fairs. Knowledge fairs are defined as a type of temporary gathering where "sellers" can attract "potential buyers." Most of the ways that knowledge fairs are facilitated within the Carbon Trust OWA program have already been touched upon previously in this chapter, and for this reason they will only briefly be named and described here. One knowledge fair that the Carbon Trust OWA program puts together, as specified earlier in this section, are Summits, where Steering Committee and their bosses (who approve funding for the program) are invited to a one-day presentation and discussion about the work that goes on in each of the TWGs. As stated by a OWA management team member:

> "You get a lot of good discussions there… it is kind of neat to have all these senior people in a room talking about the industry problems that they'd like the program to be focusing on."[305]

As stated here, summits provide the opportunity for partner organizations to evaluate, better understand, and possibly impact what is taking place within the OWA program, as well as make decisions about "buying into" further participation. ***Innovator workshops*** (as discussed in section 5.2.5 Increased Organizational Learning in relation to the concept of boundary engagement and interfacing) are another type of knowledge fair that the OWA program facilitates, where TWG members (potential buyers) are able to engage with innovators (potential sellers) on a one-to-one bases. This was reiterated by an OWA management team member saying:

> "I think that's a pretty hugely valuable experience for them [the innovators], to have all of your potential future customers come in and say "you need to look at this, and this and this, and if you do those things…. We'll give you more money to keep developing your idea."[306]

Another type of knowledge fair facilitated through the OWA program (not previously discussed in this chapter) is having Turbine Days, where, as stated by a Steering Committee member:

> "The turbine manufacturers can give short presentations to the OWA members and then they get good and closer contact [to each of the partners]."[307]

This is yet another example of a way in which sellers (the turbine manufacturers) can attract potential buyers (the OWA partners). Because the OWA program is very focused on creating a competitive and robust market for offshore wind, knowledge fairs are something that the Carbon Trust OWA management team is interested in facilitating where possible.

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[305] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 34:55
[306] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 33:30
[307] Steering Committee member, April 24th, 2012. Recording time: 24:55

Another good way to facilitate synergy, as specified in chapter four, are **cross-silo forums**, where critical interfaces are identified, and face-to-face interaction is facilitated. Examples of cross-silo forums where given previously in this chapter (in section 5.2.4 Knowledge Sharing in relation to facilitating having basic terms and working knowledge in common). In general, if you look at each partner organizations participating in the Carbon Trust OWA program as a silo, then the program itself can be perceived as one large cross-silo forum because it brings together technical experts from nine different silos (partner organizations). In section 5.2.4 each TWG was identified as a cross-silo forum, and additional cross-silo forums were found to be needed between the different TWGs, and between the TWGs and the Steering Committee. Reiterating this point, a Wake Effects TWG member said:

> "I'd be interested to see more about what happens in those [Steering Committee] meetings, and I don't really know how their decisions are made… I mean, a five minute chat with me about something doesn't necessarily give you all the information you need to make a good call on that judgment necessarily… And I think that would be kind of interesting, just to know more about what the Steering Committee does, and share their knowledge a bit more with us… I [also] don't really know a lot about what's going on in the other work packages [TWGs]… So maybe a bit better communication I think between the work packages [TWGs] would be quite interesting." [308]

For this reason, it was suggested that a cross-silo forum be created for all of the internal members of the Carbon Trust OWA program. Keystone was also found to have cross-silo forums in section 5.2.4 through, for example, what they term lunch-and-learns, gathering many engineers together to learn about a new tool or share working knowledge.

In relation to culture, the Carbon Trust OWA program is seen as having a very large number of *cultural tiles*, or cultural elements that exist within and in common with other participants. Cultural frames do seem to have been commonly built between members of, for example, the Carbon Trust OWA management team, Steering Committee, TWGs (to a greater or lesser extent depending on the TWG), and Keystone engineers working on the Twisted Jacket foundation project. When interacting with one another, shared cultural identities have to a greater or lesser extent been built as well. The OWA management team is understood as having done a very good job of linking these different actors to the OWA program, and to a greater or lesser extent to one another through, for example, knowledge fairs and cross-silo forums.

We now move on to the issues of conflict, complexity and the discovery of unknown unknowns within the OWA program.

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[308] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 1:43:30

5.3.3 Conflict, Complexity and the Discovery of Unknown Unknowns

Conflict and complexity are often seen as creating uncertainty and preventing smooth processes from yielding specific results. K.I.S.S. (Keep It Simple Stupid) is a good example of this pervasive sentiment that is common within management literature generally (and the reason for classification under obstacles of knowledge management). However, a different conceptualization of conflict and complexity is called for in chapter four, one suggesting that rather than viewing these concepts as obstacles to be overcome, they should instead be viewed as natural processes occurring within the knowledge processes of all organizations. As stated by a Carbon Trust OWA Steering Committee member:

> "We know that we live in an uncertain world, and we have to continue to balance risks of all kinds."[309]

For actor oriented innovation programs (where new technology is being developed in turbulent markets), it is particularly important to realize that conflict is often necessary for the development of knowledge, (Stacey, and Griffin, 2005) and the effective implementation of new ideas (Davenport, and Prusak, 2000). Also, embracing complexity is a way for organizations to be more flexible, and create awareness of their environment and how to adapt within, and change it. Embracing complexity also provides the opportunity to uncover unknown unknowns (things that one didn't know that one didn't know), leading to the ability to more effectively manage knowledge processes. The following five suggestions (as presented by Weick and Sutlife, 2007) are given for incorporating conflict and complexity into organizational routines to create dynamism and robustness: *raise doubts to raise information; encourage alternative frames of reference; put a premium on interpersonal skills; revise assessments as evidence changes; and treat all unexpected events as information*. Each of these five suggestions will now be considered with relation to the Carbon Trust OWA program, discussing whether they are prevalent and useful in this case for managing knowledge towards the end of building and sustaining innovation.

First, **raising doubts to raise information** has to do with creating an atmosphere that encourages critical reflection. Questioning not only information that one receives from elsewhere, but also one's own pre-understandings by asking questions like "am I missing something?" can facilitate new and possibly critical information about a knowledge process. Within the Carbon Trust OWA program, the Steering Committee can be seen as raising doubts and questioning the development of the program in many different ways. As stated by one Steering Committee member:

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[309] Steering Committee member, April 24th, 2012. Recording time: 32:55

"I myself ask questions at the Steering Committee meeting, you know, if maybe a Technical Delivery Consultant has not lived up to expectations in terms of delivery of work and progress and quality etc. etc. We have that discussion continuously."[310]

Questioning "progress" and "quality" "continuously" is one way in which doubts are raised, to raise information. Another Steering Committee member, when discussing the possibility of adding other activities to the OWA program that are outside of the scope of the current TWGs, said:

"I'm not always against adding new things, but it needs to be very carefully thought through, and understood – what are the pros and cons with bringing in additional topics – broadening the scope."[311]

This statement describes a situation where a Steering Committee member is being critical, while still remaining open to changing his opinion. Within the Foundations Technical Working Group, a Foundations TWG member identified the group as a whole becoming more willing to raise doubts to raise information when he said:

"I guess that certainly is what happens when people are letting their guard down, you know, that they're putting their views and comments out there, and people can feel free, or more willing to do so. Especially if they disagree with that view, they can feel compelled to say something… And it definitely is affected by the facilitator, down to the way that they communicate, and their presence, and the way they ask questions, or the way they present material."[312]

Recognizing the role of facilitators is also important, as this statement specifies, for creating an atmosphere where people feel comfortable expressing their opinions and raising doubts even when their view may differ from someone else's. If we now turn to Keystone, the Drafting Supervisor who worked on the Twisted Jacket project stated that they raise doubts to raise information even when they are working with very limiting time constraints. As he put it:

"We check our work; we check all our work before it leaves. So we have a lot of checks. A lot of checks before it leaves and goes to the client… Both inside and outside, mostly, actually, we use a checker who is outside of this group. Somebody who has knowledge of the offshore industry – you've got to have that." [313]

By having someone outside of their group check their work, they can have any doubts raised before a product leaves their organization, which can increase the quality and certainty of their work. Overall, individuals involved in the OWA program seem to do a good job of raising doubts to raise information, undoubtedly increasing the quality of the program on the whole.

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[310] Steering Committee member, Dec. 14th, 2011. Recording time: 18:35
[311] Steering Committee member, May 5th, 2012. Recording time: 59:50
[312] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 5:00
[313] IBGS Foundation Drafting Supervisor. Keystone, Feb. 6, 2012. Recording Time: 37:15

Second, **encouraging alternative frames of reference** is a way to combine, challenge, and develop one's knowledge. Individuals have the ability to compare and contrast frames of reference in unique ways to develop new understandings. Encouraging alternative frames of reference can discourage over-simplification and help to avoid problems before they arise. The Carbon Trust OWA program encourages alternative frames of reference in a number of different ways. As stated by a Carbon Trust OWA member:

> "Since the Cables [TWG] is so new, we've introduced a guest speaker series. So we invite different cables [experts] to each meeting and then we ask the Technical Working Group who they want to hear from… Some of them don't have a huge commercial focus and say "we have a really cool technology, look at what this thing can do," and then the Technical Working Group says "yeah, but how much does it cost? What's the business case for offshore wind?" And then they say "I don't know." So it's good for them as well… so they leave and have homework to get back to us." [314]

Here, both TWG members and cables experts are encouraged to consider alternative frames of reference when interacting. The way that the OWA program is structured also encourages alternative frames of reference. As stated by an OWA management team member:

> "In the context of the OWA [there is]… lots of insight from people in the energy companies and the rest of the industry, and I guess that's the knowledge base that we're working from and trying to develop. So we'll identify something that we're not very sure what the answer is, we don't know how to do something, and then we'll try to build knowledge that will help us to understand it a bit better."[315]

In trying to "develop" the "knowledge base" of the industry, the Carbon Trust gathers many experts, each with different frames of reference, and tries to understand things better by combining the knowledge held by the OWA members, as well as drawing in knowledge from individuals outside of the OWA program. Having a number of experts come together in the TWGs is also identified by a Wake Effects TWG member as contributing to a reduction in "unknown unknowns," where experts communicate to make sure that they are not missing anything important. As he put it:

> "You've got the known unknowns, and then you've got the unknown unknowns, so the trouble is… say we've got noise in our scatter, and we're trying to reduce it through further development because we think at the moment that scatter is caused by "x" and "y" processes. So we're going off and modeling those, seeing if that will reduce our scatter. But what we don't know is if there are other processes that are affecting it more, that we just haven't identified. We can only investigate the things we're aware of. But what we do have is a lot of experts on board, and we hope that if we don't know it, and the guys we consort with [through

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[314] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 52:10
[315] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time 1:15:35

the OWA program] don't know it, then it's probably fine that we didn't, I don't feel like we're muddling. We've got access to the most advanced knowledge we can have."[316]

In this instance, having alternative frames of reference available can make one feel confident that one is not overlooking anything vitally important. It was also mentioned by a Steering Committee member that discovering what other individuals' frames of reference are, can usefully be facilitated in an informal context, and that this could be facilitated to a higher degree in the OWA program. When talking about the Steering Committee members, he said:

> "We are always rushing into these meetings, and rushing out for a flight back home again… you don't have that whisky with them afterwards, or the night before… having a drink or two after the meeting, to talk over things we discussed during the Steering group meeting… sometimes that social thing breaks down barriers, and you tend to get more out of these things than the Steering Group meetings."[317]

As clarified by this statement, interacting socially can provide individuals with a better understanding of why other people have particular opinions, which gives better insight into the frames of reference that they are working with, and gives one the opportunity to re-frame one's own understandings as well. The concept of combining different frames of reference to find an optimal solution to a problem is also a concept that is well understood within Keystone. As stated by Keystone's Managing Principal, when working on installing the Twisted Jacket Foundation:

> "We had an interface with another company that was providing the instrumentation, and for whatever reason their contract wasn't awarded simultaneously with our design contract, so we had a lot of last minute changes to where the equipment was located, and we had to come up with… we had something that was already designed, and we had to come up with a way of making it work, or fix it. So there were a lot of team discussions about how to make this work… Our normal approach when the project team is presented a problem is to have a little meeting – address what the problem is, get some ideas on paper, or just on the chalk board, or talk about some ideas, and try to get an initial path forward were we go in and explore different options to correct the problem or challenge that's facing us."[318]

As is demonstrated here, the typical way that problems were solved for the Twisted Jacket foundation project was to encourage different frames of reference (suggesting different alternatives), and discussing each to find the best alternative. In addition to encouraging alternative frames of reference, the Carbon Trust OWA program and those involved with it seem also to **put a premium on interpersonal skills**. The head of the OWA management team, for example, was identified by one of the other OWA management team members as displaying a high level of interpersonal skills when she said:

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[316] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 1:12:50
[317] Steering Committee member, June 4th, 2012. Recording time: 1:22:45
[318] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 23:40

"When he interacts with some of the TDCs that we have that are underperforming, he's nice, but he doesn't let things slip either. So I think he's a good manager in that sense, and if somebody doesn't do something properly, he will address it in a nice way. He might send them an email and not cc their boss, asking them to fix it. But if it is a problem, he'll escalate it. I work really well with that type of manager."[319]

This statement shows one way in which the head of the OWA management team displays interpersonal skills. The importance of these interpersonal skills was also identified in a story that was told about the head of the OWA management team. As stated by another OWA management team member:

"I was at a meeting yesterday with some people that worked for the government… And I was just hanging around at the end, and I was thanking the guy who organized it… And basically the guy from the government that I was speaking to was saying that [the head of the OWA management team] predecessor was not so well liked… And so even though he had all of the skill sets – his resume was very tailored to succeed at the job, he didn't. And so the story that I was told is that since [our current head] has taken over, everybody's quite happy with it [the OWA program]."[320]

This story does a good job of illustrating that it is not only technical skills and capabilities that are important for succeeding, but also interpersonal skills. Interpersonal skills are particularly important for this actor oriented innovation program, a program that interacts with such a large number of different individuals on a regular basis. Interpersonal skills are also very helpful for resolving miscommunications, as clarified by an OWA management team member:

"Language barriers are certainly an issue. Maybe not a massive one, but it's a cause for miscommunication I think… Maybe you need to be a bit more patient with individuals to let them explain themselves. Maybe you ask as well, just to make sure that you understood correctly."[321]

Here, suggestions are given for how to proactively deal with situations that might otherwise cause frustration, and to avoid miscommunication, practices that can definitely be seen as positive interpersonal skills. The Wake Effects TDC also displayed a high level of interpersonal skills during a TDC call that was observed. During the TDC call, the Wake effects TDC was saying that his company wanted a statement from a sub-contractor:

"We want a statement saying that they are happy, and that it is worthwhile. If they annoy the TWG by saying they need more and more measurement, then they well be annoying a lot of important people, so the subcontractor is likely to comply with giving this statement. It also

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[319] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 6:50
[320] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 9:15
[321] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:33:50 – 1:35:30

helped having [a particular individual] along for a meeting with the subcontractor, because "he is nice and knowledgeable."[322]

Here we see that the Wake Effects TDC is encouraging positive interpersonal skills from a subcontractor, which will please the Wake Effects TWG and may elicit positive behavior between the TWG members and the subcontractor in the future. In terms of the Foundations TWG, A Foundations TWG member mentioned becoming more open within the Foundations TWG when he said:

> "I would say our initial motivation was as a new player in the market, was to understand what other companies are doing, understand what their problems are… I think now we were able to start feeding something back into it from our own real experiences. And again that's how these things should work. It's important that it's a two way process. Although I always felt like we were welcomed into it, even though some of the other partners had more experience. We always seemed to be fairly welcomed into it. People did seem to be quite happy to be open at all times."[323]

Although this TWG member did not start out in the group by speaking up (because he did not feel that he had as much to contribute), he did, over time, begin to share more within the group as he gained experience. This would seem to suggest that by displaying interpersonal skills, the Foundations TWG has elicited a feeling of openness in a person coming from a company with less experience in the offshore wind industry, which strengthens the group as a whole by increasing the overall sharing that exists within this TWG. The Keystone General Manager for Offshore Renewables also did a very good job of explaining why putting a premium on interpersonal skills is so important when he said:

> "I just got [a phone call] the other day from a company in Brazil that's interested in using us for a met mast[324] foundation, and I never met him face-to-face. I mean I think it's a small group of people at every conference that you go to, no matter where it is on the planet, you know like half the people there. Word of mouth is big in this industry. If I found out about some product, and I've done it before as well for another technical product, it's an anti-fouling product, and I've contacted these people because I've read about it in one of these wind magazines."[325]

As is stated here, interpersonal skills are particularly important in the offshore wind industry because many of the people within the industry know one another, and companies can quickly

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[322] TDC call regarding progress of all TDCs, Jan. 18, 2012. Quotation is from notes taken during the call.

[323] Foundations Technical Working Group member, May 1st, 2012. Recording time: 58:20

[324] Again, a met mast is a temporary measurement tower placed on top of an offshore wind foundation that measures the wind resource on a prospective site. Typically they are as tall as the proposed wind turbines, and they log the wind speed data at frequent intervals for at least one year.

[325] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time: 30:15

acquire a reputation through "word of mouth," where future business could be based upon what someone else has said about you or your company.

The fourth suggestion for incorporating conflict and complexity into organizational routines to create dynamism and robustness is to **revise assessments as evidence changes**. This is yet another concept that the Carbon Trust OWA program seems to pay particular attention to, and facilitate in a variety of different ways. For example, an OWA management team member discussed revising assessments by checking to see if anything new had come along since initial assessments were made about foundations and access systems. As she explained:

> "We are also trying to branch out from just the innovators we've had since the competition, since both the Foundations and the Access competitions were a few years ago and we realize there are probably a lot of other innovations out there that weren't part of the competition that we might want to consider. So we've had some Working Group members bring forward a name of someone that they've come across or that they're interested in hearing more about, and we've been inviting them to Technical Working Groups… The competition did come up with a lot of really good ideas, but it doesn't mean that there are not others, and maybe some of those other ones are more deserving of funding."[326]

This statement exemplifies the point that the OWA program revises assessments that were made in the past for the purpose of checking to see whether the evidence has changed. A Steering Committee member explained another way that the OWA program has revised assessments when he said:

> "Examples have happened where, you know, something wasn't working and we had decided to go with three of these and for one reason or another, one of them was not going to work, and quickly we could see that it wasn't going to work, or it was just going to be very risky. It might delay the project and it was adding risk to it, and we just said, 'ditch it and move on.' We'll go with two instead of three – that's happened."[327]

Here we see that decisions can be made quickly to adapt to the situation when evidence changes. Another Steering Committee member gave an example of revising as evidence changes about what is possible in terms of cost reduction, when he said:

> "There was a conscious decision, which was correct, taken in the setup to look at everything except the turbines…. On the basis that turbines are being developed by the turbine companies, and in some cases very secretively, but in a lot of cases they are very specialized and therefore it is very difficult for us to be involved in. But we've gotten to the stage now where some really quite radically new turbine concepts are coming through. They're all getting bigger, and it is very related to these things [that the OWA does focus on]. Therefore we have to be sure that the work of the OWA is totally aligned, and as well as doing its work to improve foundations, wakes, electrical, and access – it also facilitates what the turbines

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[326] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 51:15
[327] Steering Committee member, April 24th, 2012. Recording time: 10:55

need to do to deliver their cost reduction. So that's going bigger, and the other innovations as well in the turbines. So that's a bit lacking at the moment, and I'm very keen to see that we build that into the OWA program to be fully effective."[328]

"Turbine Days" are one way that the Carbon Trust OWA program has started to facilitate an understanding of new turbine development. Also, simply by identifying that there is development, the OWA program can evaluate what other steps might be taken for further development in this area as well. A Foundations TWG member also saw the OWA program as revising assessments on a continual basis when he discussed the concept of flexibility within the program, saying:

> "I can say yes there is enough flexibility built into the process. Within this initiative even though you may have missed some of the items initially, like concrete structures which were not considered in the initial tender phase – in the initial phase the focus was on the steel structures – however afterward now we have a separate initiative where we look at concrete structures, and then shipping out in an assembled way. So that means, yes, even though you have not considered some of the relevant items up front in the beginning, you later on are able to consider them, and that means you have flexibility."[329]

Here, revisions of initial strategies are made to include some additional concepts that developers are interested in. Another way that the Carbon Trust OWA program is seen to revise as evidence changes is by "lessons learning." As stated by a Foundations TWG:

> "And I think the other thing is making sure we learn the lessons. So I know when in some of the current scopes of work – we've put in some different mechanisms, if you like, for trying to make the suppliers perform better for us. So that's been a way of dealing with problems we've had in the past with some of these contracts."[330]

This statement makes the very good point that "lessons learning" is a type of revision that takes place when problems arise. In this case, revisions are made so that the problems do not re-occur in the future. Keystone's Managing Principle also identified engineering in general as a process of constant revision, saying:

> "The problem with engineering is that when you embark on a design, you never know what you're going to find. You don't know what the member size is going to be until you run the analysis. So it's constant discovery and re-setting of the parameters as you go. So you never really have this perfect plan. You don't really have a fixed definition of what to plan to. So basically you plan, and then the plan changes constantly because it's a constant discovery. I mean, I can plan to run a certain type of analysis two times. But there's no assurance that I'll get the right answer in two times. I might have to run it six times to get the right answer… you don't know what you're going to find as you go through the course of the project."[331]

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[328] Steering Committee member, April 24th, 2012. Recording time: 14:10
[329] Foundations Technical Working Group member, June 13th, 2012. Recording time: 34:05
[330] Foundations Technical Working Group member, May 1st, 2012. Recording time: 40:20
[331] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 3:10

By having a plan that "changes constantly because it's constant discovery," revising is something that engineers must do on a very regular basis. It would also seem that the Keystone engineers that worked on the Twisted Jacket foundation are very happy to revise their assessment, when for example, they can improve their concept or make it cheaper. As stated by the General Manager for Offshore Renewables:

> "Initially our transition piece had a spherical bottom on it, or a hemispherical bottom. Now we've gone to an elliptical bottom on it, because again the fabrication yard has told us that it was cheaper. We've gone to an elliptical bottom on it, because again the fabrication yard has told us it was cheaper. We've changed some things about it the way we planned on installing it because installation contractors told us it would be cheaper. So we are very open to solving problems in different ways, and we think that's great. Because again, like I said, the more people that can put their heads together, the better your product becomes."[332]

Perhaps because of the way the Carbon Trust OWA program is set up, or perhaps because many of the individuals participating in the program are engineers, the OWA program seems to proactively revise assessments as evidence changes.

The fifth and final suggestion for incorporating conflict and complexity into organizational routines to create dynamism and robustness is to **treat all unexpected events as information.** It is proposed in chapter five that by doing this, organizations and actor oriented innovation programs may be better prepared for inevitable complexity in their internal and external environment, as well as being more able to identify unknown unknowns. Two examples of this will be given, one from a Steering Committee member, and one from a Foundations TWG member. First, a Steering Committee member described exactly why treating unexpected events (what he terms uncertainty) as information can be helpful. As he put it:

> "Well, we accept uncertainty. This is what we're dealing with all the time. As developers we are always grappling with uncertainty of all kinds, from regulatory uncertainty to market uncertainty, to technical uncertainty as well. So we don't have a problem dealing with it. And to some extent, when it comes to risks as I mentioned, we know that we won't be able to eradicate risk either, it's more about being aware of the risks so that we have flushed out the unknown unknowns, if you like. So if we can get to that position, then we can make a decision, because we know what the risks are. So I mean, that's where we're trying to get to."[333]

As stated here, the fact that unexpected events (uncertainty) in both internal and external environments occur is well understood, and the way that this is dealt with is to have as much information as possible in order to make the best decisions possible. Treating unexpected events as information was also described by a Foundations TWG when he said:

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[332] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time: 10:30
[333] Steering Committee member, April 24th, 2012. Recording time: 32:15

"There's evidence when [change] has happened. For instance, if a certain foundation concept is not looking as promising as we might like, and there are re-occurring risks that we can't seem to establish and what have you, there is evidence where we've said "ok, well this is not the only foundation in that genera, let's take stock, because it was two years ago that we made the decision. Let's take stock, let's see what's out there, if there's been any changes in technology, whether we are pouring our money into the right foundation." And that is a flexible approach given the competition and the screening process that has happened – to get from one hundred plus down to four. I think that is a very change oriented process to then say "ok, well we're willing to potentially bring other foundations in." [334]

Although it would be easy to understand if the Foundations TWG members were extremely attached to the foundations that they had originally selected (because they went through a very lengthy process to get there), this TWG member explains that they are willing to look at what else is available if one particular concept does not seem to be working out as they had hoped. By treating this fact as information, it might allow the Foundations TWG to find a foundation that is even better suited to their needs.

In looking at conflict and complexity overall in relation to the Carbon Trust OWA program, there are many ways in which participants can be seen as very aware of the dynamic internal and external environment in which they are operating. The program structure also facilitates the management of conflict and complexity in a proactive way, which may also enable the discovery of unknown unknowns, and further a number of knowledge processes with which members of the Carbon Trust OWA program work with on a daily basis.

Having explored three potential obstacles, we now move on to the last section covered under obstacles of knowledge management, namely increasing size and geographic dispersion.

5.3.4 Increasing Size and Geographic Dispersion

The problem (or obstacle) with increasing size and geographic dispersion is that knowledge (held within individuals) can be difficult to locate when needed. In small companies, it is likely that one can walk down the hall and ask a colleague for their opinion. However, for large organizations, as well as actor oriented innovation programs like the Carbon Trust OWA program, diverse actors that come together to build and sustain innovation do not see one another on a regular basis. In this context, the question then becomes, how can these individuals communicate most effectively? Two specific actions were identified in chapter four as helping to ameliorate the obstacles associated with large and disperse organizations such as innovation programs, namely *providing creative space*, and *creating a common language and 'frames of reference.'* Each of these will now be examined in relation to the Carbon Trust OWA program,

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[334] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 29:20

discussing whether they are seen as useful for successfully managing knowledge processes despite large distances and the large number of participants in the program.

Creative space forwards the idea that space plays an important enabling role in helping people to collaborate, think, and find new opportunities. Individuals need a balance between collaborative and private space, particularly for innovation-related work, such as that of actor oriented innovation programs. In terms of the types of spaces that may be helpful for fostering creativity and innovation, having a brainstorming area, hub-space, fully equipped meeting room and fluid work environment are proposed as enablers of collaborative knowledge processes. A **brainstorming area** that has paper and pens/pencils, post-its, presentation technology, whiteboards, comfortable seating, etc. is understood as important for giving people the means to effectively work together and come up with ideas collectively. The Carbon Trust OWA program does facilitate periodic brainstorming sessions, and one such brainstorming area was created for the workshop in London in the summer of 2008. Describing this, a Steering Committee member said:

> "At that workshop in London, we simply made a very traditional brainstorming. There were I think four or five other interested partners participating in that workshop. And we simply, you know, wrote on yellow stickers in a traditional way where what ideas and what focus areas we thought would make sense to look at - and very specific subjects, and some others that were broad. They were then, as far as I recall, now it's three and a half years ago – as far as I recall they were then organized in some groups by offshore O&M (operation and maintenance), foundations, electrical issues, etc. And then we had a discussion on: "what were the overall headlines for this?" And as far as I recall at some stage during that afternoon meeting – it was a one-day meeting – it was just decided to have, I think, the four major work streams that were identified, and were the ones that we then went on with. Which were Access Systems, Electrical issues, Foundations, and Wake Effect calculations."[335]

Although it may seem simple, having a brainstorming area is also effective for helping people to collaborate. The OWA program was also said to provide a brainstorming area when foundations concepts were being examined, as stated by Keystone's General Manager for Offshore Renewables:

> "One of the good things about [the selection process for Foundation designs] was… So we had eight different firms in there throwing ideas about in a room… I mean we did some parts were we just presented by ourselves, but a lot of it was all the different firms together, so it was really good."[336]

In this case, selected innovators got the chance to brainstorm with one another, which allowed them to share ideas with individuals working with similar engineering challenges, with whom

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[335] Steering Committee member, Dec. 14th, 2011. Recording time: 00:40
[336] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time: 31:25

they may not have otherwise gotten a chance to see or speak with. The reason that brainstorming areas can be so important was also very well stated by a Wake effects subcontractor when he said:

> "Sometimes it's appropriate after a period of thinking – you may not be getting anywhere – to have discussions with people. It may be a one-to-one, it may be a many-to-one brain-storming session where you just sit around over a cup of coffee, have a board close by, and just chat about the issues: "what about… could it be this? Could it be that? What about… have you seen anything similar?" And just generally chat through the kind of issues to get different ideas in. Maybe some lateral thinking about ways to get around the problem without having to solve it directly. Can you do something different?"[337]

This statement suggests that facilitating brainstorming may be a method of creating an environment for seeing things from a new perspective and possibly even gaining new insight or knowledge about a problem or challenge being faced. Because there are a great number of challenges still to be faced in the offshore wind industry, brainstorming areas should not be overlooked as the Carbon Trust OWA program continues.

Next, having a **hub-space** offers the opportunity for individuals to mix in an informal setting – it is an alcove for people to get something to drink and have a chat, and may provide an opportunity for serendipity. As stated by a Carbon Trust OWA management team member, hub-spaces provide the opportunity to be less formal and provide the opportunity to share what one knows in a more relaxed atmosphere. As he put it:

> "I think it's very professional. It's very business-like [in the Steering Committee meetings]. I think that's probably - words are hard to use. Also the people, in the breaks, there are jokes…"[338]

This statement demonstrates the difference in atmosphere between Steering Committee meetings and coffee-breaks (or "hub-space" chats). The importance of this less formal, more spontaneous atmosphere that hub-spaces create was articulated by a Foundations TWG member when he said:

> "All the partners have access to this [SharePoint site]. And that's where everything is formally saved and shared. But the other part - you talk over a cup of coffee, and the knowledge you learn there, how is it going on this project, or that project, or the other thing… and the small meetings that are set up afterwards, and all that stuff – it's more difficult to measure, to pinpoint exactly what you get out of it. But it is valuable, you know, when [other partner companies] come to us and say "what happened to that project? I looked away and then you built it." You know, and then we can enter into discussions about that… it's something that

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[337] Wake Effects Sub-Contractor, Dec. 15, 2011. Recording time: 24:30
[338] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:20:50

when you get that knowledge over the coffee table, it's hard to pinpoint, it's hard to measure, and it's also very hard to distribute… it's very difficult to structure."[339]

Here, hub-space interaction is described as "valuable." One reason for this may be that in these more informal interactions, people can ask more questions of one another and understand more about the context of what the other person is doing, and why they may make the decisions they do in other contexts (like the TWG meetings). Providing hub-space may also be a good idea because, as stated here "it's very hard to structure," and in most cases just happens spontaneously. This Foundations TWG member then goes on to say:

> "I think the level of trust is at the coffee breaks, when I talk to [other partners]. When I talk to [them] I of course have relations with [them] because of the work that I do on other projects. But at the meeting, at the formal meetings, and at the big technical working group, it's a formal, should we say that, it's a formal atmosphere. And the level of trust is based on that formality."[340]

As is identified here, having informal conversations with people can elicit feelings of trust and openness, where personal understandings and ideas can be shared between two (or a small number) of people, rather than in formal meetings where these TWG members may feel more that they are representing their companies, rather than themselves, when they speak. For the Carbon Trust OWA program, facilitating hub-space to a greater extent may be a good idea in order to build trust and promote openness. The third suggestion, related to creative space, for enabling collaboration and knowledge processes is to have a **fully equipped meeting room**, including technology to connect with those outside the program when necessary, give presentations, etc. Meeting rooms at the Carbon Trust headquarters (where most meetings are held for the Steering Committee and TWGs) provide space for both large and small meetings, and are equipped with presentation technology. However, as stated by a Carbon Trust OWA management team member:

> "We could probably do a little bit better at video conferencing and things like this… or sharing documents, over a computer, sort of this Webinar sort of thing. But we're not there yet."[341]

This shows two types of technology that might be useful for the OWA program. Having better video-conferencing capabilities was also discussed by quite a few of the Steering Committee and TWG members interviewed as a better alternative to the teleconference meetings that are currently being held. However, as identified in section 5.2.3 Knowledge Capture, it would be very difficult to get something like a video-conference up and running between people in nine locations, so even if the Carbon Trust headquarters did have all of the latest technology, it is not

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[339] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 39:50
[340] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 45:00
[341] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:12:15

sure that all of the partners would be able to take advantage of it. The fourth suggestion related to creative space is to have a **fluid work environment**. The idea behind having a fluid work environment is that if you are physically confronted with new experiences, new people and new environments that you may mentally be able to avoid getting "stuck in a rut," which can occur when one follows the same thought patters and only talks to the same small circle of people. The Carbon Trust OWA program can be considered as providing a fluid work environment for all of the partners and innovators that participate. Not only do they meet at the Carbon Trust headquarters, which is in London, but they also get a chance to talk to one-another, which can expose each of them to different perspectives coming from the different developer organizations. The Carbon Trust OWA program also facilitates a fluid work environment by, for example, holding summits and technology workshops. An OWA management team member discussed a workshop held for the Wake Effects TWG, saying:

> "We had a workshop in December, and there were a lot of people that took off two days from their day job to come and participate, so that's pretty neat that all these people found it so important that they're going to prioritize it and fly to Denmark in order to participate in this workshop." [342]

Here, TWG members are seen as placing importance on the opportunity to leave their every-day context and participate in a workshop with individuals from other companies developing offshore wind farms. Later in the conversation, the same OWA management team member discussed ways in which the innovators were provided with a fluid work environment when she said:

> "We were talking about how the Foundation designers were quite helpful to each other when they were presenting some of their designs in the competition, so I think we were talking about that, and how it led to the idea of having the two separate rooms, and the second room being one were the innovators could have the option of presenting to each other. So I do know that that was something that worked in parallel. And we do have some innovators working with each other, so there is a little bit of that happening." [343]

Here, it is identified that innovators also have the opportunity, through the Carbon Trust OWA program, to gather in a context out of their normal daily routine and get a fresh perspective on whatever they may be working with at the time. Also, Keystone employees were provided with a fluid working environment when their Twisted Jacket design was selected and then built. As stated by a Keystone Structural Engineer:

> "I was there when we built our met mast. I was there for the load out of that structure, where, once it was complete, we put it on a barge to take it to Rotterdam. And I was there overseeing

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[342] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 12:40
[343] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 39:50

that process, getting everything loaded on a barge, and shipped to the Netherlands. I did go to London once… I met with two of the guys from the Carbon Trust."[344]

This statement exemplifies a number of different experiences (providing a fluid work environment) that were made possible by participating in the OWA program. Overall, the Carbon Trust OWA program can be seen, to a very high degree, as providing a fluid work environment for individuals participating in the program, through a wide range of different activities that are set up within the OWA framework. One other suggestion related to size and geographic dispersion (when interaction may be periodic rather than frequent), as indicated in chapter 5, is to have a chance to **'sleep on it.'** Because busy professionals are often rushing from one task to another, it may be important to give them not only the *space*, but also the *time*, to process new information and develop new knowledge. Within the OWA program, both Steering Committee and TWG meetings are usually scheduled for one day, which does not give partners a chance to 'sleep on it.' However, many OWA workshops are held over a two day period. For example, as articulated by an OWA management team member, the Cables TWG held a two-day workshop:

> "We'll do this work shop, and it'll be kind of a two day thing… give people a night to sleep on it and then come back… I think that would, in this case, be quite beneficial because we're going to start talking about year four projects. So we have this workshop where everyone's going to come and talk about all of their problems and then the next day we are going to talk about the projects we want to focus on."[345]

This quotation pinpoints having a chance to 'sleep on it' as "beneficial," precisely for the reason of giving members of this TWG a chance to go away, think about problems that were discussed, and think about which projects can then best meet those challenges, or problems, that were specified. In other words, having a chance to 'sleep on it' may create "distanciation" (a necessary aspect of knowledge creation, as shown in figure 7), enabling people to critically reflect, and providing the opportunity to see solutions to problems more clearly. Many of the respondents interviewed in connection with the OWA program described the amount of interaction within the Steering Committee and TWGS as "about right." However, if these meetings were generally scheduled over a two-day period, participants may be even better able to think about the different projects that the OWA program is involved with, as well as share and generate knowledge about the program to an even greater extent. One last issue that will be discussed in relation to increasing size and geographic dispersion is that of creating common language and frames of reference. Creating common language and frames of reference, otherwise known as **redundancy,** is achieved when interacting people understand each other's frames of reference. Although encouraging alternative frames of reference was discussed as useful in the last section, there also

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[344] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 49:00
[345] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 39:40

needs to be a common base of understanding as a starting point, in order for new ideas to make sense and be built upon. Building redundancy also takes *time* for individuals to interact and reflect. Within the OWA program, the Wake Effects TWG seems to be a best practice case in terms of individuals involved in this group understanding each other's perspectives. By way of explaining how this has been achieved, the Wake Effects TDC said:

> "…just recalling a specific example, we put out an invitation to tender for some subcontracted work, we had four suppliers who replied, and I created a weighting table. So I said, you know, mark out of 10 each proposal in this category. So technically – is it a zero or is it a 10 technically. Commercially – is it too expensive, is it… Knowledge base – so if, for example, you have a great proposal from an organization, but you know there's only one person in that organization who knows anything about anything, then you might say that's only 1 out of 10 for the knowledge base because if the project deviates a little bit or that person gets ill, then that organization can't deliver. We just came up with 10 categories – and agreed in advance with the Technical Working Group which the 10 categories were. So you've got multiple categories, you've got multiple proposals, and you've got multiple partners. So you're asking each partner to provide a score for each category in each proposal. And you can imagine doing that in Excel. I'm not a great proponent of then saying "well add them all up, and the highest score wins." Life isn't that simple. But it does give you a framework for evaluating the response."[346]

This statement provides a very specific example of how redundancy, or common frames of reference, is achieved within the Wakes effects TWG. This TDC then goes on to describe the advantages of using a weighting table:

> "It gives you the basis for a discussion. And a consensus evolves, and what's great about the Technical Working Group is that everybody's put down a mark, but actually my mark might be better informed than your mark, or the other way around, you know? So you have a discussion about that, and you say "oh, I hear what you're saying; I didn't realize you'd worked with them before and they were really good at that." So that's how we tend to get things done, which does require a high degree of Technical Working Group input. It's no good if they sit around and don't open their mouths, or if they don't feel empowered to make a decision, which comes back to the way that the whole project has been set up."[347]

This statement describes the way that a weighting table can create a very detailed discussion from which to draw consensus (thus achieving redundancy). The importance of having redundancy within the OWA program in general was a concept brought up by several individuals interviewed. One Foundations TWG member said:

> "So I think it, when it comes to the scale of the thing, it's just fundamental to the whole project, I think it's quite important that everybody buys into it. I mean that's my own personal view, it could happen a different way, but I think in terms of keeping things as open as possible I believe that's the strongest way. The discretionary projects that have happened so

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[346] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 17:00
[347] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 18:50

far… haven't necessarily been the focus of the whole working group, but I think moving forward they probably will become much more of a focus of the whole working group rather than the common projects that we've been doing a lot of to date."[348]

This statement expresses some concern that if not all partners buy into the discretionary projects for demonstrating novel foundation designs, then the OWA program will lose its ability share knowledge effectively because some of the partners will not be included, and discussions will not be as open. Put another way, if some of the partners are not included in the primary activities of the OWA program, then discussions between partners will become more limited, and the program might lose the ability to generate redundancy. If this happens, generating new understandings collectively will become increasingly difficult, and the relevance of the program may be questioned. For this reason, it is important that the OWA program maintains redundancy between its members, not the least by ensuring that all partners are included in primary activities.

When looking at size and geographic dispersion in relation to the Carbon Trust OWA program, it is very apparent that these are issues that are dealt with on a daily basis. The advantage of having so many diverse actors come together in this type of program is that there are vast resources available for knowledge processes and actions of different kinds. The disadvantage, however, is that getting the right information to the right individuals at the right time can be extremely challenging (particularly for the Carbon Trust OWA management team). This section has looked at the way that the OWA program deals with creative space and redundancy, having good examples of how each is facilitated, as well as specifying some areas where even more creative space and redundancy could be useful for the program as a whole.

Now that knowledge management *drivers* and *obstacles* have been discussed in relation to the OWA program, we will move on to the analysis of *critical success factors*, discussing the way in which they are handled within the Carbon Trust OWA program.

5.4 Knowledge Management *Critical Success Factors*

Critical success factors describe the many different ways in which organizations and actor-oriented innovation programs have successfully managed individuals with regard to the knowledge that they possess. The broad categories of social networks, genuine shared goals, experience and action, and engagement were, in chapter four, related, through an organic paradigm perspective, to the specific context of actor oriented innovation programs. What emerged from this discussion was the identification of a number of theories and tools that can facilitate knowledge processes in the context of organizations or programs wanting to build and

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[348] Foundations Technical Working Group member, May 1st, 2012. Recording time: 19:55

sustain innovations. This portion of the empirical analysis will relate each of the above mentioned critical success factors specifically to the case of the Carbon Trust OWA program for the purpose of analysing how this program has dealt with each of these issues in practice, and the degree to which this case supports conclusions presented in the theoretical analysis.

5.4.1 Social networks

Unlike data and information, knowledge can most easily be conveyed through human interaction. It is for this reason that social networks are listed as the first critical success factor for knowledge management. However, like so many of the other concepts discussed thus far, social networks are discussed within many different disciplines including organizational theory, business studies, sociology and psychology. In order to specify how this concept could be useful for actor oriented innovation programs, both 'social networks' as well as 'social network analysis' has been understood and approached from an organic paradigm perspective – highlighting simple deals, as well as complex emergent patterns of behaviour, between individuals as they interact in their environment over time. Social network analysis, in this context, is useful for highlighting the extent to which knowledge circulates within and between communities, identifying the ways in which people interact to accomplish their goals – in this case to reduce the cost of offshore wind by building and sustaining innovation.

In relation to understanding the way that social networks function within the Carbon Trust OWA program, qualitative interviews were conducted in order to understand respondents' interpretations about the dynamics that have evolved between individuals in the context of the OWA program over time. In particular, three aspects of social networks were explored in detail for the purpose of gaining a deep level of understanding, namely *network characteristics*, *network roles*, and *conditions facilitating knowledge processes* within actor oriented innovation projects. The expectation is that by looking at each of these three aspects of networks, greater insight will be achieved into the dualities, actions, and frameworks that are represented within the OWA program.

Let us first examine **network characteristics** within the Carbon Trust OWA program. Most fundamentally, there are internal and external links as well as strong and weak ties within a network. As may seem apparent, **internal links** describe relationships developed within a network. For the Carbon Trust OWA program, internal links can be considered to be all of the actors that are listed in Figure 2: Organizational Structure of the Carbon Trust OWA program, as depicted September 2013. Included in this list are the Steering Committee members, the Carbon Trust Management team (including TDCs), TWG members from the five work streams, and

innovators and designers who have been awarded contracts with the program (typically after responding to a call for tenders). As emphasized in chapter four, it is of utmost importance that information be shared between the appropriate parties within a network. In relation to the OWA program, information is generally understood by respondents as being shared and made available between relevant parties. Two areas where information may need to be shared to a greater extent, as expressed by several TWG members, [349] are 1) between the five working groups, and 2) between working groups and Steering Committee members. A Steering Committee member, when asked about whether information flowed freely between innovators and the rest of the members of the OWA program, replied:

> "Yes. That's a good principal that I hope, I think, is working."[350]

Members of Keystone generally saw information as flowing freely between their organization, the OWA management team, and most of the partner companies involved in the program. However, they also felt that they missed out on the opportunity to discuss with other sub-contractors (such as fabrication and installation contractors) who could have advanced their innovation to an even greater degree. As stated by Keystone's Managing Principal:

> "You couldn't take and marry the engineering and the installation into one team effort. We lost the ability to produce a team effort."[351]

For future demonstration projects, it may be particularly important for the innovators to have more direct contact with the installation and fabrication subcontractors, both in the selection process and before the concept is actually built, to make sure that what is produced is the best possible product at the best possible price.

Next, **external links** describe relationships that individuals develop with those outside of the network. The Carbon Trust OWA program can be viewed as having a core competency in the area of interacting with external links. Their competitions for example, have attracted a great number of external links (104 entries for the foundations competition and 450 entries for the access completion). Additionally, organizations outside of the OWA program are also invited to give presentations to all of the partner organizations through topical seminars such as, for example, Turbine Days. [352] The Steering Committee members have also identified creating new

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[349] discussed previously in this chapter, see section 5.3.2 Knowledge Management and the Cultural Dimension
[350] Steering Committee Member, April 18th, 2012. Recording time: 42:00
[351] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 33:00
[352] Turbine Days are also discussed previously in this chapter, p. 230, section 5.3.2 Knowledge Management and the Cultural Dimension

external links through the OWA program when, for example, interest has been taken in competition designs that were not shortlisted. As stated by a Steering Committee member:

> "We have had interest in some of the competitors in this Access Completion. And we have also been doing demonstrations with some of them. They were suppliers that didn't reach the short list in the Access Competition. So I think we also have some relations [with these suppliers] outside [of the OWA program]."[353]

In addition to developing external links with suppliers, external links are also formed when TWGs contact experts to make sure that decisions are as informed as possible. For example, a member of the Wake Effects TWG said:

> "So say we're doing a scoping campaign, and we were aware that we didn't know necessarily what information we needed to know. So we got a range of industry and academic experts in to tell us what they think we should be doing. And then from that then we could make decisions – more informed decisions."[354]

This is an example of individuals outside of the OWA program being accessed inform an entire TWG of the most current technological developments. However, TWG members also contact experts within their own organizations (but external to the OWA program) in order to make the most informed decisions possible. This was articulated when a member of the Foundations TWG said:

> "I'll go to other people in the company, and ask for their views on [a particular technical issue], I've done that in the past. And that helps me to form my view, and form the company's view when taking it back for a decision to be made at one of the TWG meetings… I think it has to be done on an ad-hoc basis really, and it's up to the individual partners really to make sure that they're as educated as they can be when they're providing their opinions and views."[355]

This statement shows initiative taken on the part of TWG members when contacting experts that are not part of the OWA program, for the purpose of making the most informed decisions possible. If we now turn to Keystone, they demonstrated contacting many external parties when putting together their foundations proposal for the OWA program. As stated by Keystone's Managing Principal:

> "When we were trying to put together a team to do this work, I had called a guy… he was one of the owners in a software company – but he had left the software company, he was retired. So I brought him in as a consultant. This was even before we submitted our proposal to the Carbon Trust, and he actually went with [us] to the presentation in London, to the very first presentation. Umm, we also engaged… I'm trying to think of exactly how that happened…

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[353] Steering Committee Member, April 18th, 2012. Recording time: 5:45 – 6:05
[354] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 1:17:00
[355] Foundations Technical Working Group member, May 22, 2012. Recording time: 55:10 – 55:50

> When I talked to Vestas, who had been involved early on back in 2004 and had suggested that we participate... And so he gave us a lot of good advice, you know about what Vestas thought about installation costs, and fabrication costs, and what have you. Plus one of Vestas' really top-notch load engineers had left the company and started his own company, so we hired him as a consultant to help us put everything together, to make sure we had everything covered. I also used a gentleman that we still work with today that is a specialist in finite element theory and finite element analysis… And so we kind of brought in a lot of people from outside of the company because inside the company we had very few people who understood the intricacies of these new loadings and designs and what have you…One was a programing expert, another a finite element expert, and the other guy was the guy from Vestas. And that made up the basic team that we used."[356]

Although this took place before Keystone actually entered the OWA program, it does a very good job of explaining the extent to which members of Keystone were able to utilize external links in order to prepare the concept which was shortlisted and then built through the OWA program, as well as demonstrating how important external links can be in general.

Now let us move on to an examination of strong ties. **Strong ties** are understood as established and reciprocal relationships that have been built up through continual interaction and information exchange over time. When looking at the Carbon Trust OWA program, although strong ties exist, many of the relationships, for example between members of the individual TWGs, or Steering Committee, are complex and not equally reciprocal. If we return again to Figure 2: Organizational Structure of the Carbon Trust OWA program, as depicted September 2013, among the individuals interviewed for this dissertation, strong ties are identified between all Carbon Trust OWA management team members (and to a greater or lesser extent between the OWA management team and TDCs), as well as between all members of the innovator Keystone who worked on the Twisted Jacket foundation. It makes sense that these are the groups within which strong ties have been built, because these individuals work together on a daily basis. Members of the Steering Committee and TWGs, on the other hand, meet only periodically in London for meetings, and may not meet each other outside of the OWA context at all (although some do work on other projects together, or see each other at conferences, etc. allowing for stronger ties to develop). In order to better understand these complex relationships, each individual interviewed within the Steering Committee and Foundations TWG (as well as the head of the Carbon Trust OWA program, and one member of the Wake Effects TWG) was given a social network exercise, where respondents were asked to place each of the other partners (as well as the Carbon Trust) at a relative distance from their organization (which was placed in the center of the bull's-eye).[357] From the conversations that followed this exercise, an understanding developed about which

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[356] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 22:00
[357] For a depiction of the bull's-eye and methodological explanation for using a social network exercise, see: Chapter 3, Figure 5 and the corresponding discussion.

members were closer than others and for what reasons, and what this has meant for the evolving dynamics of the OWA program. To start with, over half of the Steering Committee members and all of the Foundations TWG members interviewed placed the Carbon Trust as either closest, or next closest to them during the social network exercise, suggesting that there are strong ties between the Carbon Trust OWA management team and all of the partner companies. Perhaps the reason for this is best stated by a Foundations TWG member when he said:

> "I've put the Carbon Trust in the first ring... Since I've been involved anyway, they're the company that I've had the most contact with and discussion with about the aspects of the Technical Working Group. Obviously the Carbon Trust I've put in there because I often have discussions with [the Carbon Trust OWA management team] about just exactly what we're trying to achieve. And I find them approachable and easy to discuss things with, so I don't have any concerns about having an open discussion about what or where [our company] is coming from, so I would probably say they are in the first circle."[358]

This statement exemplifies the importance of personal interaction, and being open (and actively listening) which has helped the Carbon Trust OWA management team to build a strong relationship with many of the partners. The benefits of these strong relationships can be felt through the growing number of activities that have been approved and undertaken through the Carbon Trust OWA program. Among members of the Steering Committee, there were many reasons for strong ties being formed between companies. In one instance, for example, two companies participating in the OWA program were started by the same individual, meaning that individuals have known each other, and worked together, previously. Within the Steering Committee generally, strong bonds were most often identified as formed because:

> "… we talk to them regularly at different levels… we probably have project relationships with them, either joint investment in a project, or something similar. And [it is the] same [for another partner], we work closely with [them] in terms of some of the other work we're doing at a University and in terms of funding the tech project."[359]

As this statement points out, having common projects or working on common initiatives facilitates a greater degree of communication between individuals, and helps to form a strong bond between these individuals within the OWA program's Steering Committee. Another common reason for strong ties having been formed between Steering Committee members of the OWA program is because:

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[358] Foundations Technical Working Group member, May 4th, 2012. Recording time: 27:30
[359] Steering Committee Member, June 4th, 2012. Recording time: 33:50

> "…we have similar viewpoints on a number of things, and we generally seem to share the same ideas in relation to the OWA – I suppose what I'm trying to say is that they're quite close as well."[360]

As this statement illustrates, having a similar viewpoint, or frame of reference, has also helped to facilitate strong bonds between members of the Steering Committee. Within the Foundations TWG, many strong ties were acknowledged between members. Reasons for strong relationships were identified as being formed because of, for example, one company preforming tests for another, companies working on joint ventures together, and participating in common projects together. Most often, strong ties were identified as present because of:

> "…a combination of a commercial relationship on a project, and also personal relationships."[361]

Here we see that working on projects outside of the OWA program together has facilitated a greater amount of communication, both professionally and personally, leading to strong bonds being formed between these TWG members. Just as working on projects together outside of the OWA program can facilitate greater ties between individuals, participating in the Carbon Trust OWA program can also facilitate greater interaction and understanding between members. As stated by a Steering Committee member:

> "In the end you always need people to do a project, to organize it, to define it, to get it approved, and within the companies you need a person to fight for every specific R&D project to get the funding, to get the resources. And the good relationships between the people here help and support these projects and these will remain."[362]

As stated here, the OWA program can also facilitate strong ties between members that "will remain" in the future, and may help the offshore wind industry to grow.

In contrast to strong ties, **weak ties** occur when actors have few interactions. On the positive side, week ties can contribute to the discovery of new information. However, having few interactions can also mean that common frames are not developed, and it can be difficult to work towards common objectives or understand the perspectives of others when ties are weak. Within the Carbon Trust OWA program, Steering Committee members identified weak ties as existing when:

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[360] Steering Committee Member, April 24th, 2012. Recording time: 17:00
[361] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 34:50
[362] Steering Committee Member, April 24th, 2012. Recording time: 45:25

"[One partner] entered on board for the second phase, and [another partner] they have changed a lot of people within the Steering Committee, and the same with [another partner], they entered into the last phase."[363]

Also, as stated by another Steering Committee member:

"…we don't have that many project relationships with [them]."[364]

As these statements point out, weak ties most often exist when individuals have physically not been in that many of the Steering Committee meetings, or when there are no other projects outside of the OWA program that are being worked on jointly. Within the Foundations TWG, reasons for weak ties are similar. As stated by one TWG member:

"We've got less in common with these companies. We don't have any joint ventures, so there's less in common, so it's more discussing Carbon Trust issues etc. with them… well I don't feel I've built up quite the same relationships with them, and it may well be because [of where] they're based… I'm not sure but the relationships have been slightly slower to build there."[365]

Having "less in common" may be a problem when trying to achieve common goals; however, it may also provide the TWG with new perspectives on how to solve problems, as long as these individuals have feelings of mutuality within the TWG. In the most extreme case of weak ties, a Foundations TWG member said:

"[There is] just no relationship. And I don't think they turn up at many meetings either."[366]

Obviously, if an individual is not present from a particular partner organization within the TWG meetings, it makes it not only difficult to understand their perspective, but it also makes it difficult to reach consensus between that individual and the rest of the group, which is a principal that the TWGs are based upon. In this last instance, having weak ties within the TWGs may harm the effectiveness of the program, because decisions (of which there are many, and which often need to be made in a timely manner) will be harder to attain.

Another network characteristic that is present within the Carbon Trust OWA program is social circles. **Social circles** are clusters of nodes (individuals) that may have direct or indirect connections with one another. If we return to Figure 2: Organizational Structure of the Carbon Trust OWA program, as depicted September 2013, social circles have been formed between members of: 1) the Steering Committee members, 2) the Carbon Trust Management team

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[363] Steering Committee Member, May 11th, 2012. Recording time: 36:50
[364] Steering Committee Member, June 4th, 2012. Recording time: 35:00
[365] Foundations Technical Working Group member, May 4th, 2012. Recording time: 29:00
[366] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 37:15

(including TDCs), members of the 3) Foundations, 4) Wake Effects, 5) Cables, 6) Electrical, and 7) Access Systems Technical Working Groups, as well as each team that worked on contracted work for the OWA program (such as the Keystone Twisted Jacket foundation team). The structure of the Carbon Trust OWA program, containing a number of social circles, was the reason for conducting social network exercises with all members of the Foundations TWG *and* the Steering Committee – because their social circles were different, and could be impacted by the dynamics that existed within these circles. For example, Steering Committee members and TWG members from the same company did not always place other companies at the same relative distance from their own. Also, as the tasks performed by each of these social circles is different, they are involved in different activities and have different approaches for handling their respective tasks. The advantage of acknowledging that social circles are present within the OWA program is that many of the 'frames of reference' that each social circle operates with are the same, and by understanding each of these groups separately (as separate social circles), a more clear understanding of their needs, desires, and problem-solving methods and tools can be attained.

The last network characteristic that will be covered in relation to the Carbon Trust OWA program is a clique. A **clique** is a group of nodes (individuals) with strong and stable connections to one another. Within the Carbon Trust OWA program, there is at least one clique that exists. This clique is between four of the partner organizations that are part of the Forewind Consortium. As stated by a TWG member:

> "…a consortium for forewind, which is one of the round 3 sites, so all 4 of us sit on a separate board. So the same guys that sit on the OWA also sit on the forewind resource assessment group… we all have an input. So we're all very, again under that guise of forewind, we do a lot of communication and discussion about further aspects of… quite often we've formed an opinion in that group, and then all kind of brought it to the OWA board, as a kind of unified front, which is really useful as well, because it enables us to push some of our ideas in a slightly smaller forum, but then get the weight of all the others behind, if we can convince the others."[367]

Here it is clearly stated that by being a member of this clique, members feel that they can speak with a more collective voice and possibly get their ideas to carry more weight within the TWG as a whole. The down side to this is that the remaining TWG members may feel that they have less of a voice, and therefore become less engaged in the activities of the TWG, although this was not stated explicitly during the interviews conducted. For this dissertation, looking at the Carbon Trust OWA program in terms of network structures has been helpful for understanding the

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[367] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 37:45

relationships that have formed and the complex and multi-faceted knowledge processes that have evolved over time.

Next, we will turn to a discussion of network roles within the Carbon Trust OWA program. *Network roles* describe different ways in which individuals can facilitate a network of which they are part. Four network roles will be focused on in relation to the Carbon Trust OWA program, namely central connectors, liaisons, bridge roles, and peripheral specialists. These roles have been selected because, as described in the theoretical analysis, each is seen as facilitating (or hindering) knowledge processes within actor oriented innovation programs. First, **central connectors** are either a "carrier of information" or a "bottleneck" within a network, because others often come to them for advice. Central connectors may also have a great deal of influence when it comes to decision-making, because their opinions are valued. Within the Carbon Trust OWA program, central connectors can be identified as all Steering Committee members and TWG members, because they are the links between the program and their organizations. These individuals are also the ones making decisions about which projects to proceed with, and which to drop. As stated by a Steering Committee member, for example:

> "So they [the other Steering Committee members] are listening to us when we are discussing those issues, I would say, but otherwise we are quite similar when it comes to experience, except when it comes to [a particular partner], which of course [has more experience]."[368]

Here, we see that the opinions of a particular Steering Committee member are valued by the others on a particular issue where they have relatively more experience than the other members. This statement also identifies similarity between the Steering committee members, which can be seen as desirable since they are all central connectors, and decisions need to be consensual. This is also the case among TWG members, and as one of them stated:

> "…we have internal meetings at the time of the budget reviews and that's when the recommendations are made about going forward or perhaps recommendation about not continuing with a particular project. So we come together in the various working groups and each working group reports their preferences."[369]

As conveyed here, Technical Working Group members also make decisions about which projects to select for the OWA program, making their opinions important. Because of the central connector role that is held by Steering Committee and TWG members, it also seems particularly important that mutuality is felt between them, so that they can find projects that have the biggest overall benefit for all partners, and so that they can agree on projects to select.

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[368] Steering Committee Member, April 18th, 2012. Recording time: 23:00
[369] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 21:00

The next network role that will be examined with relation to the Carbon Trust OWA program is that of a liaison. **Liaisons** are individuals who span between two or more groups (or social circles), have relationship knowledge, and know 'who knows who,' which enables them to actively manage the boundaries, or interfaces between groups, connecting the right individuals at the right time for enabling knowledge processes. Within the Carbon Trust OWA program, the OWA management team can be seen as the liaisons of the program. This management team has been noted throughout the OWA program to be filling the liaison role very well. As stated by a Steering Committee member:

> "I think they are doing well. I think it's a difficult task... I think that they are good at identifying what we need to decide on, and I think they do well in defining business cases for the projects that we want to initiate. I think they do well in delivering material that is easily accessible and understandable, and with well-written scope of work."[370]

As pinpointed in this quotation, the Steering Committee members feel that their ideas and concerns are being taken into consideration, and that the material produced by the OWA management team is clear and accessible to all relevant parties. Another Steering Committee member stated that:

> "The Carbon Trust is doing an incredibly good job. So they are a very good facilitator and moderator. And they have a very good role in this activity. They can't do better."[371]

This is a sentiment that was reiterated throughout interviews conducted with Steering Committee members, as well as Foundations TWG members. A Foundation's TWG member also did a good job of describing the Carbon Trust OWA management team as liaisons when he said:

> "First of all the Carbon Trust, I think they provide just that important interfacing in-between role. I would deal with them more than anybody else, really. In terms of individuals, in terms of providing information, in terms of taking our views on board, and disseminating them throughout the rest of the project. So I feel sort of quite close to them."[372]

Additionally, describing in greater detail exactly what makes the OWA management team so good at their job, the same Foundations TWG member stated:

> "I think [The OWA management team] tend to prepare very well for those [TWG meetings], and they always have very clear agendas. I don't envy their job; I think their job is actually very difficult. Because they're bringing people from lots of different organizations who have all got different views - so they're all from different countries; like me they are also working in lots of different real projects. And it's sometimes difficult in this industry to get people to open up, to actually… people tend to be quite secretive sometimes, I think, about what they

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[370] Steering Committee Member, Dec. 14th, 2011. Recording time: 32:00
[371] Steering Committee Member, April 24th, 2012. Recording time: 8:40
[372] Foundations Technical Working Group member, May 1st, 2012. Recording time: 4:20

want to tell you. But I think that [the OWA management team] are very good at preparing the face-to-face meetings and they provide good structure to them: they plan it well; they get good people along at the right time to talk to us. So I think in terms of the coordination role, they provide that part of it, and it works quite well."[373]

Here the identification of bringing people together "from different organizations," and with "different views" shows that they are able to connect individuals that come from different groups or 'social circles.' Additionally, having the right people join meetings "at the right time" also highlights the OWA management team as being good liaisons for the program. One caution articulated in the theoretical analysis is the necessity to have enough liaisons to facilitate this important role, so that bottlenecks to not arise. This was also reiterated by a Foundation's TWG member who said:

"It's clear that the small team involved in the OWA are very hardworking and they have - maybe at times they're a little bit too stretched so perhaps additional staffing might help."[374]

Since this interview was conducted, two additional members were added to the OWA management team, which should help this issue to some degree, but with an ever-increasing number of activities being undertaken, this issue may need to be taken up again, particularly if the program gets extended for another two years. In relation to the OWA management team's interaction with innovators, Keystone's Managing Principal had this to say about the OWA management team:

"… I would describe them almost like fans. They became fans of what you were doing; they were helpful. They also were able to give you good insight into who to contact. Like for example, we asked them, when we were trying to figure out fabricators, or installation contractors, can you give us a list of European fabricators, or European installation contractors, they were very helpful in that. If we called them up and asked them if they could give us some company to look for and do certain things they were very helpful in some of those things… In general I thought the Carbon Trust folks, if you called them up and asked them, they tried their best to get you any information that you needed. They were very amenable to provide a lot of assistance and help. But it was more like contact names, and stuff like that. They weren't… they did not actually get involved in how the concept was actually developed, or suggestions on the innovation, or anything like that."[375]

Keystone's General Manager for Offshore Renewables added to this by saying:

"Commercially yes, they support us incredibly well and it seems like they're out there talking us up all the time, and they still do to this day."[376]

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[373] Foundations Technical Working Group member, May 1st, 2012. Recording time: 11:20
[374] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 6:50
[375] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 12:20
[376] IBGS Foundation General Manager for Offshore Renewables, Keystone, Feb. 7, 2012. Recording time: 9:00

Overall, the Carbon Trust Management team can be understood as fulfilling the Liaison role within the OWA program, and fulfilling this role to the satisfaction of participants generally.

The next network role that will be discussed in relation to the OWA program is that of a bridge role. Individuals who fulfill a **bridge role** are described in the theoretical analysis as fulfilling a similar role to that of liaisons in that they connect people across boundaries and help to make information more accessible, but they also have the added benefit of being "technically skilled," and therefor can also make sure that a particular "sub-group" (in this case Technical Working Group) is working to specifications, as well as providing motivation when needed. Within the Carbon Trust OWA program, individuals that fulfill a bridge role are called Technical Delivery Consultants (TDCs). Technical Delivery Consultants have assisted the OWA management team with technical expertise and the running of the TWGs, and this interaction has had a varying degree of success depending on the TWG in question. The two groups that were looked at most closely for this dissertation (the Foundations TWG and the Wake Effects TWG) are perhaps the worst and best cases. The Foundations TWG now has no Technical Delivery Consultant (after the former TDC was dismissed for poor performance), and the Wake Effects TWG has a very engaged Technical Delivery Consultant that has been with the OWA program from the start. To understand the role of the Technical Delivery Consultant within the Carbon Trust OWA program, a general description of their intended role will be given, followed by some specific examples of the way in which the individual Technical Delivery Consultants have functioned in practice.

First, during the preliminary interview that was conducted for this dissertation, the role of the Technical Delivery Consultants (bridge role) was described as follows:

> "And then we have, in each of the four [TWGs], we have a technical Delivery Consultant, an external consultant that has been hired to carry out the project management work in each of the four work streams. So he would then, you know, he'll do the hard work, and he'll have meetings with the technical working group on a regular basis, and discuss his findings and how to proceed. And that's how it works… they are very interesting to talk to… they are the key, they are very key in the process."[377]

Then, in the second interview conducted with the same Steering Committee member, the reason for the Technical Delivery Consultant's being labeled as "the very key in the process" was elaborated:

> "They're key in two ways. One is that they are the ones that drive the work in each work package… So they are facilitating the meetings in the technical working group. They are in dialogue with the Carbon Trust, who runs the program on an overall basis. So they are very much the project managers of each of the four work streams. And they also have, at the same

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[377] Steering Committee Member, March 17th, 2010. Recording time: 11:20

time as they are facilitators, they should also have the technical insight into each of the four work streams, so that they can actually contribute technically and ask the right questions, and make sure that the quality of the work that is being carried out is at the level that we want. So they are an important part of the program."[378]

This statement does a good job of identifying Technical Delivery Consultants as both connecting people (through meetings and discussion), as well as providing their technical expertise, which solidifies their position as a bridge role. However, the question then becomes, how has this role actually functioned within the Carbon Trust OWA program? To illustrate the difference in performance of Technical Delivery Consultants, an OWA management team member said:

"My impression of [the Foundations TDC] was very poor. He did the bare minimum, he didn't organize meetings - we did - and invited him… this guy would just come if he was invited, and sometimes he wouldn't come. Like he didn't come to the one that we were presenting his report at, so that was strange. And then the Access TDC is someone who I just think doesn't have enough resources on the project. So he's the one who sends twenty emails, and then he disappears for two weeks. So I think ideally you would have a [Wake Effects TDC] situation, where he's probably 70% of the time on this project, but it's a constant 70%, versus the Access group, where it's two weeks on twenty-four hours a day, and then completely vanished for another couple of weeks, and then it starts again. So kind of going from the best situation and then down would be then finally the Foundations group, where it's like pulling teeth to get him to come, or he doesn't want to correct any of the things in the report – it's just kind of a frustrating situation where we end up taking over the position of TDC."[379]

Here we see a great deal of difference in the way three of the different Technical Delivery Consultants have performed within the OWA program. It would seem that it is precisely having both the inter-relational skills, as well as the technical skills, that enables individuals in this role to succeed. For example, an OWA management team member discussed what it is about the Wake Effects TDC that makes him successful when saying:

"The ideal TDC should be operating a bit like [the Wake Effects TDC], in that he has quite frequent engagement with the different members from the Technical Working Group. So he'll often call them individually to get their views on specific topics, and he'll brief them quite well before his meetings. So that when people come to a meeting, then they know what it's about. And he'll be actively trying to push the pace of activities, and understand what needs to happen next to take things forward. So that's the sort of best practice."[380]

Supporting this understanding, a Wake Effects TWG member described the Technical Delivery Consultant as the linchpin of the entire OWA program:

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[378] Steering Committee Member, Dec. 14th, 2011. Recording time: 10:00
[379] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 48:00
[380] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:35:05

"Well the linchpin of all of it is the Technical Delivery Consultant. So we have, and some of the other projects have something similar– there are effectively some consultants that we have hired to do all the legwork for us – to do all the project management, do all the emailing, and also run the studies and scope out the studies. So I think that's really key because they kind of materialize our thoughts, and they've also – because they've also been with us since the beginning, and because they're, they're kind of technical consultants anyway… they basically take care of all of that, and make sure everyone is up to date, and know everything that is going on. And if you've got queries to the Technical Working Group you can obviously just mail everyone, but it's usually just easier to mail them, and talk to them, and then they will just send you that information that they feel is important at the right time."[381]

In order to give one last perspective on precisely what has made the Wake Effects TDC so good at facilitating a bridge role for the OWA program, let us examine a statement from this Technical Delivery Consultant about what he does for the program:

"Do I even have a style? I guess I try to keep things very simple. I try to communicate very clearly. And I try to listen to what they [The TWG members] are telling me, because sometimes I'm the guy in the room that knows the most about a particular technical challenge – sometimes that's me. Much more often it's one of the other guys, you know, so I've got to realize that, I've got to listen to what they're saying about the solutions. We've got this challenge, how are we going to address it? Those guys know, pretty much, between them how to address things… To explain what I mean – the project was set up and funded because there was a conviction from the Steering Committee level that we needed to do something to improve understanding and capability in wake effects. That's fine, but that doesn't give you a project, it doesn't give you things to work on, it doesn't give you areas to spend your time on. You've got to work with the Technical Working Group to establish what their requirements are, and they have different requirements, and you've got to prioritize and discuss them. So my approach I guess is very much to figure that out. Try to get them to discuss and agree amongst themselves, and then formally say "these are our requirements." Right from day one, so you've got a shared set of objectives. And then just to be as inclusive as possible going forward, in trying to achieve that."[382]

This statement, although lengthy, gives good insight into exactly why this Technical Delivery Consultant has been so successful in the bridge role that he has facilitated. It shows the great deal of care that he takes in actively listening to everyone's opinion, and trying to combine and present these opinions as clearly as possible in the form of actual projects that can be carried out by the TWG. Of course, in order to be able to "prioritize," it is also necessary to have a grasp of the technical issues that are being dealt with, which was also a noted strength of this consultant. If we now turn to the Foundations Technical Delivery Consultant, we can look more closely at what has hindered success in this role. The Foundations TWG has had two Technical Delivery Consultants. The first Technical Delivery Consultant, although very technically capable, may

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[381] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 8:10
[382] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 10:50

have lacked the degree of interpersonal skills necessary for this role. For example, a Foundations TWG member stated:

> "[The first TDC] was chosen because he was very technically capable – very technically capable. And that was the core role of what he was doing, but in terms of maybe engendering group comment… What I'm getting at is that at previous meetings, people would often sit quite quiet, and they wouldn't have been as actively engaged, and [the TDC] wouldn't say "alright, what do you think of this, and what do you think of that," instead he would say "this is my presentation," and people would be like "ok, wow!"[383]

As indicated here, the first Technical Delivery Consultant may have lacked the necessary interpersonal skills to actively engage the Foundations TWG and make them feel like a necessary part of the OWA program. Then, after the first phase of the OWA program was completed, a different Foundations Technical Delivery Consultant was hired; who seems to have performed poorly both in managing the interfaces between important social circles, but also in the level of quality in the technical work delivered. As stated by the Keystone Managing Principal:

> "[For] the [second] TDC, it was more of a job. 'I got so many man hours to deliver this report, and I'm working with these five fabricators, and these four installation contractors, and I don't want to give them any more than they need, I just need them to give me an answer, and I'm going to bundle it up in a nice report and I'm going to present it to the [Carbon Trust].' That's the way I took that part of the thing… I mean, all they did was determine how much it was going to cost. But they did nothing to advance the innovation. And I still think that was a total fiasco - A wasted effort."[384]

This statement clearly points to the fact that the second Foundations TDC also lacked the interpersonal skills to bring important people in the process together in order to advance the OWA program, as well as the offshore wind industry. This was reiterated by an OWA management team member who said:

> "The worst case is that the [Foundations] TDC delivers results, just by analyzing it themselves without any interaction with the Technical Working Group. So they'll present a finding, which the Technical Working Group don't agree with, and might not answer the question that they wanted to be answered. So I think the lesson there is that you have to have a good engagement between the TDC and the Technical Working Group members. And that they need to be asking the Technical Working Group what they want to do."[385]

Here again, good communication is stressed as necessary, in this case in order to attain results that are useful for industry partners. Overall, both cases of strong and weak (or non-existent) bridge roles are present within the Carbon Trust OWA program. When asked whether the Foundations TWG needed a new Technical Delivery Consultant, respondents had very mixed

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[383] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 2:15
[384] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 1:36:20
[385] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:36:00

responses, some saying definitely yes (because more structure and technical support is needed), and some saying definitely no (because the scope of the projects has become too large, and projects can more usefully be managed on a case by case basis, in addition to the facilitation provided by the OWA management team). The OWA management team also discussed asking both Foundations TWG members as well as Steering Committee members if a Foundations Technical Delivery Consultant was needed, and it was decided that the OWA management team was doing a sufficient job of coordinating the Foundations TWG, although, as stated by a OWA management team member:

> "Maybe we will go back, and maybe at some point it will make sense, and we'll have a really good contractor that we think could just fill that TDC role but right now this seems to work pretty well [with the OWA management team managing the Foundations TWG]."[386]

This statement shows that the Carbon Trust OWA management team would be open to reinstating a Technical Delivery Consultant if the right opportunity presented itself, which may happen at some point in the future. Overall, individuals fulfilling bridge roles (Technical Delivery Consultants) have played an important part in the OWA program thus far, and this case has also exemplified the need for *both* technical and social competencies in order to successfully carry out this role.

The last network role that will be examined in relation to the Carbon Trust OWA program is that of peripheral specialists. **Peripheral specialists** are either newcomers to an organization or program, or an expert in a particular field. Peripheral specialists are particularly important to the Carbon Trust OWA program because new technology is being developed. In order to get the best ideas and advice available, it is important that peripheral specialists are identified and utilized, which is a fact that is well understood within the OWA program. To start, putting out multiple calls for tenders has enabled the OWA program to attract a number of peripheral specialists from around the world. For example, in discussing the Foundations Competition, a Foundations TWG member said:

> "[The OWA management team] made a world-wide announcement for this competition, and we actually received more than 100 suggestions for new foundations. And this was everything from, you know, big naval architect companies and interviewing companies, and huge world corporations, suggesting what they thought was the best knowledge available, to some more… all different places from all over the world. I noted it down how many different countries there were, that were represented in those 100 [plus] concepts, and it was more than 10-15 countries that were represented from all over the world."[387]

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[386] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 27:10
[387] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 9:35

This is one example of a way in which peripheral specialists have been drawn into the Carbon Trust OWA program. A way that peripheral specialists participate in the OWA program is when partner companies bring in-house experts along to TWG meetings in order to comment on particular issues. As stated by a Foundations TWG member:

> "I can give you examples, though, of where we've had meetings, and people have brought in their geotechnical experts – real senior experts in the field – who have knowledge that relates to, say, a certain foundation… it has quite complex geotechnical interactions in the way it resists forces, and retains integrity and stays upright, that aren't fully understood, that aren't fully documented in codes. And for example it's designed to criteria that have been devised at Aalborg University by those people. And that needs to be verified so that everyone is comfortable with it. And for example our company brought in a geotechnical expert for aspects around, say, installation, and verifying what was proposed. And he used his knowledge and previous experience to review that. And that was very useful."[388]

Here, peripheral specialists are described as coming from the wider organizations within which TWG members work, making very good use of the collective resources maintained by TWG members. Specific smaller issues that may need further expertise within TWGs have also been contracted through the OWA program. As stated by a Steering Committee member:

> "We have seen that in the foundations project actually, where 3rd parties have been asked, or 4th parties have been asked, to come up with some work that can be formally put into the project. So we would then pay for having work done by external partners."[389]

And Steering Committee and TWG members are not the only ones contracting specialized work. The innovator Keystone also contracted peripheral specialists for specific work, as stated by one of Keystone's Structural Engineers who worked on the Twisted Jacket project:

> "We have a couple of subcontractors that we use for things that are outside of our specific knowledge area, the two that come to mind most immediately are… [a] finite element [analysis, and]… the world's leading expert on soils."[390]

As can be seen by the statements above, peripheral specialists are used throughout the OWA program to make use of knowledge that is outside of their immediate network, which has helped them to develop, and may very well help them to sustain, innovations in the offshore wind industry.

Networks play a vital role within knowledge management, as they are comprised of individuals who are interacting with one another for very specific reasons. Within the Carbon Trust OWA

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[388] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 43:40
[389] Steering Committee Member, March 17th, 2010. Recording time: 5:35
[390] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 1:21:50

program, like many other actor oriented innovation programs, knowledge is being developed for the purpose of reducing costs by building and sustaining innovations (and in the case of the OWA program, also sustaining the offshore wind industry in general). Despite their importance, networks are also very complex, and the purpose of describing both network characteristics, as well as network roles within the Carbon Trust OWA program has been to shed light on how this particular network can be interpreted and understood with relation to its network. Put shortly, the OWA program is a well-functioning network overall, which has produced concrete innovations that can help to reduce the cost of offshore wind, despite early shifts in the OWA management team, disparate pipeline objectives within partner organizations, low engagement from some of the TDCs, etc. Moving forward, the big challenge seems to be gaining wide support among partner organizations for further discretionary projects, so that an increasing number of innovations can be built and sustained in the offshore wind industry.

From the above understanding of how social networks function in the OWA program, we can now move on to exploring the way in which the Carbon Trust OWA program has handled six particular conditions which are seen as *facilitating knowledge sharing* in the specific network context of actor oriented innovation programs. The six conditions are: 1) strong ties through repeated exchanges; 2) multiple knowledge connections between partners; 3) noncompetitive approaches to knowledge transfer; 4) goal clarity; 5) cultural diversity; and 6) strong shared vision (shadow of the future). (Inkpen and Tsang, 2005) A discussion of these six conditions in relation to the OWA program should provide a broader understanding of the way that knowledge is shared, not shared, or could be shared further within this network. Also, because many of these issues have already been discussed previously in this section (or chapter) the presentation of each of these six points will be very succinct, discussing how each issue is dealt with more generally.

First, having **strong network ties thorough repeated exchanges** is presented in the theoretical analysis as promoting knowledge sharing and learning, promoting long-term perspectives, as well as trust and reciprocity. It is also proposed that for actor oriented innovation programs, promoting strong ties within social circles may help participants to act cohesively; and that identifying and utilizing the combined voices presented by cliques may also help to mobilize joint action. As presented above, strong ties exist to a greater or lesser extent depending on the social circle in question, and focusing on greater interaction in the Foundations TWG, for example, may positively impact cohesiveness and action. Most network members feel strong ties with the OWA management team, which may very well be a reason for the steady increase in activity that the OWA program has undertaken. A clique was also identified as present between four of the OWA partners through the Forewind Consortium, and this clique has presented ideas jointly in the

OWA forum, which may also have helped to increase activity, and could be encouraged (to the extent that the programs general interests are served by their input, by for example the OWA management team) to do so to a greater extent in the future. Among members of the innovator Keystone who were interviewed, it was reiterated many times that strong ties were formed between their company and many of the partner companies, the Carbon Trust OWA management team, and many of the other sub-contractors who are involved with the OWA program as well. On the whole, although stronger ties may be needed in some areas, there are many strong ties that already exist between members of the Carbon Trust OWA program, and these have led to knowledge sharing on a great number of issues, and are understood as being able to "support the industry also in the future."[391]

Second, providing **multiple knowledge connections between network members** is understood as providing the opportunity to gain exposure to ideas outside of their typical boundaries, as well as to share experiences in different contexts. Liaisons may also play a key facilitating role in enabling multiple knowledge connections, by deciding when and where different network members may usefully be brought together in different contexts. Within the Carbon Trust OWA program, there are a great number of knowledge connections between partners. Many of the partners, for example, have other joint venture projects with one or more of the other partners (such as the Forewind Consortium, London Array, Sheringham Shoal, Greater Gabbard, and Galloper projects). There are also other research programs (such as the National Renewable Energy Centre – Narec, and a co-funded Technology Innovation Center) or forums (such as the Norwegian Wind Energy Association – NORWEA, and the European Wind Energy Association - EWEA) that multiple partners are involved in, and forums that innovators and partners participate in jointly (such as members of Keystone being involved in writing the American Wind Energy Association's guidelines for American offshore wind, and off the record meetings that are held between certification bodies and developers, to discuss important common issues).

 As liaisons, the Carbon Trust OWA management team has also been very open to facilitating knowledge connections between partners whenever possible. For example, during time spent observing at the Carbon Trust headquarters in London, plans were being made for an Access Systems workshop, where discussions revolved around how to best get partners involved and "feeling like they own it."[392] Both the Access Systems workshops and Turbine Days are good examples of the OWA management team facilitating multiple knowledge connections, as well as the Steering Committee and TWG meetings that are facilitated by the OWA management team –

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[391] Steering Committee member, April 24th, 2012. Recording time: 39:35
[392] TDC call regarding Access Systems Workshop, Jan. 18, 2012. Quotation is from notes taken during the call.

all of which have allowed partners to meet each other outside of the context of their everyday jobs. The Carbon Trust OWA management team is also starting to provide multiple knowledge connections by representing innovators collectively at conferences. As stated by an OWA management team member:

> "we're also, having for the first time at [the] Renewable UK [forum]… we're going to have a pavilion and we're going to invite all of the OWA innovators to that… so we'd have a poster for each of the innovators, and maybe those innovators would also have booths, so we would point to their booth, and they could point to our booth, but it could be interesting to show the general industry what the OWA even looks at, so it's a bit of an education on the OWA and a lot of investors would be at that conference, so it could give a bit more exposure to some of the innovators for future investors that might help commercialize their designs."[393]

This statement exemplifies the fact that the OWA management team is constantly looking for ways to provide multiple knowledge connections (personal connections) between network members. Overall, having multiple knowledge connections between network members is understood as having allowed a great deal of knowledge sharing to take place within, across, and outside of the boundaries of the OWA program.

Third, having **non-competitive approaches to knowledge sharing** is understood as reducing the desire to "hoard" one's knowledge, and instead to try to commonly solve problems. This concept is closely related to that of peer-to-peer interaction, as identified in section 5.2.4 Knowledge Sharing. As pointed out previously in this chapter, the offshore wind industry is "notoriously secretive." [394] However, as illustrated in section 5.2.4, non-competitive (peer-to-peer) approaches to knowledge sharing can be identified throughout the interactions of the Carbon Trust OWA program members. Examples are given of this behavior being displayed between members of the Carbon Trust OWA management team, Steering Committee and TWGs, within Keystone, and between Keystone and the partners of the OWA program.

At a very general level, information is shared between innovators and other members of the OWA program in a non-competitive manner because of the "IP promise" that is in place – insuring that the innovation concepts remain the property of the innovator. Leaving IP with the innovators also enables knowledge to be shared in a relatively non-competitive way between innovators, as specified by a Steering Committee member:

> "We don't have any stakes in technology as such. We are the end user, so there is no danger at all in sharing experience and knowledge. I think it would be a totally different thing if we had a collaboration among different suppliers. Just because we are the end user of the technology,

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[393] Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 30:40
[394] Foundations Technical Working Group member, May 1st, 2012. Recording time: 48:20

not selling the technology, not having any stake in the technology – I think this is a very good arena for this. And I think this enables us to be open on this topic."[395]

This feeling of openness and non-competitiveness is reiterated by the Wake Effects TDC:

"They're all in the same industry, but I think they feel more that they are in it together than they feel that they're competing with each other… within the Technical Working Group – we do have a lot of interchange of ideas and experience and genuine discussion at a scientific level, when: "Oh, we tried this, and it didn't work." "Oh, what did you do?" "Oh yeah, we've had a look at that device, and I'll give you some figures on how expensive it was." You know, there is some real exchange. And if those guys felt like they were competing with each other, they just wouldn't do it, their mindset overall just wouldn't be there to do it."[396]

Despite these statements of non-competitive knowledge sharing, there were also multiple network members who stated that information or knowledge was also withheld in TWG meetings. As stated by a Foundations TWG member:

"The business of the Working Group, I think the communication and sharing of information is pretty good. I think when you're talking about sharing information from other projects, there's obviously… I think because all of the Round Three projects have been early on in their development, there's always a slight reluctance to get into any great discussion on where substructures solutions are going…. I think companies are very wary about keeping things close to their chest at the development stage for whatever reason. And I've seen a lot of that within [my own company], when I talk to other people it's quite clear they're holding things back [as well]. You do have discussions and small snippets of information, but I don't think everybody tends to discuss openly what their company and projects are doing."[397]

Although there is also some difference in the degree of openness between TWGs, it was also a common concern expressed that projects in very early stages of development were most often kept quiet, and not discussed as openly. When looking at the Carbon Trust OWA program collectively, however, their approach to knowledge sharing seems to be largely non-competitive, which has allowed them to learn from one another and advance innovations in a number of areas.

Forth, **goal clarity** is understood as promoting knowledge sharing because it provides a foundation for collaboration and common purpose among network members. Goal clarity was a particularly prominent issue among respondents. In general, it would seem that although overall objectives may be common, goals within individual partner organizations are often different. One Foundations TWG member did a good job of describing this situation. When asked if all partner organizations shared the same goals, he said:

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[395] Steering Committee member, May 11th, 2012. Recording time: 1:07:35
[396] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 9:30
[397] Foundations Technical Working Group member, May 4th, 2012. Recording time: 46:45

"I think everybody has a vested interest. I think generally everybody wants, as I said, wants to reduce the costs of offshore wind, and wants to ensure that round three is a success. I think that is a shared goal. However obviously depending on the stage projects are at etc., every company has their own vested interest which they've got to protect. Some companies are more keen on certain projects than others, and I think that's always going to happen."[398]

So, although all partners have the same common goal of successfully installing and operating offshore wind farms in the UK Round Three - timelines, specific concepts, third parties already contracted for work, etc. may all be different. This situation means that many partners have different foci, and thus different goals and objectives within the OWA program. In the most extreme case, a Foundations TWG member expressed feeling that there was very little goal clarity with the Foundations TWG when he told the following story:

"Actually on the very last meeting with the Carbon Trust that I had, I brought this up. You know it's funny, because we were in the middle of London, and there was a fire drill at the venue where we had the meeting… so everybody had to leave the building and go to the designated areas…. And I talked to [the head of the OWA management team] during that fire drill, and I said that it was a shame, you know, the issue that I just explained, that we weren't able to take this any further, you know, that we weren't able to build stuff. Because I thought that was the whole purpose of it. And afterword when I came back from the fire drill, we took up the discussion at the technical working group, and it appears that the other companies might - they're more content with just getting a little bit of knowledge, and the networking that we do, at least some of them."[399]

This statement expresses that goals may not be aligned, or clear, within the Foundations TWG - where some members are very interested in demonstrating new technology, and others are more content to use the OWA as an overall networking forum. Another Foundations TWG member also stated that goals may need to be more clearly articulated within the TWG when he said:

"The [TWG] meetings themselves always have an agenda. And they are conducted well I would say – they are maintaining their time. I think [what is needed] is more in the way of having this – of having someone to follow up or have the full picture, and being able to convey that to the group: what are the main focus areas at the time being?; how are the studies coming along?; how do they tie together?; and the overall picture. That could be good maybe, to have a little bit more focus on that side."[400]

One way that the Carbon Trust OWA program has maintained goal clarity is through having yearly evaluations, where funding and project decisions are made between the OWA management team and all partner organizations. This was described by a Foundations TWG, saying:

"I think as a government organization, [the Carbon Trust OWA program] does need to be very clear with its goals, and it is - And how it's performing against them. So [each partner

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[398] Foundations Technical Working Group member, April 24th, 2012. Recording time: 32:45
[399] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 47:55
[400] Foundations Technical Working Group member, May 22th, 2012. Recording time: 56:55

company has] a steering committee that is across all four [and now five working] streams of the Offshore Wind Accelerator, and they are reported back to annually on what the goals were for that year, and the level of achievements against them. I do sometimes think that the proposed achievements for that year are a little optimistic sometimes, but I think they are well set up to recognize achievement and not achievement slash failure."[401]

Having annual evaluations, where the previous year's work is evaluated and presented by the OWA management team and the next year's projects and funding are decided jointly between the partner organizations, seems to have been a very good way of clarifying goals. These evaluations not only help to clarify goals between members of each partner organization (including Steering Committee and all TWG members), but also between the different partner organizations, where debates are taken up about which projects will best fit the overall objectives of the program. Despite a possible need for more goal clarity within the OWA program, it should also be viewed as a program in a good position to achieve goal clarity. As stated by a OWA management team member:

"And that's another unique aspect [of the program]. OWA is very focused because they are just developers. What is very unique, I think when you look at research programs - they normally try to get as much diverse expertise into their research program as possible. But then you have very diverse objectives, and that makes it more difficult."[402]

This statement also indicates that by only having offshore wind developer organizations as partners makes things less difficult because everyone is pulling in the same direction (having the same end goal), presenting the opportunity for goal clarity to emerge.

The fifth condition that is seen as facilitating knowledge sharing is cultural diversity. **Cultural diversity** is understood as facilitating knowledge sharing and learning when individuals within a network combine the dissimilarities (coming from cultural diversity) in their mental models, which also promotes the generation of new knowledge. Within the Carbon Trust OWA program, an OWA management team member expressed cultural diversity as benefiting network members when he said:

"With [some of the partner companies] I think they all want to learn from each other in the OWA… they're getting a lot of benefit from [other partners] who have got more experience than them."[403]

Here we see more experienced partners as having different frames than less experienced partners, from which the less experienced partners can learn. A member of the Steering Committee also expressed cultural diversity as an asset among OWA network members when she said:

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[401] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 53:45
[402] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:19:20
[403] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:07:10

"I think it's important to say that those people that are attending in these technical working groups, and also us as part of the Steering Committee, I think it's fair to say that we are learning by working together, because we have different experience. And I think that's also very valuable now. We should put that very high in this context."[404]

As this statement shows, partners do also consider their cultural diversity an asset within this network. In specifying exactly the nature of some of the different cultural pieces or "tiles" the different partners are able to contribute within the OWA network, a Steering Committee member elaborated by saying:

"That is something that we bring to the table…Long experience in operating installations offshore. I think we are different from the others in that respect… [Another partner] has much more experience than us in having wind turbines offshore."[405]

Also, within the team at Keystone that worked on the Twisted Jacket foundation, it was noted that having different specialties (cultural diversity) was a benefit to the team generally because:

"We know what each other are good at, and we can use that to maximize our efficiency."[406]

Cultural diversity is also acknowledged as valuable within one of the Wake Effects sub-contractors. When asked whether members of his team had similar backgrounds, this sub-contractor said:

"No. We complement each other in different ways. So [one of our team members has a] background in atmospheric physics, [another team member] has a background in mechanical engineering, I've got a background in mathematics… So we all have different backgrounds, complementing backgrounds. We have access to people with deep knowledge of the internals of the software. So it's very much that we've got complementary skills, I would believe."[407]

Overall, cultural diversity can be seen as an asset within the Carbon Trust OWA program, where many different individuals collaborate, combining their different and unique skill sets to achieve a specific goal.

The sixth, and final, condition which will be discussed here as facilitating knowledge sharing within actor oriented innovation networks is a **strong shared vision, or shadow of the future**. Having a strong, collective understanding about what the future will look like can engender trust and cooperation toward the desired end of achieving this shared vision. The Carbon Trust OWA program, despite its many partners with different pipeline objectives, all seem to have a strong

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[404] Steering Committee member, May 11th, 2012. Recording time: 23:00
[405] Steering Committee member, April 18th, 2012. Recording time: 22:15
[406] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 40:40
[407] Wake Effects Sub-Contractor, Dec. 15, 2011. Recording time: 18:30

shared vision of successfully building and sustaining wind turbines in deep water – specifically at the UK Round Three sites. As stated by an OWA management team member:

> "Round Three is much further from shore, so up to 200 kilometers off shore, maybe 2,500 turbines on a site. So, and it's deeper waters – rather than less than 30 meters, its up to 60. So it's technically more challenging. And in terms of the time scales, the developers are getting consent at the moment to build those projects, which takes at least 2 years, to get planning approval. And then construction is likely to start in 2015. But they need to take the decisions about what turbines to use, what foundations they use, now. So, any information that we can give them now is relevant to their projects; so there's quite an urgency to the work that we're doing."[408]

The urgency discussed in this last statement, to prepare as fully as possible for the UK Round Three sites, seems to have translated into a genuine desire for the partner organizations to work together within the OWA program, which can be understood from a statement by the Wake Effects TDC:

> "I think the main thing, and where it started, was that there are genuine common aims [among the OWA partner organizations]. You know, they aren't manufactured aims. You know, they are genuine. They do actually want to work together. I am being very careful in my choice of words, because I'm aware of projects were large organizations have said that they want to work together, but actually they don't. What they want to do is put in a joint project proposal, so that they get some kind of public funding, which isn't the same thing at all. So if there's one thing that's important, I think that that's the first thing – they do actually want to work together."[409]

The genuine common aim or vision – to reduce the cost of offshore wind though advancing technology – has been pervasive throughout the interviews conducted. This common vision does seem to have united members of the OWA network, in order to find solutions to the common challenge of building offshore wind farms that are larger, and farther from shore than has been seen previously. A Steering Committee member reiterated this vision in a slightly different way by saying:

> "…more efficient or more cost effective solution. And this is what we expect from the OWA, to get learning and knowledge about the more efficient and more cost effective solutions. So, this is our target behind the OWA, because we are convinced that the cost of offshore wind needs to decrease. Otherwise offshore wind will get into rough waters."[410]

It is generally acknowledged that offshore wind is currently too expensive in relation to other forms of energy, and that overall costs will need to come down for the offshore wind industry to be competitive. For this reason, finding "more efficient" and "more cost effective solutions" is a

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[408] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 10:50
[409] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 8:20
[410] Steering Committee member, April 24th, 2012. Recording time: 37:20

high priority for all of the partner organizations to realize in the future – and as near in the future as possible. Another Steering Committee member expressed an aspect of the common vision when saying:

> "Also develop competition in the supply chain. That is also a success factor. So if we can get more suppliers, new suppliers established through this project, and increase the competition, that would be good for all of us, because then we can drive costs down - competition."[411]

This shows another way that the cost of offshore wind is envisioned as being brought down – by increasing competition. Increased competition will also mean more choices for OWA partners, all of whom are developing offshore wind farms in Round Three. Having more selection in the market is also a sign of a maturing industry, which was identified as needed by a Foundations TWG member when he said:

> "I think it's very, very important that the industry matures. Get past these learning curves. And also, we are used to much more cooperation in the oil and gas business to drive the technology - And also between developers, because we all in the end want to do things as cheaply as possible."[412]

Here, this TWG member is envisioning a future with technology that is more advanced (getting past the learning curves) information is more freely shared (through cooperation), and the costs of offshore wind are driven down (doing things as cheaply as possible).

The fact that the offshore wind industry is still maturing (where new and improved technology is needed, and prices are too high) gives all of the OWA network members a reason to work together and share what they know in order to achieve the vision of a mature and competitive market for offshore wind.

Each of the network *conditions facilitating knowledge sharing* that are presented here are supported by the network structures and roles discussed above. Taken together, this section has provided insight into the way in which the Carbon Trust OWA program functions in terms of structures and roles, as well as how these structures and roles are carried out to facilitate knowledge processes within this particular actor oriented innovation *program*, or as we can now view it – actor oriented innovation *network*. As depicted above, not all structures and roles function optimally for the purpose of facilitating knowledge processes. The purpose of discussing the OWA program in social network terms was precisely to demonstrate some of the more complex interactions that take place within this network, as well as how they relate to knowledge processes. This could then be taken further, and used as a foundation for making more informed

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[411] Steering Committee member, April 18th, 2012. Recording time: 55:00
[412] Foundations Technical Working Group member, April 19th, 2012. Recording time: 37:40

decisions about actions to be taken for achieving a future where offshore wind farms (and the innovations that are developed for them) are built and sustained at the UK Round Three sites.

5.4.2 Genuine Shared Goals

We now turn to the second critical success factor of knowledge management that will be discussed in relation to the Carbon Trust OWA program, namely genuine shared goals. The identification of genuine shared goals is not unique to the field of knowledge management, and has led many organizations and actor-oriented innovation programs to successfully manage individuals and the knowledge that they possess. For any network, organization, project or program, individuals need to know what they want in order to have a good chance of getting it. (Davenport and Prusak, 2000, p.58) For the OWA program, it is particularly important for those involved to find common ground because there are so many diverse objectives present (primarily due to the fact that there are so many different organizations participating). If common goals are not shared, the ability to agree on actions is likely to be seriously weakened, leading to an ineffective program that risks being disbanded. This section will discuss two types shared goals with relation to the OWA program: longer term, visionary goals, as well as shorter term goals, both of which are important for the management of knowledge. It should also be acknowledged that although having genuine shared goals was discussed in relation to social networks above, this topic is deemed sufficiently important to be elaborated upon as a separate critical success factor for knowledge management.

First let us turn to longer term, visionary goals. **visionary goals** are understood as a critical success factor for knowledge management because striving towards a common vision is what helps to keep organizations, programs and projects moving forward, instilling a sense of purpose or drive that might not otherwise exist and without which, endeavours would likely come to a standstill. Visionary goals are seen as particularly important within actor oriented innovation programs such as the Carbon Trust OWA program, because having a common vision also allows individuals to work 'with' rather than 'against' each other in order to achieve said vision. This is particularly important when there are many partners involved, and decisions are based on consensus (as is the case with the OWA program). Having a strong and compelling vision of the future (also termed 'shadow of the future' by Parkhe, 1993) is also understood as reducing opportunistic and freeriding behaviour to the degree to which this vision is perceived as attainable and desired. Visionary goals, or shadows of the future, are also similar to what David Boje (2008) calls 'antenarratives,' because they describe a 'bet' on what the future will hold. When this vision is clear, compelling, as well as open and challenging, it can entice individuals to "think outside of

the box" and come up with unique solutions to commonly held problems. Let us now examine the concept of vision further, with relation to the Carbon Trust OWA program.

Among the OWA management team, the vision of the overall program as well as the vision for the individual TWGs is well understood. As stated by an OWA management team member:

> "I think one of the challenges is that with so many people involved, you can't please everyone. But I think at least we have a pretty common goal, which is to reduce the cost [of offshore wind] and deliver stuff quickly, which should help us to have outcomes that are good for all of these stakeholders and the innovators."[413]

Here it is indicated by the OWA management team that the overall goal, or vision of reducing the cost of offshore wind and delivering innovations to the market quickly has led to outcomes within the OWA program, keeping momentum up and focus in the right direction despite having a large number of actors involved. In relation to vision for each of the TWGs, an OWA management team member said:

> "If we managed to get the four foundation concepts to market, demonstrated, and we managed to get a number of access systems demonstrated and to the market, and we concluded our measurement campaign, that would be a very successful outcome for the OWA, if we managed to get 66KV tested. I would be a very happy man, and I'm sure the energy companies would be happy with that outcome… I think that these guys have signed up until 2014, and I think it's realistic to achieve a lot of that by 2014. Because the nature of the program is that we want to achieve stuff in time for Round 3, so we need to get it done quickly. Well, 2014 is fast in terms of offshore wind."[414]

Here, we see not only vision in terms of what the TWGs may achieve, but also a challenging vision in these areas (in terms of the sheer amount of work to be done, and the time scales being worked with) that is understood as largely achievable. From the Steering Committee, an overall vision is also identified, namely being prepared to develop projects at the UK Round Three Offshore Wind sites. As a Steering Committee member stated:

> "I think it's also one driver, that all players are interested in UK Round 3 essentially, so they have some kind of interest in that. And with that comes a rather significant number of challenges that are either the same or very similar for all partners."[415]

Here, we see that the common vision of developing offshore wind farms also provides a common drive to overcome some very specific challenges related to this development. Going into more detail about this vision, another Steering committee member said:

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[413] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:37:00
[414] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:11:00 – 1:12:30
[415] Steering Committee member, May 5th, 2012. Recording time: 32:45

"Essentially it was kept very simple. So latest 2015 we want to have demonstrated offshore foundations that reduce CAPEX with at least 10% and still being able to cope with deeper waters without… so reducing CAPEX despite deeper water essentially, and further offshore. And to have that commercially available, so that means full-scale demonstrations have commenced latest 1014. So 2015 we should be in a position where we could place an order for it… But given that we are a great number of participants, and we have the Carbon Trust having their will as well, making it into a detailed plan is just not… just doesn't pay off, because you need to adapt anyway, so it is better, then, to keep the overall targets in mind, and then in every given situation work towards that… [and perhaps it is] not so surprising [that] this is not very different from the overall targets from the other partners and the Carbon Trust as I perceive them… from my point of view, there's a benefit for all partners if offshore wind is making progress as an industry."[416]

As this statement does a good job of explaining, having an overall vision helps the OWA program to be flexible, and adapt to changes by keeping the overall goal or vision in mind when making decisions. In describing how the vision of the OWA program has enabled members to work well together and stay focused on delivering outcomes, a Steering Committee member stated:

"This particular group I have found exceptionally workable with. There hasn't really been conflict, which is surprising… perhaps because there's a clear vision… We are all trying to build offshore. We all know that it's too expensive, so we all want to reduce our costs, prove reliability, reduce risks, and we've put money into it. So those sorts of things focus your mind very much on outcomes. So we have clearly defined outcomes, and even projects that come to the table that don't make sense because the outcome doesn't make sense – just get pushed sideways. So you know, clear outcomes, clear vision, and a good, well-focused group."[417]

This is closely related to yet another Steering Committee member's statement, who, when asked what his motivation for sharing his knowledge with all of these other developers was, said:

"I guess the underlying motivation is to try and make sure that the industry survives for a start. And that we meet the targets, so that's a common goal."[418]

This statement relates the vision of the OWA program specifically to a desire to share knowledge, reaffirming its placement within the critical success factors of knowledge management. However, it may also be the case that some partner organizations have a vision that extends further into the future than others, as we see in the following statement:

"So we look a little bit longer term to what we're doing, possibly than some of the other companies do. So I would hope that one of the things that we bring to the OWA is a slightly more strategic perspective, like the turbine issues I have spoken about. And I think that links quite well with the Carbon Trust's actual thinking to be honest. We have tensions, you know, within the company as always – there are a lot of people who are purely focused on delivering

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[416] Steering Committee member, May 5th, 2012. Recording time: 57:20
[417] Steering Committee member, April 24th, 2012. Recording time: 1:50 – 2:45
[418] Steering Committee member, June 4th, 2012. Recording time: 1:20:30

the projects that are on the books here and now, but we are able to balance that with this longer term strategic view."[419]

This statement suggests that perhaps some partner organizations have a vision with a longer time horizon than others. While all organizations involved may have the vision of reducing the cost of offshore wind, and driving the technology forward, approaches to accomplishing this task can also be different, both within and between partner organizations. Having different approaches towards achieving long-term, visionary goals was also stated by a Foundations TWG member no longer participating in the group:

"The focus was varied between the companies. Some companies were there because they could just sit on the corner and listen, and learn something. And others were there… I think when [our company] entered it, it was very clearly to demonstrate some of these concepts. At least that was my very clear goal, and I never heard anything else within the company… it would have been much more ambitious, much more profitable to build something. And we are doing that with the Mainstream project now. It's not a turbine, it's a met mast, but we are gaining some knowledge that way. I think when you look at it from above, and you take this whole thing, we had this big tender round, where you had initially up to 15 companies come in – you had two American companies, they crossed the Atlantic to come over and tell us about this. And they did it several times. And you had big European companies working, putting a lot of effort into some of these concepts. And what came out of it? A small tea-party kind of club (laughs). I know we are building the Mainstream project, and we are building other things, but I think… I know this is the way the commercial side works. If there is an opportunity, you might seek it, you might not get it but I think it's a shame that we didn't have a little bit more results – have bigger results, because we had a great opportunity."[420]

This quotation seems to explain almost a lack of vision, where opportunistic and free-riding behavior is taking place. It may be that the Foundations TWG, as well as the program overall, has evolved since this interview took place, because about a half a year later, another Foundations TWG member stated:

"Well the goal is – particularly with relation to the Foundation work group - is to see the demonstration projects of each of the foundations supporting wind turbines."[421]

Then, when asked if this was an achievable goal, the TWG member replied "yes." Another Foundations TWG member stated:

"Everyone definitely shares the same end goal, and I think generally their approach to achieving that is quite similar as well, you know. For example, their thoughts on whether they specifically want to reduce their cost of energy, or whether it's to reduce [the cost of] offshore

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[419] Steering Committee member, April 24th, 2012. Recording time: 18:10
[420] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 27:40
[421] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 41:45

wind energy [generally]. I think people have a generally similar approach to that, which is the goal of the Carbon Trust: To reduce the cost of offshore wind. That's my feeling."[422]

The above statements describe contrasting perspectives within the Foundations TWG. It may be that the need and ability to achieve results through the OWA program is not felt equally by all partner organizations, despite the overall vision that each member participating in the program has of advancing offshore wind technology and reducing cost.

In relation to innovators, Keystone's Managing Principal told a story about the original vision of building novel foundations being lost, and then finding this vision again through the instatement of discretionary projects. As he put it:

> "In my opinion the Steering Committee kind of lost its way, and they weren't going to go straight from feasibility through demonstration, they kind of didn't have a clear focus of what the end game was going to look like. Then it became much more broken up. Much more random I would say. At least from my perspective… Because the original concept, I think, was to go through this feasibility, go down to several concepts and then maybe demonstrate two or three of the concepts at some wind farm that was being constructed around this time frame, that was owned by one of the developers. And when it was apparent that that wasn't going to happen, then they kind of lost focus I think. They went to do these de-risking studies, in my opinion kind of like a stop-gap thing, like "ok, let's spend a little bit more money and see if we can't do something else." Then they seemed to get re-focused on the fact that it was going to be demonstration by groups who wanted to do a demonstration [through discretionary projects], and kind of broke it up that way. And at that point it got less regimented… they went way off their original schedule."[423]

One issue that came up during the conducted interviews is that the partner organizations could not agree on where to demonstrate the concepts. In the end, this may have been a contributing factor to the Steering Committee "losing its way," or its vision. This vision of demonstrating novel foundation designs was at least partially regained when discretionary projects became available, where a limited number of partners could work together to demonstrate innovations. When looking at the overall goal or vision within Keystone, it is clear that they have a very clear vision, to demonstrating their Twisted Jacket concept with a wind turbine on it, and ultimately be a part of the offshore wind energy market. As stated by the Managing Principal:

> "I think the one thing that always drove the overall project team is… we're keen to get a turbine on one of our foundations, and spinning. You know, that is an overall goal. In fact, in the meetings, when it was brought up about doing a demonstration for a met mast, we said that we don't have any objection participating in demonstrating for a met mast, but in our opinion it doesn't really demonstrate anything that has not already been demonstrated in the Gulf of Mexico, because we've already installed two structures, we've already built two. So all it does is say "we can do the same thing in Europe as we did in the Gulf of Mexico." But

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[422] Foundations Technical Working Group member, Jan. 13, 2012. Recording time: 27:55
[423] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 33:40

as far as demonstrating something that would allow us to use the foundation, or propose the foundation for a large wind farm, and ensure that there were no issues with the financing of that wind farm, because they are using this particular foundation, that doesn't help us get to that point. It doesn't help us leap over the financial hurdle. So, demonstration is key… demonstration with a turbine is key, I think."[424]

A Keystone Structural Engineer also described the vision of having the Twisted Jacket foundation used as part of offshore wind farms, as his motivation for working hard:

"We put that [Twisted Jacket foundation] in there as the first of many to come. That was the idea. We definitely see the bigger picture that this is only the beginning, and we would like to have an entire wind farm with our foundation. That's our main goal… Yeah I think it's a possibility, I think it's a strong possibility. I mean there's things we can't control, like governments' budgets, and what kind of loans people are going to be giving, or how the overall economy is doing, or how oil prices are doing, all that kind of stuff. But as far as forecasts go, and as far as what I read and what I've learned, yeah I think a lot more wind farms are going to be created. And as far as where they're going to be located, there are water depths that totally match what our foundation is great for. So nothing is defined or anything like that, we're just trying to be part of that market, and a big part of it. I mean I definitely think that's why I work hard, basically, because I think it's going to happen."[425]

As these statements show, members of Keystone that worked on the Twisted Jacket foundation have a very strong interest in sharing what they know with other members of the OWA program – namely so that they can achieve their vision of having their foundation used for the development of an offshore wind farm.

There are two other issues that should also be touched upon before leaving the issue of vision. The first issue is related to improving the overall industry for offshore wind, as opposed to improving offshore wind for the individual partner organizations. This was very clearly explained by a Foundations TWG member when he said:

"These guys [(partner organizations)] aren't in it necessarily to make it better for the industry; they're in it to make it better for themselves. But as a result of doing that, as we are the industry, it makes it better for the industry… and that's the main goal, isn't it - to implement all the benefits that we're getting into our company."[426]

Here we see very clearly the connection that can be made between the vision of each partner organization in relation to each other, and to the industry as a whole. This point of view was reaffirmed at the Steering Committee level, by statements such as:

"We're in it for ourselves, so our main role in this is to improve offshore wind essentially. So drive down cost CAPEX or OPEX, improve safety, improve environmental performance, and

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[424] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 44:35
[425] IBGS Foundation Structural Engineer 2, Keystone, Feb. 8, 2012. Recording time: 27:55 – 28:30
[426] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 27:25

make sure that we manage [to achieve] this for the industry because that's good for [our company]."[427]

So, by improving offshore wind for each partner organization, it will also improve the overall industry. However, when organizational objectives do not align (for instance when partner organizations have had trouble committing to spending money on demonstrating chosen foundation designs), the vision may become less clear, as it becomes less obvious how overall objectives, or the vision, will be achieved.

The second issue to be discussed is the issue of senior management support. In chapter four, it was explained that **senior management support** is also required for visionary goals to be prioritized and worked towards. This is also definitely the case within the OWA program. One Foundations TWG member suggested that a lack of senior management support may be hindering the demonstration of innovative foundation designs. As he put it:

> "This might also be the reason why we haven't built these test sights, is also because the politics from upstairs, from management is actually that we should be, you know – lets hold back a little bit, wait and see what happens… Let's do this Carbon Trust thing to make sure we're not missing out on anything, but let's not take too much initiative, let's just wait and see a little bit."[428]

As seen here, if the top management is not supporting the overall objectives, or vision, of a particular endeavor or program, it will be very difficult to move forward. And for the Carbon Trust OWA program, this vision needs to include not only support for the offshore wind industry, but also support for each of the partner companies, which was explained by a Steering Committee member who said:

> "I guess it's becoming more challenging because a lot of the governmental decisions in terms of funding and subsidies are influencing the amount of money we put into collaborative projects, and whether we're getting the return on it or not. Because there's uncertainty now in the UK government, for example, whether they're going to maintain the level of subsidy for renewables. So that has an impact on our senior management supporting these types of initiatives."[429]

As this statement explains, whether it is the level of government subsidies or other contributing factors, senior management needs to support the overall objectives of actor oriented innovation programs, if they are to move forward; their success will depend on it.

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[427] Steering Committee member, May 5th, 2012. Recording time: 40:30
[428] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 46:25 – 47:15
[429] Steering Committee member, June 4th, 2012. Recording time: 11:15

The last few pages have explained how important visionary goals are for knowledge processes within the Carbon Trust OWA program, including the ways in which collective and disparate visions have impacted the program. Now we will examine short and medium term goal clarity, which are equally important for knowledge management, and equally complex within the OWA program. This complexity comes not only from the number of partners interacting and number of projects being undertaken, but also from the nature of innovation generally – where short and medium term goals often need to be adjusted in order to achieve results. The reason that short and medium term goals are so important is that they break up large tasks, or visions, into manageable pieces. Short term goals, or **low-hanging fruit**, can bring groups together and give them a sense of accomplishment once achieved, providing the confidence to take on tougher challenges. Medium term goals, or **high-hanging fruit**, describe more difficult changes that take relatively more time and effort to achieve. Setting firm deadlines for these more difficult tasks is also important to make sure that projects produce results. For the Carbon Trust OWA program, a basic premise of the program seems to be that there is a need for small and medium term goal setting and alignment, so that projects produce results that are useful for the partners. As stated by an OWA management team member:

> "I think the reason why we are monitoring carefully is because we want to be able to re-adjust the direction that we are going. So we are constantly on the tiller of this boat. And constantly adjusting - and we do this together with the buy-in from our partners, so that's probably the main reason. So we could probably say: "OK we just don't need to bore you about this," or we just monitor what they are doing, but not necessarily need to involve our partners. If innovators did not need to make progress updates to our partners, and they just made them to us, and we just told the partners, then you wouldn't have the buy-in from the partners, and we wouldn't be able to re-adjust the course to ensure at the end that we arrive at the right destination. And that's the reason why, I think, we really need the partner involvement, and this constant review of where we are, and a good understanding of where we are going as well."[430]

This statement compares the OWA program's projects to steering a boat, which is an analogy that does a very good job of explaining the way that small and medium term goals are viewed within the OWA program. Small and medium term goals are agreed among the partners, and results in relation to these goals are reported to the partners on a regular basis, which helps to ensure that what is being achieved is indeed what the partners are looking for - it gives the partners a chance to "steer" projects in the right direction, so that they can "arrive at the right destination." This OWA management team member also discussed the way in which small and medium term goals have been specified for some of the specific work streams within the OWA program:

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[430] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:03:15

"So there are overall objectives, 10% of cost of energy, it doesn't really mean a lot. But then in the Foundations there's an objective to develop new novel foundation designs. So then you have, for the Keystone structure, you have an objective to improve or de-risk the installation - there's a certain objective. And also the objective is to install, and demonstrate the structure for a met mast. And then the next objective there is to demonstrate with the turbine. For another structure it may be de-risking and engineering parts, a certain area of the structure maybe that is not so well known or understood. On wake effects, there are all the time very clearly defined objectives and the scope that supports these objectives also needs to be defined in a way that you have clear deliverables at the end of the day and everybody has a very good understanding and agreement that this is what we want to get out, but then there needs to be enough room then to ensure that this is possible."[431]

This statement describes needing not only to have enough specification to achieve short and medium term goals, but also enough freedom built into the process to make changes where they are needed. In describing how it is possible to set short and medium term goals, even when all the steps are not known ahead of time, the Wake Effects TDC identified the following:

"To give you an extreme example, which isn't the lengths we've had to go to with this project, but to give you an extreme example – if you literally have no idea – I mean we sometimes we have clients who turn up and say "look, I need three graduate engineers." "What are they going to do?" "We don't know yet, but we've got loads of work." How do you give them a proposal for that? Well you just say "our milestone will be a report every month," or whatever they have done. We haven't had to go to that length, and to be honest we don't like going to that length, but if the scope, the nature of the work, the scope of the work is by its own virtue flexible, then you have to be flexible with it. But you can always find a way to do that."[432]

One technique that the Wake Effects TDC has utilized in order to set small and medium term goals within this work stream is to have regular reporting. As stated by a Wake Effects TWG member:

"so… say for example some of our longer running projects, we'll have monthly updates. And some of our shorter projects, we'll probably have updates or updates at the stage gates, so they will often go off and do a bit of work, it's only going to take a couple of weeks, and then they'll come back when they're finished, and we'll review that, because it's probably not going to take more than half a work day, or something like that. So, it's just depending on time, and then if, again, if some of the companies – if there's some important news – you don't have to stick to those reporting schedules."[433]

So, by having a regular reporting schedule, and impromptu reporting if something important happens, the Wake Effects TWG is kept up to date on both small and medium term goals, whether they are achieved or need to be adjusted. The Wake Effects TWG also experienced a "big win" or short term goal achievement before any of the other working streams, which seems

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[431] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:05:10
[432] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 16:20
[433] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 12:45

to have made both their working stream, as well as the program overall, more cohesive. As stated by a Wake Effects TWG member:

"I mean the big one is this bit of software called Fuga which is really a bit of a game changer. I mean it allows us to do stuff that previously we just couldn't do in terms of flexibility and now we can really optimize projects based on layouts and design. And yeah, it has taken runs that used to take weeks down to minutes. So you can really churn through runs, and it just means that you can test a lot more hypothesizes, and therefor you'll eventually find a better project. So that's like something we really achieved there. And there was a fairly high risk that they wouldn't be able to pull it off. I mean before the OWA kicked in, it was a theoretical idea in some guys head, in terms of – he saw some equations that he thought he could work, and the one guy ended up pulling it off, and it was a major breakthrough. And it wouldn't have happened, at least on these time frames, if we hadn't put the money behind them and really cracked the whip, and told them to get on with it."[434]

In describing what exactly this Fuga tool meant for the partner organizations, an OWA management team member said:

"The Wakes group was quite successful and the partners quite liked it because you had something out there that you could actually benefit from directly, you could use it… Yes I think [this has made them more cohesive as a group]. At least they got strong buy-in from their management as well. So they said: "OK because of OWA we have this new computer model and it gives me X Y Z benefits," and then it's much easier to sell the benefits to the senior management. They can see" OK there's something." And I think it also helped for new [partners] to join. They said: "Ok, if we're joining we pay this amount, but then we can get this computer model." And that's a direct benefit that you can put some money to - you can evaluate the cost/benefit thing. Whereas this with knowledge that is not necessarily so easy, to say: "OK I gained more knowledge about a structure."[435]

As this statement shows, short-term goal achievement has meant buy-in from top management within partner organizations, as well as being an attractor for new partners to join the OWA program. Since the Carbon Trust was initiated in 2008, it has almost doubled in size, going from five partners to nine.

Another way that short and medium term goal clarity is achieved within the program as a whole is by having yearly evaluations. As stated by a Foundations TWG member:

"The Carbon Trust, every year, they come to us and say "for an additional 100,000 pounds you can stay in the club for another year." Then we'll do an evaluation of what we think of the Carbon Trust, and what are the benefits, and what are the drawbacks, and all these other things. And we'll have an internal evaluation of the Carbon Trust. Sometimes [our Steering

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[434] Wake Effects Technical Working Group Member, Jan. 13, 2012. Recording time: 1:09:55
[435] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 51:20

Committee representative] will ask, you know, "how do you think this process went?" and he'll take that to the Steering Committee as a kind of feedback."[436]

Explaining in more detail what this yearly evaluation process entails from within the Carbon Trust OWA program, another Foundations TWG member stated:

"I came in at the end of Stage I. But for Stage II, they did a wash-up of stage one, saying "this is the status, these are, say, the foundations we want to take forward, this is how we're going to manage it, and this is what we THINK the key work packs and tasks are. Listing them, and then saying this is our key goal, and we want to achieve it by bla, and this is a provisional plan." So they had the tasks in a plan, and a date for when that overall mile-stone should be achieved. And that would be proposed by the Carbon Trust, and reviewed by the whole Working Group: Whether it was achievable, whether they were the right tasks, and all of that kind of thing."[437]

So, yearly evaluations not only provide a means of evaluating short and medium term goal achievement within the program as a whole, but these evaluations also map the low and high-hanging fruit for the following year, making sure that all of the partners in the program agree on the intermediate steps to achieving their long term goals. This does not mean, however, that this process is perfect. This was observed by a Foundations TWG member who said:

"Sometimes we have the feeling - and that's the feedback we gave to the Carbon Trust as well - we generate work without specifying this in enough detail. And without following the outcome - if the outcome diverts and deviates from our expectations, it happens without insisting on correctness and updates - this is something where some improvements could be, or could happen in future."[438]

So, it may be necessary to have more short and medium term goals set for projects, so that the program can do exactly what has been identified as one of the main benefits of the project, namely steering the projects in the right direction as they progress, to bring the partners the most useable results. Setting better short and medium term goals is also seen as important at the Steering Committee level, with statements like:

"Maybe we should be better at evaluating the progress and the deliveries. Yup, it's probably not as organized as it could be… I mentioned that at the last Steering Committee meeting - we have some status reports, where it says "what's the status, etc. etc." I think we need some, at the Steering Committee level at least; we need some more information about what has been delivered, in terms of specific deliverables so far, and what are the expected deliverables from within each of the work streams, and each of the tasks that we are performing. So that we can

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[436] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 1:17:05
[437] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 56:40
[438] Foundations Technical Working Group member, June 13th, 2012. Recording time: 18:45

see what's been achieved, what are the expected results going forward – what is it that we are aiming at?"[439]

This same point was made by another Steering Committee member who said:

"I could see a better summary of what the Working Group is trying to do – making sure they're on target, whether they're achieving what they set out to achieve, whether they need to change direction. Maybe, you know, half of the way through, to get the overall return, if you like. I mean maybe we need to start evaluating it mid-way perhaps- evaluate the way that the working groups are going on a specific project, to make sure they're still on target… mid-way in a specific project - On a project basis."[440]

In general, short and medium term goal alignment, readjustment and achievement are seen as important within the Carbon Trust OWA program. Although the program is set up with the general approach of setting short and medium term goals, more specification may also be needed to achieve desired outcomes for all of the work streams. As a conclusion to the discussion about visionary, as well as short and medium term goals (low and high-hanging fruit), it seems important to highlight a point that was made by the Wake Effects TDC, namely that the partner organizations may need to be more ambitious, and reach for the "higher hanging fruit," if they want to achieve their visionary goals through the OWA program. As he put it:

"In terms of the nature of the work, I think we have done a good job in exploiting – I mean that in a good way – exploiting the research gains at universities, so that the best practice in industry is catching up with the cutting edge stuff in research. And we've squeezed that gap. And we're getting to that point where the universities are telling us "look, there's only so much left." So I think what's going to have to change is that they need to get to the point where they're getting riskier. They're not picking the low hanging fruit, they're actually being more ambitious and going for bigger, more risky projects..."[441]

So, in relation to goal setting, if the members of the OWA program want to achieve their common visionary goals, they may need to be more ambitious within the program. Also, in terms of short and medium term goals, the Carbon Trust OWA program seems well structured to both set and achieve them, but may need to pay some additional attention to this issue, in order to realize the full potential of each specific project.

5.4.3 Experience and action

Knowledge is difficult to represent outside of the human mind, and this is in large part why knowledge management is not a simple or straight-forward process. Experience and action, however, allow us to create and demonstrate knowledge in a way that can be directly observed, making them great facilitators, or conduits, of knowledge processes. It is for this reason that experience and action are classified as

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[439] Steering Committee Member, Dec. 14th, 2011. Recording time: 18:35 – 33:15
[440] Steering Committee Member, June 4th, 2012. Recording time: 26:30
[441] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 2:40

critical success factors of knowledge management. The importance of experience and action was also identified by a Steering Committee member, who said:

> "The experience that a person has is extremely important in this and many other businesses. We have people in our company that have 20 years of experience within offshore wind. And that is so valuable. They have negotiated contracts with, you know, everyone in the market. They know the players, they have so much experience with commercial projects, and everything that, you know, if you have something that you want a discussion on, we have people available to consult, and that is SO important – it is so important. And experience is so important in this business."[442]

It is perhaps also for this reason that, when asked if there was any other information or knowledge that would help him do his job better, a Resource Manager at Keystone said:

> "I think [it would help to have] additional project experience, you know working on wind turbines in the North Sea area [that] would help with this wind turbine work… I think it would help if we had more direct experience with that type of work and other members who worked on the wind turbine farms in the past."[443]

When enough experience is gained in a particular area, it becomes second nature, and indwelling has been achieved, providing a high level of efficiency for tasks associated with that area of expertise. The reason why experience, or indwelling, is so important for the area of offshore wind was well articulated by a Keystone Structural Engineer, when he gave the following example:

> "One of the key advantages of our structures is the ease of installation. The ability to install ten structures a week. That comes from years and years of working offshore. Working offshore is unlike any other type of construction, because if you get it out there, and to put it simply, if you don't have the right size wrench, you can't just go to the hardware store and buy one… So you have to make sure everything's going to work ahead of time, and you want to make everything as smooth and as efficient as possible. There's a lot of that designed into our foundation design. The only way you can have that, or get that experience, is just through years and years of building stuff off shore… [Keystone's Managing Principal] has decades of experience in design, so he brings a lot of that to the table, in terms of how the geometry is all laid out."[444]

As specified here, having experience helps to ensure that processes go as smoothly and efficiently as possible. When experiences and action are carried out in groups, it also provides necessary shared frames of reference that allow greater levels of understanding to emerge. Experience allows individuals to make inferences about how to act and react in new situations. The more experience one has, the more distinctions can be made about how to act in a new environment in order to achieve a desired outcome. Action, and particularly for actor oriented innovation

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[442] Steering Committee Member, Dec. 14th, 2011. Recording time: 57:50

[443] IBGS Foundation Resource Manager, Keystone, Feb. 9, 2012. Recording time: 51:10

[444] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 23:50

programs, is necessary for understand things more fully – identifying limitations, possibilities, and information that was previously unknown.

In Chapter Four, the recalibration process (Bahrami and Evens, 2005) was proposed as a method for combining experience and action for the purpose of generating factual feedback through action. This recalibration process goes through the stages of: 1) *experimentation* – where intentions are clarified in small cohesive groups to create viable options by casting a wide net; 2) *escalation* – where resources are concentrated on several selected options with executive support, and; 3) *integration* – where transition takes place and new arrangements are made as initiatives go live. There is also, between each of these stages, the option to *reject* work currently underway, if it is deemed to be no longer furthering the goals of the overall program. *Recalibration* can and should also happen throughout the process, to revise as new evidence presents itself, in order to make projects as useful as possible. This recalibration process is seen as particularly useful for actor oriented innovation programs, as well as very similar to the way that the OWA program is already set up, because it allows plans to be revised as new information becomes available, and generates useable feedback through the implementation of new technology. To explain the ways in which the OWA program seems to follow (or not follow) the recalibration process, we will first explore each of the individual components of the recalibration process with relation to the OWA program, followed by issues of *rejecting work*, and *recalibration*.

First, **experimentation** is seen as best facilitated by small teams of thinkers and doers who look at a wide range of options to understand what is available, and act cohesively to coordinate with a wide range of stakeholders. The OWA program has a number of small teams of thinkers and doers. The OWA management team (including TDCs), the Steering Committee, and each of the TWGs can be seen as small teams. Perhaps the most important teams in this context are each of the five Technical Working Groups, where technical experts are gathered together based on their area of expertise. With help from the OWA management team, and objective setting from the Steering Committee, TWG members make decisions about how to act. An OWA management team member described this process with the Technical Working Group as follows:

> "So I guess the process is that we have to agree with the energy companies what we're going to do next. So we want to get the **Technical Working Group** to advise what they want to do based on cost of energy, and what's most valuable for them. The Steering Committee will approve it, then the Carbon Trust will turn a business case into a scope of work which will be agreed by the **Technical Working Group**, and then we'll agree who should receive the tender with the **Technical Working Group**, and then issue that, and deal with any issues that the tenderers might have. Assess the bids, make sure that the **Technical Working Group** assesses the bids, and then have interviews, decide, get the contracts in place, and then hold the kick-off meeting. And then the Carbon Trust will manage the person who's been awarded

the contract, and make sure that they get the **Technical Working Group** involved in the key decisions in the project, and the key findings. So those are the major processes I think."[445]

As this statement demonstrates nicely, the Technical Working Groups play a key role in deciding on what work should actually be executed within the OWA program. In general, the OWA program has been very good at "casting a wide net," because each piece of work contracted from the OWA program goes out in a call for tenders. One of the pieces of work that has been carried out within three of the working streams thus far, and relating directly to *experimentation*, is having competitions for new innovations. The competitions in the Foundations TWG, Access Systems TWG and now Cables TWG have allowed the OWA partners to identify a very wide range of new technology from around the world. When discussing the importance of these competitions, one of the Steering Committee members commented:

> "Especially because for us to try and run [one of these] competition[s] they ran, and go through the process of evaluating, it probably wouldn't have happened. And these sorts of ideas that could come to the forefront – and some have – would only have come through osmosis of some kind, rather than us driving it in a certain way."[446]

So, as shown here, the OWA program has enabled small teams of thinkers and doers to cast a very large net indeed, and evaluate a number of new concepts, which is unlikely to have happened without this program.

Next, **escalation** occurs when options are narrowed down, and only a few promising concepts are selected for further development. It is also important not to put 'all eggs in one basket,' but instead to develop a few concepts further. Senior management support is particularly important here as well, as additional funding is likely to be needed to ramp up development. For the OWA program, one of the OWA management team members predicted that escalation would happen in the future. When discussing how the OWA program is likely to develop, he said:

> "Projects are normally changing over time. So it's rare if they're very consistent, because you learn things, and you improve things. And I think there will be more projects coming out. I think there will be more large projects, going toward demonstration, rather than smaller desk-based studies. Or some desk-based studies that then will lead into further demonstration projects. So I think that there will be a change in the number of projects as well as the type of projects that the OWA will look at."[447]

In addition to its likelihood, another OWA management team member stated the need for escalation when he said:

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445 Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 25:00
446 Steering Committee member, April 24th, 2012. Recording time: 7:00
447 Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 8:55

"So we shouldn't be sitting around comfortably thinking, "Oh, we're doing our job, it's going fine." People should be pushed to take hard decisions. So I need to be pushing the energy companies to do big investment in a new demonstration project, because that's what's going to accelerate the industry… [The OWA program] is meant to be accelerating things. So what the Carbon trust are trying to do is set a good pace. And the challenge is, is if we're doing too many activities, then we can't push that pace so effectively. So there's a lesson for us, that we need to keep focused on what we're doing well, and keep the developers moving quickly."[448]

As this statement shows, the OWA management team understands the role that they need to play in helping to escalate promising innovation concepts so that they can get to market. One of the Steering Committee members also identified their company's role in the OWA program as being to escalate, in order to bring new concepts to market. As she put it:

"I mean the main goal is to reduce cost. And then of course I think the main purpose of what we do is to prove you can do that. To verify that it's actually possible to reduce cost. And the only way to do that is to actually show it in practice. So if you have to reach a point where you can actually test using real life – build prototypes and test them, and actually see them work, that's what we have to do, and that is the reason why we joined. We want to see costs going down, and new technology coming to the market. And this is a way of helping this new technology to the market."[449]

And although escalation has been achieved in some areas, this stage seems to have posed relatively more challenges than the first. This challenge was well articulated by a Steering Committee member when saying:

"The 104 ideas were looked at [in the Foundations competition], and narrowed down, identifying the good, new ideas, or the good adapted ideas from the different sectors. That was a success. And properly, with appropriately qualified personnel and consultants and all of the rest of it, and the TWGs – being able to do that scrutiny, and scrutinize costs and the installation practicalities as well, that to me has been a success. The challenge for that and for the other work streams has been moving it to the next stage, which is testing demonstrations, and the discretionary projects, and that's one of the things that the scheme is grappling with. And we've got some discretionary projects that we've got going at the moment, but not as many as we need, so that's something that's got to be a focus."[450]

Particularly in the area of Foundations, even though four foundations concepts were selected from the competition, and further de-risking was done, it was very difficult for the partner companies to commit to funding the demonstration of these four concepts. In order for partner companies to take greater interest in demonstrating novel foundation designs, discretionary projects were instated so that a smaller number of partner organizations could collaborate to

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[448] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:28:00
[449] Steering Committee member, April 18th, 2012. Recording time: 7:30
[450] Steering Committee member, April 24th, 2012. Recording time: 34:30

demonstrate selected novel concepts. This was explained by a Foundations TWG member when she indicated that:

> "It depends where you're coming from, which kind of foundation you believe most in. What you want, how you want to spend your time and money. So that is why it's good with the discretionary projects, because then it usually costs more money, and then the ones that are interested could spend the money on what they want to do… But I understand that for the Carbon Trust, I think they probably feel that it's a hard process."[451]

To date, two of the novel foundations concepts have been demonstrated, but more action may yet be needed in order to achieve the kind of escalation envisioned by the recalibration process. There has, however, also been escalation in other areas of the OWA program. For example, within the Wake effects TWG, both the Fuga tool and the Floating Lidar system got demonstrated, and within the Access Systems TWG many of the competition winners received additional funding as well. Overall, it seems that the OWA program is moving in the right direction to achieve more and more escalation. A suggestion was also made by a Foundations TWG member, describing how the program might be able to escalate to a greater extent, namely:

> "Getting pre-approval of a certain level of funding, so we don't have to go, or a company doesn't have to go through a certain process for a smaller spend. See what I mean? So you could pre-approve a spend of half a million, or something like that. And the board will say "ok, we know what you're doing," and if it's for those purposes, yes, you've got pre approval. That would be it."[452]

Getting spending pre-approval for particular projects may be one way that the OWA program can achieve escalation to an even greater extent, since it reduces the investment in time required of a company in order to gain formal approval for relatively small projects.

Let us now move on to the third step in the recalibration process, namely **integration**, when initiatives 'go live.' Symbolic changes (such as name, location or leadership changes, or reporting more widely about outcomes) can help to signify that the project is no longer in progress, but completed, and can help to spur more significant changes, namely integrating them into the business structures where they can be utilized. Integration, like escalation, has been achieved in some areas of the OWA program, and may still need to be achieved in others.

In terms of integration achievement, first, in March of 2011, the Fuga Wake Effects modeling tool became available for use by OWA partners. As stated by a Steering Committee member:

> "You mentioned Fuga, I mean that's obviously a tool that has come out of OWA. But… and that is something that we are using. I mean, that is a very useful tool, even though it's not

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[451] Foundations Technical Working Group member, April 19th, 2012. Recording time: 18:35
[452] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 16:55

really validated yet, at least not 100% - it's not a commercial product - But we are using that, and it's very useful."[453]

 Also, in June of 2012, Fjellstrand (an OWA Access Competition finalist) won an order to build six vessels. Both of these examples show ways in which work done through the OWA program has been integrated into the activities of the OWA partner organizations. However, one of the reasons why integration may be difficult, as stated by a Steering Committee member, is as follows:

> "So we want to take the various work streams to a certain stage, where it's close to being able to be implemented, and then that's it. Because we don't want to - if we go all the way, and we share everything all the way, then we're all equal, and we see ourselves as one of the stronger engineering companies within this industry. And therefore we want to maintain that position."[454]

As this statement demonstrates, companies, although feeling a strong need to cooperate to advance the technology in the offshore wind industry generally, may still want to protect their individual company interests by not sharing all results equally (a problem which discretionary projects may have helped to at least partially solve), thus making integration more difficult. As mentioned above, symbolic changes can also be made for the purpose of spurring the integration of new technology into organizational structures. This may also present an opportunity for the Carbon Trust OWA program, where, by making symbolic changes, they can spur further integration. It was also reiterated in many of the 41 interviews conducted, that the OWA program could do a better job of highlighting outcomes, which could benefit the industry generally. For example, one Steering Committee member said:

> "Well the [Carbon Trust] name is well known, I don't think they're that well understood. And I don't think either that they advertise what they're doing as much as they could. They go to conferences and talk about it and so on, and that's fine, but it doesn't have the profile that it should. As I look at, to be perfectly honest, the Crown Estate have done pieces on cost of offshore energy, and the other groups have as well, and it's been very well advertised, but I think the Carbon Trust really could do a better job of profiling themselves and what they've been doing. This is the leading program in offshore wind R&D, but it's not really that well recognized as such, and not even in government, I would say, it doesn't have the profile that it should."[455]

So, by doing a better job of profiling themselves, the OWA program could alert actors within the industry of the possibilities for integration coming from the OWA program. One way that the OWA management team is doing this now is by presenting innovators and their designs

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[453] Steering Committee member, April 18th, 2012. Recording time: 13:00
[454] Steering Committee member, Dec. 14th, 2011. Recording time: 30:05
[455] Steering Committee member, April 24th, 2012. Recording time: 30:50

collectively at the Renewable UK event, where innovators will gain exposure and may be able to gain additional funding and support to commercialize their designs.456 Another way that the OWA program might be able to make this type of symbolic change leading to integration is to create an updated "Big Challenge, Big Opportunity" report. As stated by an OWA management team member:

> "And one of the reports that the Carbon Trust published in 2008 is "Big Challenge, Big Opportunity," and that explained what a lot of the major issues are, and it's amazing that that report's still used to highlight some of the key issues. I know that in the US for example, they have produced a report which is basically a version of "Big Challenge, Big Opportunity" for the US market. So that's quite a good outcome from the Carbon Trust, to be able to influence things like that."[457]

Because this report is so widely used, and even replicated for other markets, making an updated version with all the benefits that have resulted from the OWA program could also be a good idea. This new "Big Challenge, Big Opportunity" report could also include a list of subcontractors that have worked with the Carbon Trust, including the advantages of each concept, what the cost savings of each concept is, etc. One other way that the Carbon Trust OWA program might be able to make symbolic changes facilitating integration is to publicly distribute reports already created for the OWA program within the offshore wind market. As stated by a Steering Committee member:

> "It was presented today, a proposal for us to be able to put data into the public domain. Because sometimes you just want to keep it, other times it makes no sense to keep it – you don't help things by keeping it – you help things more by getting it out there. The process to do that has taken a little bit of time. But now it seems to be coming to a good place as far as I can see. Where the OWA itself, and the Steering Committee, can decide what information can be put into the public domain, and what's not to be put into the public domain."[458]

So, by using this scheme to re-evaluate selected OWA reports with the view of making them public, other actors in the offshore wind industry would be able to gain access to, and understanding about, work that has been achieved through the OWA program, and possibly integrate some of the results as well.

Overall, the OWA program has had some success with integration, and more integration is also planned to occur in the future. However, even greater strides might be made through symbolic changes that could let both partners, and the industry, know about benefits that could be attained through integration of the concepts that have been developed further through the OWA program.

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[456] This Renewable UK event is discussed in more detail in section 5.4.1 Social networks with relation to the concept of: multiple knowledge connections between network members
[457] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:23:05
[458] Steering Committee member, April 24th, 2012. Recording time: 8:00

If we now look back at Figure 12: The Recalibration Process, we can see that there are two points on this figure that are left to discuss, namely *reject*, or cancel points, and *recalibration*. **Reject**, or cancel points, are important for the recalibration process because it provides the opportunity to stop a project if and when it becomes apparent that it is not going to yield the desired results. These reject, or cancel points, can be seen as having already been built into the structure of the program. As stated by a Steering Committee member:

> "I think quickly we've seen when things have not gone the way we want them to. We've had issues with contractors. We've had issues with consultants. We've had issues with people not delivering. And I suppose we've tried to manage that as best we can. We've brought them in, we've asked them to explain themselves, and we've done those kinds of things. I think we like to move on quickly. I mean, if something's not working, let's park it and move on. I think so, I think we've been good with that, and that makes sense. So we're not going to dwell on it, we're just going to move on."[459]

Similarly, a Foundations TWG said:

> "So once a project works not as well as we thought it would in the beginning, I give this feedback to our representative in the Steering Committee - that we are heavily disappointed, for instance, whether from the project, or the report, or from the consultant. And this already happened, just to give you this feedback. So once we have this deviation, or this not meeting of the expectations, we communicate this to the Steering Committee, and the Steering Committee represents us in the meeting of the Steering Committee. And then once other members of the Steering Committee have the same feeling we change the direction, we cancel or we change the consultant, or change the scope of the project, things like that."[460]

Also, although it is possible to cancel some projects if they are not going in the right direction, it may be necessary to instate that possibility for all projects worked on through the OWA program, because as identified by the same Foundations TWG member later in the interview:

> "Sometimes we have the feeling – if it's foreseeable after a certain point - after a third of the work is done, that it is not going in the right direction, but we still proceed - that's the only point that I would say we need to correct [by having the opportunity to cancel the project]."[461]

So, although the Carbon Trust OWA program does utilize reject points to a certain extent, specifying them in contracts for all projects may ensure that it is only projects that continue to yield useful results that are worked on within the program.

Now, to conclude the discussion of the recalibration process, let us look specifically at the issue of Recalibration. Guided by relevant feedback, **recalibration** means that alternatives are harnessed up-front, so that change can happen swiftly and effectively, for the purpose of

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[459] Steering Committee member, April 24th, 2012. Recording time: 5:50
[460] Foundations Technical Working Group member, June 13th, 2012. Recording time: 26:05
[461] Foundations Technical Working Group member, June 13th, 2012. Recording time: 29:30

developing projects that are of use to those who need them. A Steering Committee member specified the fact that alternatives are evaluated up front before projects are approved within the OWA program when she said:

> "I mean this is why we are really looking closely at the business cases before we approve a project. And the business case itself, we have a risk assessment chapter stating "well, what could happen, and how would we mitigate the risk?" And I think this is a very important part of the whole description of the project, and it needs to be discussed beforehand. I mean, we are fully aware that what we are doing here is development activity in terms of technical development, and there… it can always happen that you need to go a different way. And there you have to have some flexibility in terms of organizational flexibility, but also in terms of content flexibility."[462]

This statement shows that recalibration is built into the OWA program, where possible and even probable change or "recalibration" is built into the process. When discussing change, an OWA management team member stated:

> "I think it's probably changed a lot since it was started. It's a pretty flexible program, and I think the way that it's run with the Steering Committee enables that because if the priorities change, and everybody agrees, then it's not a problem. There is no rigidity; there are no expectations that it's going to be run in a certain way."[463]

And reinforcing this assertion, a Steering Committee member specified that:

> "If I say at a meeting "I think this is important…" [And] I did that… and we set up a study… And it has made some good work, you know, were they have mapped the knowledge today, what are the opportunities, and what they cost, and what the technical challenges are, and to come up with conclusions that say there are two solutions… So that's an example of something were I just mentioned it at a meeting, it's noticed, and the Carbon Trust for the next meeting writes a scope of work that we then agree to say ok, go forward. That is a study that cost maybe 50 or 100 pounds to do within three months, and they will have that report, each of us will have that report. And we can base decisions in each of the companies."[464]

So, suggestions can be made that get followed up rather quickly, if recalibration in that direction is seen as useful. Also, the way that financing of projects happens within the OWA program also seems to be geared more towards recalibration than other projects. As stated by a Steering Committee member:

> "I think the strength of this program is very much that it is - in comparison to EU programs, and to Danish support programs, and maybe other UK support programs where you have a certain amount of money available, you apply for support of your project - this is a continuous program where it's very easy in terms of administration. We have agreed to deliver, as industry partners, two-thirds of the financing, and the Carbon Trust has one-third. And then as

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[462] Steering Committee member, April 24th, 2012. Recording time: 33:45
[463] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 25:21
[464] Steering Committee member, Dec. 14th, 2011. Recording time: 1:05:05

we go along, we continuously adapt the contents of the program, and the activities in a very, in my opinion, non- bureaucratic way, which I think is a strength. So it's an agile program."[465]

As clarified here, it is not necessary for each individual project to get funding separately. Instead a particular amount of money is agreed up front, and many of the smaller common projects use this money as the OWA partners see fit. This seems to allow the program to recalibrate continuously in small ways. Larger scale recalibration was also discussed by several of the Steering Committee members in terms of including novel turbine designs in the activities of the OWA program. As stated by one Steering Committee member:

> "There are some interesting designs from turbine manufacturers. Some of it innovative, quite a lot of it is innovative actually, and they all seem to be coming from different directions. Specifically what the OWA could do - probably more in integration than just specific designs. Like we do have one of the projects that we've been working with which is the inter-ray cabling, which could have an impact on the turbine design. But it would be more on how the turbine interfaces with the rest of the world, so looking at a DC array system rather than an AC array system, which is the norm today. And if we went into the DC, and the OWA was to go looking for a DC array system, then it would have a direct influence on what the turbine manufacturers wanted to do, or how they interface with the rest of the world - so perhaps interfacing. And a lot of your risk, actually, when you're building these projects, is in the interfacing – managing the interfaces is a key to reducing the risk."[466]

So, incorporating novel turbine designs into the OWA program may be a larger recalibration process that happens in the future, in order to be able to manage all of the interfaces that are important for reducing risk, and cost, with offshore wind farms. Recalibration was also identified as the primary task of Steering Committee members, as identified by a Steering Committee member who said:

> "And then of course going forward, staying informed on what the progress is in different areas, so that continued prioritization can be made, and that goes in different directions of course, depending on the results. If the results are not meeting expectations, I see it as my responsibility as a Steering Committee member to stop things, and not – well sometimes you might give a second chance, but as I see it - both form an economic point of view, but also from what I talked about before, a focus point of view - you can't have too many activities, so when things are not performing according to expectations or as we want, then we need to stop them. So we need to make sure that we not only add things, but also that we take out things. But of course if the results are good, it is our responsibility to make sure that there is encouragement, and also make room for either a continued common project, or taken into a discretionary project… So that is a bit of the portfolio management over time, which is very important as I see it."[467]

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[465] Steering Committee member, Dec. 14th, 2011. Recording time: 1:02:45
[466] Steering Committee member, April 24th, 2012. Recording time: 16:10
[467] Steering Committee member, May 5th, 2012. Recording time: 15:30

So, by recalibrating at the Steering Committee level, projects in the OWA program's portfolio should stay focused and useful for the partner organizations. One last quotation that will be reiterated here was put forward by a Steering Committee member who seemed to embody the spirit of recalibration for the offshore wind market in general when he said:

> "We just need to make sure that the knowledge that comes out of the scheme is, as far as it can be, shared across the market. And then how effective it is needs to be fed back, so that we've got a good feedback loop, and we can tailor the scheme and address new problems as they arise."[468]

Recalibration within the entire offshore wind energy market may be outside of the scope of the OWA program itself, but it perhaps identifies the need for recalibration within the offshore wind energy market in general, so that it can advance and adequately "address new problems as they arise."

Overall, the OWA program seems to embody all of the key elements of the recalibration process, although some areas are stronger than others. Not only has the program put together a number of small, dedicated teams of "thinkers and doers," but ways have also been found to gather much of the new technology that is being developed in the industry, focus on a few specific concepts for further development, and bring new concepts to market. As such, the OWA program seems to be able to manage knowledge by combining experience and action.

5.4.4 Engagement

The final topic that will be discussed as a critical success factor of knowledge management is that of engagement. Being actively engaged, in this case in the activities of an actor oriented innovation program, is extremely important for knowledge management because without it, individuals will not share what they know, will not learn from or with each other, and will not create and develop anything new. Without engagement, it is unlikely that either resources being shared, or collaboration undertaken, will yield any useful results. For actor oriented innovation programs, such as the Carbon Trust OWA program, engagement is seen as particularly important because individuals participating in these programs are often doing it on a voluntary basis, making it even less likely that results will be achieved without engagement. When engagement is present, it is understood as providing the basis for strong social cohesion, helping individuals to understand each other's perspectives as well as support and learn from one another, much like in a well-functioning community of practice. As with many of the other issues discussed above, engagement is not felt equally between all the members of the OWA program. This state of affairs was indicated by a Foundations TWG member when he said:

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[468] Steering Committee member, April 24th, 2012. Recording time: 41:50

"Some [of the OWA partners] are more observers if you like – in my opinion – and some are more active participants. It's all kinds, if you like… This is as good as it gets, I guess. I also notice that as time goes on, people get more involved, and if there is a particular topic that they have been experiencing, they even contribute with their experience, even though they might not talk all the time, they give input when they have something to give. The total benefit I think is very good."[469]

As stated here, although different levels of engagement may be present (with some active, and some passive members), more engagement, and social cohesion, may be forming over time. Also, the fact that there may be different levels of engagement present in the OWA program makes it even more important to understand the way that engagement is perceived, and how it might be further impacted and bolstered, to achieve as much overall knowledge sharing, and benefit, as possible. This section will discuss three important triggers of engagement, namely urgency, rewards (explicit and intrinsic), and trust and reciprocity, in relation to the OWA program.

The first trigger of engagement that will be discussed in relation to the OWA program is that of urgency. Having a sense of **urgency** can lead individuals to place importance on tasks related to the issue they perceive as urgent. In relation to engagement, having a feeling that a project is important and needs attention may lead individuals to actively engage in the project or program. Also, with constrained time resources, feeling that something is urgent or important may be the only way that tasks get prioritized and completed. In relation to the OWA program, a sense of urgency was expressed in several different ways. From the very beginning of the Carbon Trust OWA program, a sense of urgency was presented to the partner companies by the Carbon Trust. As stated by a Foundations TWG member:

"I remember from the early meetings, and early activities in the Carbon Trust, it was set up with this UK Round III offshore site. There are all these UK sites, with thousands of turbines that have to be installed offshore. And I remember when they talked about it, it was almost like we were already too late with this development of the concept. And they wanted us to buy into the concept, and they wanted us to get going with the development of the concepts, because otherwise we wouldn't be able to meet the targets that the UK government had."[470]

As shown here, the Carbon Trust OWA management team that started the program did a good job of explaining the situation, of the partner companies needing to get ready for Round III, as urgent. This sense of urgency was also expressed by a number of Steering Committee members. One Steering Committee member, for example, stated that:

"I mean for us, we have a real driving force here, because we are not doing this for fun. I mean by the end of the day we need a technology, we need the cost to get down, so that's why we are part of this project. So it's about the Carbon Trust, with all their motivation for doing

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[469] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 9:00
[470] Foundations Technical Working Group member, Dec. 12nd, 2011. Recording time: 17:50

this from the government on, and us as a utilities and developers to get technology in place in time. So it's about both perspectives I think, which has made this quite successful compared to other projects."[471]

This perspective was reinforced by other Steering Committee members who, when asked what was driving the process of the OWA program forward, said:

"That's easy, it's bringing new technology to the market, and bringing costs down…We need [this new technology] in a couple of years actually. And so there's a time limit also… So we see that those projects are so complex, we need new technology to develop them, we need cheaper technology to develop them. And if we are not getting that, the projects will not happen. So that's really why we are participating."[472]

As these statements show, there is a real sense of urgency felt by (at least some) Steering Committee members, which has led them to engage proactively in the OWA program to meet a very specific deadline. There was also a sense of urgency expressed among many of the Foundations TWG members, one of whom said:

"Going into deeper waters, and further offshore, we're going to HAVE to choose another concept. There's no question about it. The monopile concept is just not going to cut it. They won't last. They'll fall over if we build them in very deep water. And I think it's going to be SO much more expensive to build these foundations in deeper waters, and making it even harder to choose the right concept… Especially on the extreme Round III projects."[473]

Here, urgency is again related to having new concepts ready in time for Round III – an urgency that is made even greater by the fact that the challenge is so great. This urgency is also described in terms of needing to develop the industry further by a Foundations TWG member who said:

"For industries and businesses like offshore, which is not really developed fully, and a lot of engineering and solutions still needs to be developed and done. This is quite important, to have such a bonding. It could be the case that once… in ten years everything is established and engineered and the steps are clear, you wouldn't have a need for such an initiative at all. But at the current stage it's a very good initiative actually, we have a very positive view of the Carbon Trust, and we like to be part of this."[474]

So, as these TWG members have articulated, there is urgency to get new technology to market in time for Round III, but also for the industry to survive in general, the OWA program is seen as well placed to develop and sustain innovation in the area of offshore wind.

Despite these statements of urgency, time is still a considerable factor for many of the actors involved in the OWA program. As stated by a Foundations TWG member:

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[471] Steering Committee member, May 11th, 2012. Recording time: 28:10
[472] Steering Committee member, April 18th, 2012. Recording time: 50:45
[473] Foundations Technical Working Group member, Dec. 12nd, 2011. Recording time: 1:33:35
[474] Foundations Technical Working Group member, June 13th, 2012. Recording time: 8:00

> "The level of engagement of the big fabricators and the installation contractors has been limited primarily because they're just so busy."[475]

It may be the case that the fabricators and installation contractors being talked about here have other projects that they find more urgent, and are therefore not being as engaged as the OWA partners might like or expect. This lack of engagement can also be felt, to a certain degree, within the partner companies. For example, when discussing the TWG members, a Steering Committee member said:

> "I would like to see that the Technical Working Group takes responsibility and ownership of the recommendations that are put forward to the Steering Committee… I have a feeling sometimes that they are so busy in their daily work, that they do not engage themselves enough into that. And then suddenly it's the Consultant that sets the agenda, where as it should be the Working Group that sets the agenda, and the Consultant is just the facilitator of what the Working Group would like to see happening."[476]

So, lack of engagement from the TWG members could be coming from a lack of time. This was reaffirmed by a Foundations TWG member when he said:

> "We're always given the ability to comment on scopes of work, of business cases for projects. You know, sometimes these opportunities to comment fall through the cracks, you're very busy with project work, within your own company and it's difficult to comment, and if you miss the deadline then the business case goes forward without your comments. That's really just, that's your issue really… I think it's just, as always, it's going to be difficult to balance the needs of this Technical Working Group with your day-to-day work, and sometimes the two just can't quite be married together. And so when it comes to project work of the Carbon Trust, the Carbon Trust will probably suffer first."[477]

So, it would seem that there is a greater sense of urgency felt by TWG members to completed work for their partner organizations before completing work for the OWA program. A similar statement was made by a Steering Committee member, pointing out that:

> "I mean, we should have spent more time on perpetrations for meetings, and also in the Working Groups I guess. We should have spent more time on it. But still, the progress is quite good, and there has been a development over the years. But it's difficult to prioritize when you're at home, and have the projects that you are working on, and this Carbon Trust OWA work is often prioritized a bit lower."[478]

As this statement reaffirms, there is greater urgency, and therefore greater engagement, placed on projects that partners are working on in their individual organizations, which may mean that OWA program work suffers, at least occasionally, from lower engagement from the partners.

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[475] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 1:12:30
[476] Steering Committee member, Dec. 14th, 2011. Recording time: 34:40
[477] Foundations Technical Working Group member, May 4th, 2012. Recording time: 19:05
[478] Steering Committee member, April 18th, 2012. Recording time: 46:10

Urgency is also seen as an issue for senior management within the partner organizations, which was clarified by a Foundations TWG member who said:

> "We usually get the question [from senior management] "do we need to do that now? Do we need to spend this money now?"[479]

As this statement shows, a sense of urgency might be necessary to generate engagement, not only form Steering Committee and TWG members, but also from senior management within each of the partner organizations. Overall, there does seem to be a certain level of urgency felt among members of the OWA program to accelerate the technology and drive down costs within offshore wind, particularly in time for Round III. However, when these activities conflict with projects needing to be completed within participants' individual organizations, OWA activities seem to be prioritized a bit lower, and in those instances engagement can be seen to suffer.

The second trigger of engagement that will be discussed in relation to the OWA program is that of Rewards – both explicit and intrinsic. **Explicit rewards** refer primarily to monetary rewards, which is the traditional way in which employees are compensated for the work that they do. However, knowledge processes are not easily quantifiable, and therefore organizations may be less able to pay employees for engaging in such processes. Repute, or achieving tangible and useable outcomes, may be other types of explicit rewards for individuals engaging in knowledge processes (whether within an organization, program or project). **Intrinsic rewards**, on the other hand, are less tangible, and are based on some form of altruism, whether it is unselfish concern, love of a subject, or a basic desire to "do good" or help others. Intrinsic rewards are also understood as particularly important for Actor oriented innovation programs, like the OWA program, because they entail activities that are above and beyond the everyday workloads of many participants. In general, people want to be rewarded for what they do, and if they are rewarded, they are more likely to be engaged.

For the OWA program, both explicit and intrinsic rewards were identified as reasons for working on activities related to this program. One of the OWA management team members expressed intrinsic rewards that he feels by being part of this program when he said:

> "I think it's a fascinating industry to be in, because the offshore wind industry is really developing right now – it has gone in a big growth trajectory, and there is the opportunity to influence how the industry evolves, and we're at this interesting position between government and the industry. And we get to speak to… well, we were at an OWEA (offshore wind energy association) conference in November, and we'd worked out that we'd worked with 20 % of all the exhibitors there, which is quite good. So we can make a difference in the new industry.

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[479] Foundations Technical Working Group member, April 19th, 2012. Recording time: 18:35

And we also engage with government quite often, so we can help to communicate what major issues are, which can help inform policy. So it's a really interesting place to be."[480]

As this statement depicts, at least one reason for this OWA management team member's engagement with the program is his interest in the industry and his ability to impact and be part of its evolution. The Wake Effects TDC also expressed intrinsic motivation for being involved in the OWA program when he said:

"at [our company] we didn't have a great deal of work or experience in the wind power sector, but it was picked up on – I picked up on this opportunity as something that would be enormously interesting for me to do, because I hadn't worked in renewable power before, and was very motivated to do it."[481]

Here again, the industry provided interest, contributing to the motivation, and engagement, of this individual. Intrinsic rewards were also identified throughout interviews conducted at Keystone. As one Structural Engineer said:

"It certainly makes the office experience more pleasant, knowing that I got a hallway full of friends."[482]

This statement would suggest that Keystone may have been able to (as specified by Davenport and Prusak, 2000) "hire nice people, and treat them nicely," leading to a feeling of intrinsic reward for these engineers by doing their jobs. Another structural Engineer said:

"For me personally, I like it that we're actually in a good industry I think, in my perspective. As far as offshore wind, I think it's a great way to produce energy, I think it makes sense as far as where it's located with respect to cities. I think the wind is greater out there, so we get more energy. I don't think there's as many people out there so you don't have as many people bothered by wind or their energy being produced by nuclear power plants, or even an onshore wind farm. I just think it makes sense to me. So for me, it's a good thing I think. I think it makes it kind of fun and easy when you believe it's the right way to do it."[483]

Here again it would seem that the industry itself is providing intrinsic reward. One other place where intrinsic reward was identified for the work that they do is by a Wake Effects sub-contractor, who explained that his work was:

"Very, very interesting is what I would say… it's very interesting, and there's a lot of interactions going on that do appeal to us. The nature of our role is as software suppliers. People like our customer could do some of the simple, more routine, calculations that are required themselves. We come in at the high end where we have special skills in this area, which I will claim are actually unique skills that we have. And that is pushing the boundaries

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[480] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:22:05
[481] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 3:30
[482] IBGS Foundation Structural Engineer 1, Keystone, Feb. 7, 2012. Recording time: 33:40
[483] IBGS Foundation Structural Engineer 2, Keystone, Feb. 8, 2012. Recording time: 55:50

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of what we know. They want us to push the boundaries, to develop new capabilities that they don't have. And in the area of atmospheric-physics, this gets challenging."[484]

So, here it would seem that having challenging work that pushes the boundaries of what one knows has made this individual more interested in the work that he does, and thus more engaged. Despite these statements of intrinsic reward, most, if not all, of the rewards that were identified by OWA partners as eliciting their engagement were explicit, either the hope or actualization of explicit rewards. Also, not achieving explicit outcomes, or rewards, through the OWA program was also seen as a reason for engagement not always being high.

An OWA management team member described partner representatives in Steering Committee and TWG meetings as gaining repute by being in the OWA program when she said:

> "The partners are excited, it's like they're happy to be there. They've been asked to be there because they're really good at their jobs, they're an expert in they're an expert in their field. So I think it's pretty neat."[485]

This same OWA management team member also indicated that TDCs get explicit reward (increased salary) for high levels of performance and engagement:

> "We have KPIs – so key performance indicators. So that could potentially increase your salary. We will pay you X; if you're really good we'll pay you X + 10%. So you could get a 10% bonus essentially. If you're awesome, you'll get a 10% bonus, if you're terrible you'll get nothing. So it's not that much, but it's still an incentive."[486]

Also, stating specifically that partner engagement increases as explicit rewards (this case in the form of tangible results) become available, an OWA management team member said:

> "Also [the partners] really see the benefits, probably more and more now, which gets you more engagement from the partners, because you have the demonstration project with the Wake Effect too and things like this. So the more projects we're doing, the more benefit we generate, and the more buy-in we get from partners and the better projects we can generate."[487]

Affirming this statement, a Wake Effects TWG members stated:

> "we get a lot of benefits from being in this group, in that we sit at the front of the development of the projects. So we get to steer them and make them slightly more useful for ourselves. But inevitably our requirements are the same as everyone else's in the industry. So, say for example, we developed Fuga, which is a linearized CFD program – which is a really nifty little bit of kit, basically, that we didn't have before at all. And we've had maybe six to

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[484] Wake Effects Sub-Contractor, Dec. 15, 2011. Recording time: 10:25
[485] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 44:35
[486] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 51:30
[487] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 1:47:45

ten months of private access to that software after this release date, and also all the time building up to that, so we've already implemented this, are using that, so we've got a head start from being in this thing against other people that are not in the Carbon Trust group. And also that software is now being released publically, so we're also dragging the rest of the people not in the group with us, so I would really obviously get some benefits."[488]

Receiving explicit benefits is also identified as the purpose for partner companies to be in the OWA program, which was expressed by a Steering Committee member in the following way:

"I think the main interest is that we pay a certain amount for being part of this, and there is co-financing by the Carbon Trust and other partners, and that makes it possible to do things that we would otherwise have to do on our own. And sometimes we don't have the resources, or we don't have the time, or we don't, you know, it's a lot of money to do it. You know, on the Mainstream Keystone demo project where we have seen the construction and installation of a new concept for a foundation, we get access to knowledge that that project delivers through this program. And if we were to do that demo project on our own, it would be much more expensive. So this is a fairly cheap way for us to get access to some knowledge that is valuable."[489]

So, an overall reason for partners to engage in the OWA program seems to be to attain tangible results (explicit rewards) for the money and time that they put into it. There was also a specific instance identified where not gaining explicit rewards led to a Foundations TWG member leaving the group. As he put it:

"So my objective when I entered into this was to see someone's concept developed and built because I think that's a big part of de-risking the concept, is to actually build it, and show that it will last with a turbine on it, because all the design work, and all the documentation that we do in advance, and we do on the desk, is all based on, what do you call it… That's probably part of why I haven't, you know, been able to show more [engagement], because if I chose to I could have stayed with the Carbon Trust, and I could have continued with the work within the Carbon Trust, but I've chosen to leave it probably also because I didn't see what I'd hoped to see come out of it."[490]

To explain this issue in more general terms for all of the partner companies, and the reason why the Foundations TWG may not be seeing as high a level of demonstration projects as originally hoped, a Foundations TWG member said:

"I think the only slight evident disconnect is where the Carbon Trust are obviously really pushing to get full scale foundation demonstrations, because I think that is their really big deliverable goal, and due to the nature of the market, and the business, and the economic status of the developers, you know, just the way things are, we are maybe not being as forthcoming as they would like, to invest in demonstration projects… you know, to demonstrate a foundation is probably – might not make any revenue from the energy it

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[488] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 27:25
[489] Steering Committee member, Dec. 14th, 2011. Recording time: 1:10:10
[490] Foundations Technical Working Group member, Dec. 12th, 2011. Recording time: 1:37:05

produces, might end up causing us more problems than money, for us to take it down or something like that… umm… we'd have to have a really strong case that that foundation was going to work, and it was going to work on a project that you were definitely going to build. See what I mean? There are always things that would have to be in place to get it through a board, and that's pretty difficult. There's a lot of uncertainty around all of the aspects pertaining to realizing the financial benefit of the foundation which is proposed for demonstration."[491]

So, for the reasons stated here, Foundations TWG members may not be realizing as many tangible rewards, or results, as desired by the Carbon Trust (or the TWG members themselves), and engagement within the TWG group may also suffer as a product of not seeing more explicit rewards coming from the program. The last statement that will be put forward here describes the need for more demonstration projects, also explaining that the Carbon Trust is providing further explicit rewards (monetary rewards) to try to motivate partner organizations to demonstrate foundation designs. As this Foundations TWG member put it:

"I think the most important things are to get the projects to demonstration stage… It needs two things. The first is it needs developers like ourselves to provide sites, and to put those sites forward for the demonstrations. And then it needs the financial support of the Carbon Trust... And in the case of the Foundations, we know the Carbon Trust is sort of providing an increased contribution to try and insure that these demonstrations happen, which is positive."[492]

Evidently, the Carbon Trust may be able to create a positive feedback loop, where providing more explicit reward (through increased funding) for demonstrating novel foundation designs will spur partner organizations to in fact demonstrate more novel foundation designs. This, in turn, can provide explicit reward for the partners' company representatives (having tangible projects being built), and therefore increase the engagement of partners, which would benefit the program overall. When looking at the concept of rewards in relationship to the OWA program, both intrinsic and explicit rewards are seen as providing engagement. However, for partner company representatives, the explicit rewards may play a larger role in eliciting engagement within the program.

The third, and final, trigger of engagement that will be discussed in relation to the OWA program is that of **trust and reciprocity**. Individuals are more likely to share, rather than hoard, what they know when they perceive others as willing to reciprocate at some point in the future. For actor oriented innovation programs, issues of trust and reciprocity are seen as particularly important because the individuals interacting in this context are likely to be competitors in other contexts. If there is no trust under these circumstances, then individuals are likely not to share what they

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[491] Foundations Technical Working Group member, Jan. 13th, 2012. Recording time: 12:35
[492] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 10:55

know, meaning that engagement would also suffer. So, perhaps not surprisingly, trust and reciprocity have been identified as important for engagement within the Carbon Trust OWA program. One area where trust and reciprocity are felt within this program is between the members of the OWA management team. As stated by an OWA management team member:

> "If I was going to do something that was relatively minor or seemingly not so important, and I send it to [the head of the OWA management team] to review, he'll read it. He'll give me comments; he always gives me comments. So something that's seemingly insignificant, he reads it. So that, I think, makes you also be more meticulous, because you know he's going to read every single word, and correct every single typo, or whatever. So he doesn't micro-manage, but he's through, so I think that's another reason why people may pay extra attention."[493]

As shown here, not only is "attention" or engagement given by the head of the OWA management team, but his engagement also creates reciprocal engagement from the rest of the OWA management team, as well as others that he deals with in relation to the OWA program. The importance and general need for reciprocity in order for any cooperation to work was well stated by a Steering Committee member who said:

> "I think when you work together in any cooperation, there has to be a fair balance between what you contribute and what benefit you get. And if there is an imbalance in that, then one part will feel like they deliver a lot of information, and don't get very much back. Like with the turbine reliability database. Why should we share that with our competitors if we don't get very much back? We have knowledge that is valuable, obviously, to some players in the market – they would very much like to have that information – why should we share it with them if we don't get anything back. There has to be a balance, otherwise any cooperation doesn't work. I think that's very important for cooperating, that you have a fair balance."[494]

This sentiment was reiterated, and linked to the OWA program by another Steering Committee member who said:

> "There is a certain expectation of quid-pro-quo as well [within the OWA program], that if we contribute something that others would contribute as well. But obviously it's more difficult for some of the players to contribute in the same way as [partner organizations who have more experience with offshore wind projects]."[495]

The two previous quotations fit nicely together, explaining that some OWA partner companies are more experienced than others, and for that reason, it may be difficult for partner companies who are less experienced in offshore wind farm development to be able to contribute equally. Despite this fact, reciprocity still seems to be felt between the partner companies generally, and

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[493] Carbon Trust Offshore Wind Accelerator Manager, Jan. 27th, 2012. Recording time: 9:15

[494] Steering Committee member, Dec. 14th, 2011. Recording time: 53:50

[495] Steering Committee member, May 5th, 2012. Recording time: 1:00:55

this fact was often identified when individuals were asked what their reason for sharing their knowledge with the other partners was. For example, when asked this very question, a Steering Committee member said:

> "well it is that you give something and you get something back. And that is the motivation, and if there is that openness and sharing, then it benefits us all. And by sharing one thing, you are getting, potentially, seven things back, so it's just a multiplier effect, and we are all facing very similar challenges, not actually in a hugely competitive way. You know, so because of that there is and should continue to be good sharing of information."[496]

Trust and reciprocity are also linked to relationships being built within the OWA program, when a Steering Committee member said:

> "It's good to share knowledge at a technical level because it's important to do that, you know, you might get something in return, and you build relationships, so it's a main motivation for sharing knowledge with other energy companies. In terms of the OWA obviously we want a return on what we're investing, so we need to share knowledge to get that return back. So that would be my main one."[497]

Here, reciprocity is seen, not only in terms of the information that is being shared back and forth, but it is also related to monetary return on investment. However, as explained previously, return on investment can take a long time both in relation to innovation and in relation to the offshore wind sector in general. This type of concern for monetary reciprocity was also acknowledged by another Steering Committee member who said:

> "What I feel is going to be difficult with the discretionary projects is that if there are too few participants in each project, I think this will fall apart. Because I hear at least our management say: Why should we do this alone, and then you have some free-riders here that can come along afterwards and pick up all the results. So I think that will be difficult if there are too few members going into these discretionary projects. I think we need at least… there are eight in all, and I think we need six or seven each time."[498]

So, in order for discretionary projects to be a success, monetary reciprocity may be necessary between most, if not all, of the OWA partner organizations. However, despite apparent problems in initiating discretionary projects, the Steering Committee overall seems to value trust and reciprocity within the OWA program, demonstrated in statements like the following, where trust and reciprocity are connected to gaining knowledge:

> "I think we can gain some knowledge by doing this. Being open is a good way to get something back. I think everyone's interest is that this industry has evolved, and to do that we have to share experience and knowledge. I mean, because this is a marginal business, and the

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[496] Steering Committee member, April 24th, 2012. Recording time: 40:00
[497] Steering Committee member, June 4th, 2012. Recording time: 1:20:30
[498] Steering Committee member, April 18th, 2012. Recording time: 30:00

only way to succeed – one of the parameters is to work together across the industry, and to share knowledge among our developers."[499]

Trust and reciprocity were seen as important by TWG members. For example, a Foundations TWG member said:

> "The extent to which you share information about your projects will obviously be influenced by the trust you have in the other developers, the other people in question… I suppose that there are a number of reasons. If we share information about our projects, you tend to have a better opportunity of getting replication of sharing from the other developers, and many of them are very experienced on working on active projects. But I think there is a genuine sense that if the business is to succeed generally, there has to be sharing between the developers."[500]

Here, the need to trust and reciprocate with relevant information was related to the need for the industry to succeed generally. In addition, a Wake Effects TWG member noted that reciprocity of relevant information is also important so that individuals do not get left out of important new developments when he said:

> "I mean, we're sharing a lot of information, and stuff that we don't need to share because of the project that we're working on, but just because it's good to keep… it's a lot of quid pro quo, you know, if you help somebody else out, they'll probably get the help given back at some point, you know. What you don't want to do is alienate yourself because inevitably you won't know something, but another company will know something. So if you've got good friends there, or good connections, that really helps."[501]

A Foundations TWG member also stated that his motivation for being part of the OWA program was based on:

> "the principle that being open as an industry means that we'll benefit each other, and learn lessons from each other's mistakes, and improve the industry as a whole for the future. So I think it's just, it's just that principle really, that somebody's problem should be a shared problem, and the more people that know about it, the better chance you've got of trying to solve it. It doesn't always happen to be honest like that. But that would be my view anyway, that'd be my motivation for it."[502]

So, by being open, the hope is that this behavior will be reciprocated, and that advancements can be made.

Issues of Trust and reciprocity were also seen to be extremely important within the innovator Keystone. For example, the Drafting Supervisor who worked on the Twisted Jacket foundation said that trust is:

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[499] Steering Committee member, May 11th, 2012. Recording time: 1:04:55
[500] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 1:06:55
[501] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 1:33:05
[502] Foundations Technical Working Group member, May 1st, 2012. Recording time: 56:25

"Definitely, definitely important. I mean, I guess that's one reason that I like working for [my managers at Keystone], because I trust them, and hopefully, I believe they trust me too. That's very important. I've worked for people I couldn't trust. That's one of the reasons I left a job before, because I couldn't trust my boss, and that's not a good atmosphere."[503]

The discussion about trust and reciprocity will be concluded by a quotation from a Keystone Structural Engineer, who speculated about what would happen in a situation where he did not trust his colleagues. As he put it:

"[My work would suffer because] I just wouldn't care. It's kind of hard to believe that what you're doing is going to be the correct way to do something, when you don't know if you're getting quality information. I think that's just kind of a basic fundamental thing between people. I think you have to trust them."[504]

This statement seems particularly important for the discussion about engagement, because it shows that when trust is lacking, it can lead individuals not to care, thus decreasing engagement. Overall, engagement is seen as being very important for managing knowledge processes within the OWA program. Having a sense of urgency, explicit and intrinsic reward, and trust and reciprocity, have all been discussed in this section because they are seen as triggers of engagement. Each of these issues also seems to be important for participants of the OWA program, and the degree to which engagement is achieved within the program can be seen above as coinciding with how each of these triggers is perceived. At a very general level, and although the issues relating to engagement are complex, the program seems to have attracted increasing levels of engagement over time – from the OWA management team, the OWA partners, and from increasing numbers of contractors and subcontractors.

The purpose of this chapter has been to ground the knowledge management theory presented in chapter four in action, presenting both a deep and broad understanding of the knowledge processes that exist and have evolved in an organic manner within the Carbon Trust OWA program. When looking back, the OWA program does seem to support the conclusions drawn in the theoretical analysis, with relation to drivers, obstacles and critical success factors of knowledge management. Up to this point, an in-depth discussion has taken place about knowledge management processes both in theory and practice, from an organic paradigm perspective. Now it is time to revisit and discuss the research questions of this dissertation, to conclude.

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[503] IBGS Foundation Drafting Supervisor. Keystone, Feb. 6, 2012. Recording Time: 55:35
[504] IBGS Foundation Structural Engineer 2, Keystone, Feb. 8, 2012. Recording time: 55:00

Chapter 6: Conclusions and Extensions

To conclude, this chapter will fulfill three overall aims. First, the research questions will be revisited, responding specifically to the question of which drivers, obstacles and critical success factors exist for managing knowledge processes in the context of organizations involved in offshore wind energy innovation. Answers to this main research question will be aimed primarily at moving the theoretical literature regarding knowledge management within actor oriented innovation programs forward through inclusive theory building and new understanding. Then, questions of *the degree to which synergies can be formed for the development of the OWA program's knowledge resources*, as well as *how dynamic capabilities can be harnessed within the OWA program to provide both super-flexibility and focus*, will also be addressed. Answers to these questions will be aimed primarily at giving members of the Carbon Trust OWA program practical solutions for addressing knowledge process problems, thereby helping them to achieve their goal of reducing the cost of offshore wind by accelerating offshore wind innovation.

The second overall aim of this chapter will be to briefly describe the process that has unfolded during this dissertation, focusing primarily on what has been learned. This will include answers to questions such as: Where are the new contributions to the field of knowledge management? Has a holistic view of the way that knowledge is managed in actor oriented innovation programs been presented? Has the case analysis produced new ideas? To what extent has the theory-practice-integration gap been closed? And, what implications does this study have for future research in the field of knowledge management?

The third overall aim of this chapter will be to discuss the limitations of this study, and how this research might be extended in the future. For example, this study is not meant to be generalizable outside of actor oriented innovation programs. Conducting further case study research based upon the basic tenants presented in this dissertation could be one way to build further robustness into the field of knowledge management from an organic paradigm perspective. Also, it is acknowledged that there are other factors outside of this program that have had a large impact on the way that it functions. Governmental support and subsidies, for example, have had a significant impact on this program, and will continue to do so until the offshore wind industry can compete with other forms of energy. From a theoretical perspective, personality (and social psychology) issues are involved in most, if not all, of the issues discussed in this dissertation. It could also be insightful to look at knowledge management processes from the perspective of social psychology, offering further possibilities for extending the research presented in this dissertation.

6.1 Primary Research Question Revisited

If taken at face value, knowledge management literature can easily be seen as presenting a somewhat overwhelming 'mixed bag' of theories and approaches. There are not enough hours in a day to focus on everything that knowledge management literature proposes, and even if one could, it would be at the certain expense of getting primary work tasks accomplished. In order to make sense of the extensive and divergent literature on knowledge management, this dissertation seeks to create meaning from the chaos by framing these theories, approaches and tools in ways that make practical sense in context, for actor oriented innovation programs wishing to reach their organizational objectives through its use. As such, the primary research question asks: *Which drivers, obstacles and critical success factors exist for managing knowledge processes in the context of organizations involved in offshore wind energy innovation?* In chapter four, Table 3 presented an overview of knowledge management concepts (separated into categories under drivers, obstacles and critical success factors), and what the conceptual findings can be used for. Rather than replicating this table here, I will discuss each of the knowledge management concepts in turn, describing what can be learned from the case of the Carbon Trust OWA program, and how these understandings could be carried further in research and practice, when studying actor oriented innovation programs.

6.1.1 Knowledge Management Drivers

The first driver, leading organizational leaders to seek out knowledge management theories and tools, is **knowledge creation**. As displayed in chapter 4 by Tsoukas' (2009) *Dialogical model for Organizational Knowledge Creation in Direct Social Interaction*, knowledge creation is a complex process that requires being open to thinking critically, personal interaction and sufficient time to be adequately developed. This has been well understood within the Carbon Trust OWA program, where problems and solutions are discussed openly by Technical Working Groups who have specific expertise in relevant technical areas. Also, the Carbon Trust OWA management team purposely times Steering Committee meetings at regular intervals so that the managers making final decisions about projects and overall direction of the program can interact and have the time to create common frames from which to base decisions. This also has implications for future research on actor oriented innovation programs, stressing the need for interactional processes that facilitate collaboration, as opposed to rigid structures being imposed on teams or groups.

The second driver, leading practitioners to look towards knowledge management for answers, is **knowledge acquisition**. Rather than the common idea that knowledge is located somewhere outside of human understanding to be "acquired," chapter four stresses the fact that knowledge is

part of individuals, and for this reason, managing external networks (as described by Leonard, 1998) can be an effective way of keeping updated on external changes that may affect an organization or program's processes and outcomes. The OWA program has very successfully managed external networks by holding competitions to attract innovation concepts from around the world, in addition to keeping in regular contact with government officials, research institutions, universities, etc. Future research on actor oriented innovation programs can benefit from what is presented here by placing more weight on managing relationships with members of external networks, which can provide long-term, and often unexpected, benefits.

The third driver propelling a wide range of both scholars and practitioners to turn to knowledge management for answers is **knowledge capture**. Volumes have been written about how knowledge can be stored in IT or "knowledge" repositories. However enticing this idea of "capturing" knowledge may be, IT tools can only generate information repositories, and are a *means* to knowledge, *not* knowledge in and of itself. Within the Carbon Trust OWA program, not many IT tools are used. There is a SharePoint site that stores important documents, and email and teleconferences are also well used, but IT tools are by no means a primary focus of the program. Research can benefit from this understanding by de-emphasizing IT tools, and instead using them only when there is a specific need for them (meaning where they have the greatest chance of being used, and thus being useful).

The fourth driver of knowledge management, often sought by individuals wanting to avoid "reinventing the wheel" within their organizations, is that of **knowledge sharing**. In chapter four, it is proposed that by having basic terms and working knowledge in common, fostering trust through continual interaction and transparency, and encouraging peer-to-peer (rather than parent-child) interaction within teams, knowledge is more likely to be shared effectively. Evidence from the OWA program shows that knowledge sharing can be a very complex process, making it even more necessary to be clear about what is being shared, what is not, and why. Because individuals participating in Technical Working Groups have a similar technical focus, it has created a foundation for understanding, which has been built upon over time through norms of democratic processes where everyone has had an opportunity to contribute. This has further implications for the type of behaviors, the type of teams, and the type of processes (as discussed in section 4.3.4 Knowledge Sharing) that scholars might usefully study in the future with relation to knowledge sharing in actor oriented innovation programs.

The fifth, and final, driver of knowledge management within actor oriented innovation programs is **organizational learning**. Learning is an important condition for knowing, and learning is understood in chapter four as having occurred throughout history in *communities of practice*

(Wenger, 2003). When organizational groups have enterprise, mutuality, and can build up a robust repertoire over time, in addition to being able to engage with other groups at interfaces (where boundaries are common and problems are shared), communities of practice are seen as fostering organizational learning. Within the Carbon Trust OWA program, OWA management team members foster enterprise by encouraging Steering Committee and TWG members to take control of the program, and actively lead it in the direction the partners find most useful. Each of the elements of a community of practice seems well understood within the OWA program (as depicted in chapter five), and the program has fostered learning in a number of areas. For future research, paying particular attention to communities of practice with relation to actor oriented innovation programs is deemed beneficial for understanding and improving organizational learning processes.

6.1.2 Knowledge Management Obstacles

Now we turn to knowledge management obstacles, covering issues which are typically seen as hampering knowledge processes. The first obstacle covered in this dissertation is the **tacit knowledge challenge**. Tacit knowledge is often thought of as an obstacle because it is the implicit, difficult to explain part of human knowing. However, as discussed in chapter four, all knowledge has an implicit element, and tacit and explicit knowledge can therefore not be separated, as some theories (for example, Nonaka 1994) would suggest. Instead, it is proposed that processes of storytelling and mentoring can be used more widely to focus context rich information and engage in meaningful interaction, facilitating knowledge processes towards desired ends. Chapter five presents a number of stories told by respondents, conveying complex, implicit, meaning through easy to understand examples. Mentoring is also a tactic used between developers and innovators, which has helped to bring innovations to market through continued interaction that allowed each party to understand exactly what the other needed, and thus accomplish common objectives. For scholars, the biggest insight to be gained from this dissertation is that tacit knowledge cannot be treated as independent from explicit knowledge. Given the interplay of the tacit with the explicit, this duality means that knowledge processes are complex, and should be approached in context.

The second obstacle of knowledge management is **culture**, which is often seen as hampering knowledge processes because people are not able to understand each other and by extension not able to work together. When the symptom is an inability to work together, the solution is often seen as classifying individuals as having different national or organizational cultures, and then trying to understand and "overcome" those differences. However, this dissertation proposes that culture has typically been oversimplified (for example by Hofstede, 1994), and that culture may

more usefully be understood as each individual's cultural mosaic (Chao and Moon, 2005). From this perspective, by focusing on "matching tiles" or cultural elements (rather than dissimilar cultural elements), common frames can be created from which to work together. The OWA program has created cultural similarities by having people of similar technical background work together (in each respective Technical Working Group), which has created environments in which knowledge processes can take place. The OWA management team has also created similar "cultural tiles" or frames of reference by interacting with one another on a daily basis. Using the mosaic analogy to study actor oriented innovation programs in the future could place focus on creating similarities from which to share task relevant differences that can support knowledge processes. In general, this could create a more positive and useful way to understand culture.

The third obstacle of knowledge management is **conflict and complexity**, presented as such because these issues are often seen to hamper smooth processes from achieving predictable results. However, conflict and complexity are a natural part of any actor oriented innovation program, and conflict can be seen as *essential* for the movement of thought, and by extension the creation of new knowledge. Embracing complexity can also create awareness of unknown unknowns, which will reduce uncertainty in the long run. By responding proactively rather than defensively to dynamic internal and external change, knowledge processes can be positively improved. Within the OWA program, conflict and complexity is embraced, for example, by: questioning how projects meet overall objectives, and changing direction if and when it is needed; by bringing in experts from research institutions and universities to make sure that different "frames of reference" are considered; and by periodically revisiting technical areas to check whether new, better solutions have surfaced. Future research can benefit from studying how conflict and complexity are involved in all knowledge processes, and finding proactive ways to embrace these issues within actor oriented innovation programs.

The final obstacle of knowledge management discussed in this dissertation is **increasing size and geographic dispersion.** Actor oriented innovation programs are a good example of a growing trend to bring together a large and diverse range of actors (who may very well be located in different countries around the world) to develop innovation that meets specific needs on a particular market. Having different types of creative space, as well as creating common frames of reference from which to achieve common objectives, are forwarded in chapter four as important for knowledge processes - needing the right information at the right time in the right context. The Carbon Trust OWA program has created a fluid work environment for its participants by holding most meetings outside of their normal work environments, at the Carbon Trust headquarters in London. Both small meeting rooms for private conversations, as well as large meeting rooms

where Steering Committee and Technical Working Group meetings can be held are available and used, as well as a coffee area where individuals can have a chat in a less formal environment. Also, by holding meetings at regular intervals, individuals from the organizations participating in the OWA program have the opportunity to create common understandings, and then build upon them over time. Acknowledging the growing prevalence of increasing size and geographic dispersion is important for the study of knowledge management within actor oriented innovation programs, and in line with this, finding new ways to bring people together, and thus enabling them to share what they know.

6.1.3 Knowledge Management Critical Success Factors

Now we turn to knowledge management critical success factors, covering issues that are seen as *necessary* for achieving successful knowledge processes within actor oriented innovation programs, and thus leading to the desired organizational objective of building and sustaining innovation. The first critical success factor for actor oriented innovation programs is **social networks**. Because knowledge can most easily be conveyed through human interaction, social networks are seen as critically important for knowledge processes. Chapter four discusses network characteristics, network roles, and conditions facilitating knowledge within actor oriented innovation networks, providing both a broad and deep understanding of how networks are structured and can function to positively influence knowledge processes. A social network exercise was conducted with Carbon Trust OWA program members to understand exactly how this particular network is structured and functions. Results of this inquiry show a network that has increased in its ability to facilitate knowledge processes to achieve desired outcomes, both within and outside the network, over time. The OWA management team has done a particularly good job of providing a liaison role, tying important internal and external groups together, and keeping all parties focused on end goals. This is not to say that tensions do not exist within the network, and indeed some changes had to be made early on (notably adding discretionary projects) to accommodate different technical foci of the partners. Studying social networks is an important way to generate understanding about knowledge processes in any organization or program. However, doing this in an organic and hermeneutic way is also important, without which essential aspects of the network are likely to be lost or overlooked.

The second critical success factor for knowledge processes within actor oriented innovation programs is **genuine shared goals**. Genuine shared goals are critically important for any group of individuals working together, because chances of getting what you want are greatly increased by knowing what you want, and thus being able to focus efforts in a common direction to get it. Chapter four focuses on two types of goals – long term, visionary goals, and shorter term goals,

divided into short and medium term goals. *Visionary goals* are understood to reduce opportunistic behavior through a focus on desired and anticipated future benefits. *Short term goal* achievement can bring groups together, giving them confidence, while *medium term goals*, or high-hanging fruit, require more effort to be accomplished, and should have strict time lines to provide needed pressure to accomplish tasks. Within the OWA program, the common vision of reducing the cost of offshore wind by bringing new innovation to market, in time to build projects in the UK Round 3 was an overarching objective of all partners and the Carbon Trust itself, keeping the work focused. Sort term goal achievement was particularly prevalent in the Wake Effects Technical Working Group, which seems to have helped them to be a very well-functioning group willing to share what they know with one another. In relation to medium-term goals, focusing even more on deadlines and specific deliverables may help to move projects forward in the right direction. For researchers studying any organizational process, examining the goals of the individuals involved is going to be important for understanding the outcomes that are achieved (or not achieved), and the field of knowledge management is no exception in this regard.

The third critical success factor for managing knowledge processes in actor oriented innovation programs is **experience and action**. Experience can be used to connect what has happened in the past to what is happening in the present, and help to chart a course of action for the future. Also, it is through action that what we know can be demonstrated to others. Chapter four discussed a process that is specifically useful for actor oriented innovation programs, namely the recalibration process, which goes through successive steps of experimentation, escalation and integration, while continually reevaluating and recalibrating, to achieve desired results. The Carbon Trust OWA program can be seen as very effectively experimenting, by focusing on specific technical areas and evaluating a wide range of novel concepts within each Technical working Group area. Escalation, integration and recalibration has also taken place within the program, and could also be strengthened even further in the future towards the goal of building and sustaining innovation. Future case study research on knowledge processes in actor oriented innovation programs could use this recalibration framework to help create and demonstrate knowledge in directly observable ways, and help to ensure the feasibility and relevance of actions taken within these organizations and programs.

The fourth and final critical success factor for managing knowledge processes in actor oriented innovation programs is **engagement**. Put succinctly, engagement is necessary for getting things done. Without it, feelings of apathy or alienation are likely, and little knowledge is likely to be shared. Chapter four discusses issues of *urgency*, *explicit and intrinsic rewards*, and *feelings of trust and reciprocity* as necessary for engagement. Within the OWA program, urgency is highly

felt because new innovations are still sorely needed to reduce the cost of offshore wind and sustain the industry. The ability to work on innovation projects in the renewable energy sector has reportedly given some partners in the OWA program a feeling of intrinsic reward, and the fact that projects such as the Wake Effects Fuga tool have been integrated into partner organizations has provided a sense of explicit reward from the program. Although trust and reciprocity is felt within the OWA program, this may also need to be increased in order to get the full benefit from the knowledge processes already taking place. Research studying how engagement can be increased in actor oriented innovation programs may be able to provide impetus for ideas and information to be exchanged and action to be taken.

To conclude the discussion about the primary research question of this dissertation, it seems important to reiterate that before final decisions were made about which constructs would be listed under drivers, obstacles and critical success factors of knowledge management, the empirical evidence collected from the Carbon Trust OWA program helped to inform which constructs were of critical importance in this case. This process resulted in theoretical and empirical analyses that mirror one another, providing a case that supports presented theory, and theory that can carry knowledge management research in relation to actor oriented innovation programs further, by providing additional understanding and theoretical constructs about processes that happen in practice.

6.2 Sub-question one: To what degree can synergies be formed for the development of the organizations' knowledge resources?

Each of the sub-questions was presented as a report and corresponding power point presentation to all individuals interviewed in connection with the Carbon Trust OWA program, supporting the action research element of this dissertation. Subsequent teleconference meetings were held with OWA management team members regarding how these suggestions could be incorporated into the program. This particular sub-question was also presented at the 2013 Offshore Operations and Maintenance Forum in London on October second, 2013, presenting six suggestions for the formation of multi-stakeholder partnerships aimed at collaborating to reduce the cost of offshore wind.[505] The aim of answering this sub-question, as well as the next, is to use the information offered in chapters four and five to present practical suggestions for enhancing knowledge processes within the OWA program, towards the end of helping these individuals to build and sustain innovation in the offshore wind industry. And now to answer the first sub-question: *to*

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[505] For all Executive Summary reports, see appendix 7 - 10: Appendix 7: Executive Summary 1 Synergy Formation; Appendix 8: PowerPoint for Executive Summary 1 Synergy Formation; Appendix 9: Executive Summary 2 Super-Flexibility and Focus; Appendix 10: PowerPoint for Executive Summary 2 Super-Flexibility and Focus.

what degree can synergies be formed for the development of the organizations' knowledge resources?

The idea behind synergy is that the whole is greater than the sum of its parts. In other words, by combining efforts, more can be achieved than any one individual or entity could achieve alone. And indeed this seems to be one of the driving forces behind the Carbon Trust OWA project. As stated by one OWA partner, the reason for sharing knowledge in this forum:

> "… is that you give something and you get something back... And if there is that openness of sharing, then it benefits us all. And by sharing one thing, you are getting, potentially, seven things back. So it's just a multiplier effect. And we are all facing very similar challenges, not actually in a hugely competitive way, so because of that there is and should continue to be good sharing of information."[506]

In the management literature, synergy formation has been studied within multi-partner networks such as that of the Carbon Trust OWA project. In the context of multi-partner networks, synergy is understood as being achieved when all partners contribute somewhat equally (no domination by one partner), and when the needs and desires of partners are integrated. As we have seen in section 4.4.2 Knowledge Management and the Cultural Dimension, this can be visualized in the following way:

Figure 11: Four options on the management of cultural diversity
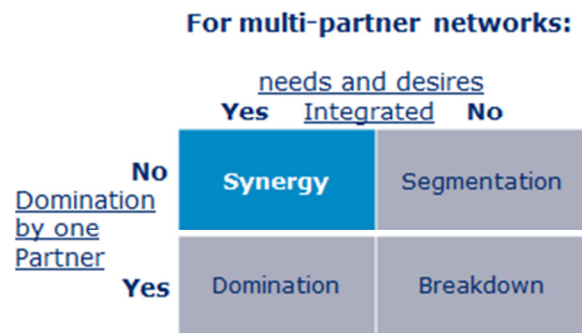
Source: adapted from Child, Faulkner, and Tallman 2005

For the Carbon Trust OWA project, this means that through **partner engagement**, company differences are not suppressed, but discussed openly, **integrating company needs and knowledge resources** to expand upon what is currently known for the purpose of creating improvements and finding new solutions (Child, Faulkner, and Tallman, 2005).

Given the above understandings, the question then becomes: How can greater synergy be achieved for the Carbon Trust OWA project? At least one answer to this question lies in the

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[506] Steering Committee member, April 24th, 2012. Recording time: 40:00

ability to strengthen interfacing capabilities. At an interface, problems are shared. Also, an interface can describe communication and interaction, where effective coordination is possible although the individual elements involved may seem disparate or incompatible.[507]

For the Carbon Trust OWA program this means that in order to harness the advantages that synergy formation can provide, there is a need for communication and knowledge sharing at the points where **problems are shared** and **boundaries are common**. In many ways the Carbon Trust OWA project has already been very effective at achieving this, particularly in the way that it is set up. For example, as stated by a Technical Delivery Consultant:

> "I've been involved in lots of multi-stakeholder projects in the past, and I've never seen one work anywhere near as well in terms of governance and way of working and cooperation and actually just getting things done than OWA… Somebody somewhere has got a lot of experience and has done a lot of work to create this Technical Working Group work stream, Steering Committee structure. I think it's a good approach."[508]

Although the Carbon Trust OWA program is already well structured to achieve synergy through interface attention, strengthening and enhancing this structure may provide even greater synergy. The following is a list of eight areas where the opportunity for further synergy formation has been identified. These include the interface: 1) *between internal company representatives*; 2) *between the TDCs of each work stream and the Carbon Trust OWA management team*; 3) *between each of the five work streams*; 4) *between developers*; 5) *between developers and innovators*; 6) *between the different innovators*; 7) *between innovators and fabricators*; and 8) *between oil and gas offshore developers, and offshore wind developers*. In order to get a better understanding of each of these areas they will be looked at in turn, covering a brief description of: what has been said during interviews; why this particular interface is important; and suggesting concrete measures that may be considered for achieving each particular interface synergy.

First, with relation to strengthening interface synergy ***between internal company representatives*** of the OWA program, a TWG member said:

> "…a 5 minute chat with me about something doesn't necessarily give you all the information you need to make a good call on that judgment necessarily… maybe they have a lot of faith that I know what I'm doing. I think that it would be kind of interesting, just to know more about what the Steering Committee does, and to have them share their knowledge a bit more with us."[509]

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[507] http://dictionary.reference.com/browse/interface. Accessed: 12th Oct. 2012
[508] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 8:00
[509] Wake Effects Technical Working Group member, Jan. 13, 2012. Recording time: 1:43:30

Throughout interviews, it became apparent that there is, in many cases, infrequent communication between the internal company representatives of the OWA program, meaning that there is also little overview of how the activities of each TWG relate to company objectives.

There are quite a number of reasons why strengthening the interface between internal company representatives of the OWA program will help to create further synergy, four of which will be highlighted here. First, it would help all participants to gain a deeper understanding of what each TWG is working on, and how work streams relate to each other. Second, it could help to identify best working practices among the TWGs. Third, it could strengthen the understanding of company goals and objectives with relation to each TWG. And fourth, it could strengthen the ability to connect specific projects to company objectives.

One way to achieve this interface synergy would be for each partner company to hold **regularly scheduled** internal **meetings** with Steering Committee member(s) and all TWG members. These could, for example, be scheduled a few days prior to each Steering Committee meeting, or when a few of the members were going to meet anyway. Topics of discussion during these meetings could include: current project progress in each TWG; the degree to which each project aligns with company objectives; current challenges; best practice; and goals in moving forward.

Second, with relation to strengthening interface synergy ***between the Technical Delivery Consultants of Each Work Stream and the Carbon Trust Management Team***, a Steering Committee member emphasized the importance of the TDC role by saying:

> "I like this set up, with the Technical Delivery Consultants. Where the Technical Working Group members, so our people, go and they support with their expertise and their knowledge, but then in the end the main activity, the work, say, that sits with the Technical Delivery Consultant. So it's a very useful set up that was chosen here… And this approach with the Technical Delivery Consultants allows us to join the activities of the OWA. Because if we would need to put the same amount of time into it as the TDC does, it would get difficult."[510]

In researching the Carbon Trust OWA program, one observation has been that TDCs are understood, on an organizational level, as performing a similar function for each of the work streams. However, their performance in practice has been vastly different in each of the work streams, and in some cases their role has been terminated all together. By more closely tying these TDCs to each other, and to the Carbon Trust management team, best practices and common goals can be kept in focus, for the purpose of having TDCs preform a similar function in each of the work streams. In organization literature, the role of individuals such as TDCs has been given

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[510] Steering Committee member, April 24th, 2012. Recording time: 10:30

the name 'hub role,' and the extreme importance of these individuals in 'hub roles' is described by the scholars Bahrami and Evans (2005, p.155) as follows:

> "A critical bridging tool is to assign credible individuals to hub roles [as the OWA has done with the use of TDCs], deployed at critical organizational intersections. They become the neural connectors who fuse and make sense of disparate pieces of information. In short they connect, integrate, synthesize and synergize."

Two suggestions will be made for achieving this interface synergy. One suggestion is to have the TDCs work together to perform a task, such as an **annual workshop** for all TWGs to share experiences and lessons learned. The second suggestion is to *continue* **regular teleconference meetings** between all TDCs and the OWA management team to stay updated on: a) specific tasks and how they are aligned with the other work streams and OWA objectives; b) the challenges that are being faced now, and those which may arise in the foreseeable future; and c) which action plans are in place for dealing with these challenges.

Third, with relation to strengthening interface synergy ***between each of the five work streams***, a Steering Committee member very clearly identified why greater interaction between the work streams is needed, saying**:**

> "…we've had at least one topic where we should have a better and improved interaction between the Foundations Group and the Electrical Work Group: so that's all around cables and getting the cables in the foundation. And then again there should be more interaction between the Foundations Working Group and the Access Working Group. Because whenever it comes to access systems, it will, or it might affect the foundation itself. So there should be more interaction and I think we are constantly asking for this as a Steering Committee."[511]

Because solutions will have to be integrated in live projects, the work of each TWG is in some way interconnected. Also, each work stream is part of the OWA program, and overall objectives are shared, meaning that these processes can be enhanced through increased interaction. As described by the scholars Bahrami and Evans (2005), networking and communication forums in this context:

> "…can facilitate spontaneous exchanges, provide opportunities for creative conversations, and foster informal experience sharing. They can keep senior executives updated on dynamic competitive and market conditions… They can also help break down the silo mentality by providing opportunities for cross-pollination and peer group interaction."

Both of the suggestions given here for achieving interface synergy have also been identified above, which means that each of these actions have the possibility for achieving multiple interface synergies. The first suggestion is to have the TWG members participate in an **annual**

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[511] Steering Committee member, April 24th, 2012. Recording time: 14:50

workshop (organized by TDCs), where they are able to share experiences and lessons learned. In addition to aligning the work of the TDCs, these workshops could also connect and enhance the work of TWGs. The second suggestion is to hold **regularly Scheduled** internal company **meetings** with Steering Committee member(s) and all TWG members. In addition to aligning company goals with the work of the OWA, these meetings could also give each participant a better understanding of what is happening in each of the TWGs, and how they relate to each other in terms of advances in the offshore wind industry.

Fourth, with relation to strengthening interface synergy ***between developers***, one Steering Committee member, for example, stated:

> "I think there should maybe be off the record dialogues for the OWA, away from the Carbon Trust setting to discuss… I worked with oil and gas before I joined renewables, and sometimes they share safety information, for example, which is of benefit to everybody in an open forum, but they don't take any notes, and no minutes are made, but we discuss common issues. Maybe that's something that could come out of this as well, could be applied to renewables - One way to knowledge share."[512]

The reason why it is important to create further interface synergy between developers is that sharing 'lessons learned' can provide a number of benefits to each company individually. First, it will contribute to the prevention of re-inventing the wheel. Second, it will help to facilitate the creation of standardization, finding best practice, and reducing uncertainty. Third, it can contribute to further cost savings.

The suggestion for achieving this interface synergy is a two-step process. The first step would be to conduct a **survey** to find out what issues OWA partners would be interested in sharing 'lessons learned' about. Once these issues were agreed, **off-record dialogues** could be held outside the Carbon Trust (maybe during conferences where many partners are already participating) to discuss lessons learned, with the objective of working towards standardization and/or best practice.

Fifth, with relation to strengthening the interface ***between developers and innovators***, a Carbon Trust management team member was talking about an innovator after the Access competition, saying:

> "And at first they didn't really accept that [idea proposed by the developer], and they said 'we're not going to change our design.' And we said 'well, we're not going to fund you.' But

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[512] Steering Committee member, June 4th, 2012. Recording time: 43:55

after getting that feedback, they had more interaction with one of the developers… and they've actually changed their design now, so they've taken it onboard."[513]

This quote exemplifies the impact that strengthening the interface between developers and innovators can have. This interface is important for at least three reasons. First, products can be developed that more closely meet the needs of developers. Second, interface synergy in this area can provide networking opportunities for developers to meet potential suppliers, and vice versa, opening the market to new players. Third, it may be able to create a feeling of security for innovators, if they know that there is a legitimate and growing market within which they can develop a certain concept (product).

OWA Competitions have been identified by members of the Carbon Trust OWA management team, the Steering Committee and Technical Working Group members as a good way to facilitate the interface between developers and innovators. After competitions have been concluded, periodic **workshops (set up in ways similar to the competitions)** could provide a venue to achieve continued knowledge sharing and concept development by innovators.

Sixth, with relation to strengthening interface synergy ***between different innovators***, the Keystone Managing Principal noted that:

> "As innovators, when we were in a room together, we all gave suggestions, and ideas to the other innovators: 'have you tried this?' Or 'have you looked at this?' Or 'have you looked at that?' You know, and we were just throwing out ideas, just based on kind of like looking at their concept. Well some of those ideas you could pick up and use and it made the concept better."[514]

The importance of interface synergy between innovators has also been identified by a Steering Committee member, who said:

> "You know, if you get a bunch of engineers around a table, they will VERY quickly start talking about the problems and solutions and comparing notes and achieving cross-fertilization. And like I said – that's exactly what we want."[515]

Strengthening this interface synergy is important because it may provide a trouble-shooting function, helping to more quickly bring products to market. Also, new comments and suggestions from different perspectives may help to identify cost reduction measures.

The suggestion given here is the same as in the preceding suggestion, namely that periodic **workshops (set up in ways similar to the competitions)** could achieve continued knowledge

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[513] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 47:

[514] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 1:35:00

[515] Steering Committee Member, April 24th, 2012. Recording time: 27:50

sharing and concept development by innovators. The fact that this suggestion is repeated means that this action also has the possibility of achieving multiple interface synergies.

Seventh, with relation to strengthening interface synergy _**between innovators and fabricators**_, one of the members of the innovator Keystone said:

> **"**What better way than to have four fabricators sit in a room and tell you what they like or don't like about your concept. And then you're asking them why, and what can I do better, and stuff like that. And then I walk away and I input all that. I get something better."[516]

There are at least three main reasons why this interface is important. The first is that it can help to drive down costs because it will give the innovators a better understanding of what is available in terms of fabrication materials and their costs, and they will have the ability to negotiate different aspects of design and fabrication. The second reason that this interface is so important is that it provides the opportunity to facilitate improved innovation concepts, based on a greater amount of input. And the third reason is that it may help to reduce the uncertainty that can arise from a lack of communication between innovators and fabricators.

There are two suggestions presented here for achieving increased interface synergy between innovators and fabricators. The first is, for future demonstration projects, to **involve innovators in the process of fabricator selection**. The second suggestion is to provide a **forum for dialogue** between innovators and fabricators.

The eight, and final suggestion for strengthening interface synergy exists within the offshore network, namely strengthening interface synergy _**between oil and gas offshore developers and offshore wind developers**_. As expressed by a TWG member, there is:

> "…a gap between oil and gas, and the ability of the offshore wind industry to transfer knowledge from oil and gas. As I see it, within the wind industry, they have defined themselves as their own discipline, and they are evolving independently of the oil and gas industry. There is a problem, and the reason that I say this is that the oil and gas industry has been facing a lot of overlapping issues in offshore for over the last 40 years."[517]

It would appear that this is a very important area where further knowledge sharing could add great benefit to the offshore wind industry. This is also supported by some of the prominent scholars in the area of open innovation, who state:

> "We know that most innovation is based on a recombination of existing knowledge, concepts and technology. Established solutions from other industries will enrich corporate product

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[516] IBGS Foundation Managing Principal, Keystone, Feb.9th, 2012. Recording time: 1:36:00
[517] Foundations Technical Working Group member, May 22nd, 2012. Recording time: 1:13:20

development while reducing the related risks through reducing uncertainty." (Enkel, Gassmann, and Chesbrough, 2009, p. 316)

One suggestion that could be carried out through the framework of the Carbon Trust OWA program is to conduct a **survey** to find key areas where knowledge can be gained from the offshore oil and gas industry for each Technical Working Group. Then **oil and gas experts** (for ex. from partner companies also involved in oil and gas) could be invited to come to **already scheduled TWG meetings** and share knowledge with the relevant group on specific issues.

Taken together, these eight recommendations can be seen as a collection of practical suggestions, and a springboard for thinking about how to strengthen the important links, or interfaces, where 'problems are shared' and 'boundaries are common.' By presenting quotations, the goal has been to illustrate each of the points presented here from the perspective of the members of the OWA program. Also, because the Offshore Wind Accelerator network is, by its nature, interconnected, some of the *suggestions for interface synergy* presented contribute to strengthening more than one interface. Examples of this can be found between the 1st 2nd and 3rd interfaces, as well as between the 5th and 6th interfaces.

6.3 Sub-question two: How can dynamic capabilities be harnessed, providing both super-flexibility and focus?

As with the previous sub-question, providing an answer to the question of *how dynamic capabilities can be harnessed, providing both super flexibility and focus* will draw from the discussions in chapters four and five, presenting practical suggestions for enhancing knowledge processes within the OWA program.

As a way to approach this question, we begin by looking at the unique set-up and structure of the Carbon Trust Offshore Wind Accelerator program. As stated by a member of the Carbon Trust OWA management team:

> "…A lot of research programs give a scope of work to somebody, a bag of money, and then a year later they get a report. We are trying, together with our partners, to be closely involved in the process. This means that the consultants, or innovators, or whomever, come to the TWG meetings; update the Technical Working Group on what they are doing, what's going on... And I think by doing this we are able to steer and change the project slightly early on."[518]

By constantly monitoring and adjusting projects as they progress, the Carbon Trust OWA program is an example of a 'super-flexible organization' (Bahrami and Evans, 2005), displaying novel approaches to management, organization and strategy as the key characteristics. More

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[518] Carbon Trust Offshore Wind Accelerator Manager, Jan. 17th, 2012. Recording time: 29:20

specifically, this program can be visualized as a recalibration process (presented in section: <u>4.5.3</u> <u>Experience and action</u>, and reproduced here), which places emphasis on both super-flexibility as well as focus throughout its activities.

Figure 12: The Recalibration Process
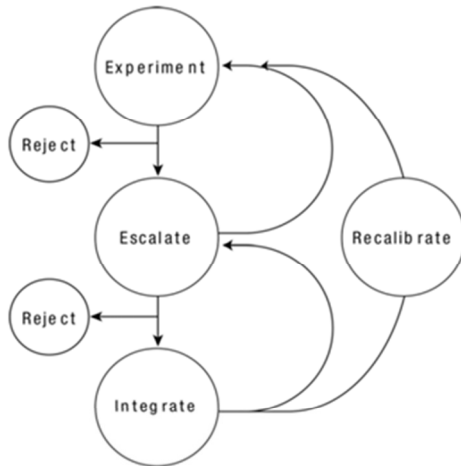
Bahrami and Evans (2005)

As this figure illustrates, the first step (**experimentation**) is that partners clarify intentions in small cohesive groups, and create viable options by 'casting a wide net.' Next, during **escalation**, resources are concentrated on several 'selected options' with executive support. Lastly, during **integration** new arrangements are made as a transition takes place, and initiatives 'go live.' Throughout this process, there are numerous opportunities to either '**reject**' or '**recalibrate**' projects, as represented in this figure. This process is also unique to the Offshore Wind Accelerator program, within the offshore wind industry.

There are several primary benefits of the recalibration process. First, this process "generates factual feedback from concrete action, and enables teams to revise plans and intentions as new realities unfold." (Bahrami and Evens, 2005, p. 102) Second, this process provides points at which to reject or integrate new information as it becomes available. These points are particularly important for shaping projects so that they will add real value and become more likely to be integrated into the industry. Additionally, this process provides the opportunity to identify unforeseen limitations and recognize new opportunities as they arise.

In terms of *experimentation*, the Carbon Trust OWA program has been very successful with the Steering Committee and Technical Working Group structure, as well as with the competitions that have been launched in the working streams. In terms of *escalation* and *integration*, the Carbon Trust OWA project has been very successful at recalibrating throughout this process, and may benefit from an even greater focus on common objectives, goals, and overviews for the Steering Committee and Technical Working Groups. For this reason, suggestions will be given for both *escalation* and *integration* that look at ways in which short and medium term goals, as well as long-term visionary goals, can be achieved. Throughout all interviews conducted, a total of eighteen suggestions arose, for helping to achieve escalation, integration or both.

Table 5: List of recommendations for achieving escalation and integration

> **Escalation and Integration**
> 1) Contract specification: clarity and 'cancel' points
> 2) Induction Reports for TWGs
> 3) Project continuum
> 4) Internal summits
> 5) Keeping the focus on creative incentive programs (CT OWA has a core competence here)
> 6) Ask TWG members for program benefits
> 7) **Within Partner Companies**: Interaction between Steering Committee and TWGs
> 8) **Within Partner Companies:** OWA update reports
> **Escalation**
> 9) Maintaining a "big picture" focus
> 10) Flexibility in interaction (CT OWA has a core competence here)
> 11) Single topic teleconference meetings
> 12) Consensus generation and knowledge sharing in TWG meetings
> 13) Templates and incentive programs
> 14) Enhancing the ability of the Steering Committee and TWGs to be prepared and effective
> 15) Document register
> 16) **Within Partner Companies:** Limited spending pre-approval
> **Integration**
> 17) Identifying areas that can facilitate "quick wins" for the industry
> 18) Moving important Carbon Trust Offshore Wind Accelerator outcomes into the industry

Each of these will now be presented, covering what the recommendation for achieving escalation and/or integration is, what has been said during interviews, and practical suggestions for achieving super-flexibility and focus.

The first recommendation, related to achieving both escalation and integration, is: ***contract specification: clarity and 'cancel' points***. Contract specification, through detailed clarity and 'cancel' points, is important for adjusting as projects move forward in the short term, and ensuring that outcomes meet developer needs in the long term. More specifically, contract specification may be able to facilitate projects that are as focused on developer needs as possible, and 'cancel points' can stop resources from being used on projects that are clearly not going to yield desired results. As stated by one TWG member:

> "…sometimes we have the feeling [that] we generate work without specifying in enough detail. And without following the outcome – if the outcome diverts and deviates from our expectations, it can happen without insisting on correctness and updates – this is something where some improvements could be made in the future."[519]

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[519] Foundations Technical Working Group member, June 13th, 2012. Recording time: 18:45

In order to achieve super-flexibility and focus, contracts could be made even more specific up front, to facilitate measurement against **specific milestones**. Then 'reject' or **'cancel' points** (which have already been identified for some current projects) could be worked into contracts up front for all projects. Also, **periodic notice/inspection points** for TWG members could be set up for projects, where all parties receive data and evaluations are made (by entire TWG or by project champions) including an explicit option for redirection (using learning from keystone).

The second recommendation, related to achieving both escalation and integration, is: ***Induction Reports for TWGs.*** Short and medium term goal alignment is more likely when personnel changes happen smoothly and allow representatives from each company to clearly understand responsibilities, projects and objectives. Generating this consistency and understanding can further increase the *engagement* and *drive* that is needed to realize long-term visionary goals. More specifically, induction reports could be important for keeping momentum up during personnel changes, for staying focused on goals and objectives generally, and for increasing engagement and drive towards integration. The importance of having an induction report is emphasized by a TWG member who stated:

> "It would have been a great idea to have a common presentation, or some kind of common paper introducing people into the Carbon Trust. It was left to the companies to seek information themselves – On the website or in the database, or something like that."[520]

An **induction report** could include a succinct overview of: What the OWA is; Responsibilities of the Steering Committee and TWGs, and why it is set up that way; some of the main OWA accomplishments; what this program hopes to achieve overall, briefly focusing on each working stream individually. Most of this information could be gathered and assembled from pre-existing documents.

The third recommendation, related to achieving both escalation and integration, is a: ***project continuum***. There are five ways in which project continuums could aid short- and medium-, as well as long-term goal alignment. First, a project continuum could help to clearly identify why the project is in place, and what the desired outcome is intended to achieve for the partners/industry. Second, having project continuums could aid new partner representatives in getting up to speed quickly. Third, they could provide focus and momentum in Steering Committee and TWG meetings. Fourth, they could help to identify and cut out 'pet projects', and fifth, they could help to strike a balance between needing to adapt quickly and keeping a high level of focus. At the Steering Committee level, it was stated (in relation to measuring overall success):

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[520] Foundations Technical Working Group member, Dec. 12nd, 2011. Recording time: 1:02:50

"That could be the overall objective of this activity: 'so far we have achieved this and this. The objectives of future work toward the end of this project is this and this.' So it's really quite simple… so to have tasks, and who is responsible… Somehow an overview that is easily accessible for each of the tasks that we are carrying out. And maybe identifying the success factors for that, so it's easier to see 'did we deliver on that, or did we not deliver?'"[521]

Project continuums could help to both escalate and integrate projects by using a high level of detail for explaining a) why the project came about (**where did we come from?**) and b) what the desired outcome is (**where are we going?**) Then each relevant meeting can be a **milestone** that gets added to the continuum as the project proceeds, which is updated by TDC (or relevant party), and can be accessed and followed by all partners. **Periodic success criteria** could also be added, associated with milestone payments or 'cancel points.'

The fourth recommendation, related to achieving both escalation and integration, is holding *__Internal Summits__*. Internal summits could help to focus OWA members in the same direction and, for the long term, contribute to trust building and idea generation for 'new arrangements.' More specifically, internal summits could facilitate experience sharing, provide a yearly internal evaluation of the OWA by its members collectively, provide the opportunity to connect people in key areas and to manage interfaces, bring Steering Committee and TWG members up to speed on each-other's activities, and bring varying perspectives to potential difficulties or problems. The desire for an activity such as an internal summit was expressed by a TWG member as follows:

> "It would be quite useful to know how other work streams are actually proceeding toward working toward this goal, how they're focusing on different things. I'm sure they would benefit from talking to us as well."[522]

Another TWG member stated that:

> "It's a little bit hard for me to see now where we're at… Maybe a foot in the ground could be good now at some point just to wrap it up and see where we are status wise."[523]

Internal summits could be primarily organized by TDCs and take place half a year after currently scheduled summits. Workshops could be organized for problem solving between TWG groups. **Presentations by each TWG** concerning main outcomes, advantages and challenges of the working stream could also be organized. **Networking** among partner companies toward

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[521] Steering Committee member, Dec. 14th, 2011. Recording time: 40:10
[522] Foundations Technical Working Group Member, May 1st, 2012. Recording time: 44:00
[523] Foundations Technical Working Group member, May 22, 2012. Recording time: 01:25:55

finding solutions and alternative agreements for moving escalation processes forward could be an additional benefit of internal summits.

The fifth recommendation, related to achieving both escalation and integration is: ***Keeping the focus on creative incentive programs (Carbon Trust OWA has a core competence here)***. Creative incentive programs are already focused upon by the Carbon Trust OWA management team. However, having all program members keeping the focus on creative incentive programs is important for increasing the attractiveness of escalation and integration, as well as for yielding results that are more 'useable.' This may also be important for increasing interaction between concept owners and developers, increasing confidence in the market and increasing the likelihood of bringing new technologies to market. For example, a TWG member indicated the importance and benefit of partner support in this activity by saying:

> "If people can, again, diplomatically bring programs together and convince each other that there are benefits to be had, then there's more chance of that happening… to sort of say 'look, we can take this road, what are you guys going to do? We're going to do this.' And then you might come to some sort of agreement that you can go down a similar road."[524]

It is extremely important in terms of achieving super-flexibility and focus, that the OWA management team, Steering Committee members and Technical Working Group members can all contribute to finding ways to make lower cost technology development a viable alternative for developers in the industry. **Brainstorming sessions** could take place during internal summits based upon areas of interest in terms of further collaboration or alternative methods for making projects more attractive. **Networking** during internal summits could help to facilitate informal knowledge sharing and idea generation.

The sixth recommendation, related to achieving both escalation and integration is: ***Asking TWG members for program benefits***. Highlighting benefits of the program can help to generate a desire for escalation and drive towards integration. More specifically it can help Steering Committee and TWG members to be persuasive within and among their organizations (the 9 industry partners), as well as to focus on achieving outcomes and generating understanding about how to reach overall objectives and goals. In identifying why highlighting program benefits could be beneficial to industry partners, a TWG member stated:

> "And one of the other things is that people like me, and the other developers as well, have to plug away internally to make sure that people are aware of the potential benefits of doing this, and are therefore prepared to potentially stump up a contribution to doing it."[525]

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[524] Foundations Technical Working Group Member, May 1st, 2012. Recording time: 21:25
[525] Foundations Technical Working Group Member, May 1st, 2012. Recording time: 21:00

Program Benefits could be set up like OWA-TDC teleconf-24Jan2013,[526] highlighting good work being done; giving a review of key OWA tools; and giving a review of other Work Streams (good work being done in the four others). Some of these comments could be presented at Internal Summits and in Induction Reports.

The seventh recommendation, related to achieving both escalation and integration is: ***facilitating interaction between Steering Committee and TWG members within partner companies.*** Clearly understanding the progress of each working stream and how they relate to one another and the overall objectives within respective partner companies can help to focus short- and medium-term goals, as well as positively impacting long-term, visionary goals. More specifically this interaction may help to strengthen the understanding of company goals and objectives in relation to each TWG, as well as strengthen the ability of each partner to connect specific projects to company objectives.

The importance of interaction between Steering Group members and TWG members was explained by a Steering Committee member who stated:

> "You can tell that a lot of the Steering group members are trying to understand the Working Group's area, because obviously they're not… the Steering Committee members are not necessarily experts in the different working groups. …The Steering Group members need more time with their Working Groups to understand what they're proposing to the Steering Group. So at the end of the day I think it's more that we need more time with the Working Groups to understand where they're coming from, and it's a two-way thing."[527]

Regularly Scheduled internal company **meetings** with Steering Committee member(s) and all TWG members could help to facilitate super-flexibility and focus in this area. Topics of discussion could include: current project progress; how projects align with company objectives; current challenges; best practice; and goals in moving forward. **Project timelines** could help to organize discussions for each TWG and be one basis for discussion in internal partner company meetings.

The eighth recommendation, related to achieving both escalation and integration is: ***OWA update reports within partner companies***. OWA update reports could help to ensure that key points are identified at regular intervals, as well as giving the rest of the members within each partner company the opportunity to see what is on the horizon, and think about how these activities could be integrated into the organization. More specifically, OWA update reports could increase clarity among TWG and Steering Committee members, as well as increase the visibility of the OWA

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[526] See Appendix 11: OWA-TDC teleconf-24Jan2013
[527] Steering Committee Member, June 4th 2012. Recording time: 21:40

program among senior management. Some partner companies already produce OWA update reports internally. As stated by a Steering Committee member:

> "…we are reporting all work going on there in the Offshore Wind Accelerator to the management, so it's in that sense that we have to pick out, or focus on, or report on things which have been a success. And in that way we are calibrating also with the management, and finding out if this is in accordance to their expectation level. So this is the way it has been working."[528]

In terms of producing **OWA update reports,** templates could be created to report key points within the OWA to the wider organization of each partner company. Update reports could also be **coordinated between TWG and SC members** so that all relevant information is presented at one time. These update reports could **supplement the induction report** on an internal basis within each company. This type of report could also be put together by the Carbon Trust for each working stream e.g. every quarter.

The ninth recommendation, related to achieving escalation is: ***Maintaining a "big picture" focus***. Maintaining "big picture" focus may be important for pooling resources toward high impact results that are needed in a developing industry, for aligning resources and creating joint expectations, and for helping the industry to become competitive and robust. The importance of maintaining "big picture" focus was identified by a Steering Committee member, when this person stated:

> "I think the overall goals are shared by the group. We occasionally have to remind ourselves of what they are, but that's ok too. It's a useful exercise. … we want the big ones, you know. It's the stuff that wouldn't be done in the normal course of events, or that we'd all be doing separately and getting the same answer, that we need to focus on here."[529]

When deciding on new projects to escalate, the **objective** of developing new, lower cost technology, should be **re-visited** and kept in mind so that the industry can become competitive and robust.

The tenth recommendation, related to achieving escalation is: ***Flexibility in interaction (Carbon Trust OWA has a core competence here)***. Flexibility in interaction creates high impact and relevance, enabling projects to stay focused and escalate while receiving valuable input. More specifically, flexibility in interaction can help to create tangible knowledge sharing, creating experience sharing, and help to make business cases as relevant as possible. The Carbon Trust OWA management team already has a core competence in this area. For example, in describing the role of *Project Champions*, a TWG member stated:

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[528] Steering Committee Member, May 11th 2012. Recording time: 24:25
[529] Steering Committee member, April 24th, 2012. Recording time: 18:40

"Something we've done … is that not everyone in the [Technical Working] Group gets involved in every business case, every discussion. There are types of sub-groups that can take the initial discussions and get the decision input to some level, and then present it to the full group."[530]

Identifying an area where greater inclusion might be needed in terms of interaction, a Steering Committee member stated:

"I clearly see that we need to work more closely in developing these business cases. … maybe one should involve the people in these Technical Working Groups to a greater extent… when it comes to more commercialized aspects, or the potential cost impact, maybe it should be passed on to the Steering Committee. … I think that could be a good way of sharing experience, because you really want to end up with business cases which are relevant, and this is maybe a good arena to meet."[531]

One suggestion for achieving super-flexibility and focus is that **selected TWG and Steering Committee members be involved in writing business cases**. The TWG Project Champions could help to write the business cases that they are involved with already. Once the case is drafted, the Steering Committee members from the same partner companies could then help with the more commercialized and cost aspects, in order to make the business cases as relevant as possible.

The eleventh recommendation, related to achieving escalation is to have: ***Single topic teleconference meetings***. Single topic teleconference meetings could help to more clearly set guidelines for meeting short- and medium-term goals, and making interim decisions. More specifically, single topic teleconference meetings could help to align expectations and facilitate outcomes in a limited contact context, as well as ensure that key points are presented and discussed, and that everyone has a chance to express their view. A Technical Delivery Consultant expressed that teleconference meetings work best in his experience:

"... If it's a single topic… so for example, if we have a report from a supplier, and we want to discuss that report with them, then we might prepare a list of questions in advance, provide it to the supplier, and then ask them to talk us through. I think teleconferences work if it's quite a structured conversation. If you're being presented at, and then you get to ask questions back, then it's great. If it's completely free-flowing conversation, it's not so good, especially if there are a lot of people in the call."[532]

The suggestion for achieving super-flexibility and focus is to structure teleconference meetings with **one topic** to discuss. Ideally, **one person would be presenting** based on a list of questions (prepared in advance) which would then provide the option for others in the call to ask questions.

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[530] Foundations Technical Working Group Member, May 22nd, 2012. Recording time: 1:21:35
[531] Steering Committee Member, May 11th, 2012. Recording time: 49:40
[532] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 44:20

It might also be a good idea to end each call with a **round-table of concluding remarks** so that everyone can present their final view on the topic.

The twelfth recommendation, related to achieving escalation is to facilitate*: **_Consensus generation and knowledge sharing in TWG meetings_**. Consensus generation and knowledge sharing could help to set the guidelines for meeting short- and medium-term goals, and aid in making interim decisions. More specifically, knowledge sharing can ensure that as much knowledge as possible is gained for each decision that is made, and can also facilitate the process of creating consensus. In explaining how consensus generation and knowledge sharing might be achieved, a Technical Delivery Consultant member said:

> "… a technique I often use is just a chairing a meeting approach – if you've got something to decide and it's important, to say to them 'in a half an hour's time, I'm going to go around and ask you all your opinion.' So they think about it and prepare their opinion, and then say 'right, what's your opinion? What's your opinion?' … and they'll give it to you, you know, and it's great – it's really, really good. You never hear them say 'oh I don't know I'm going to have to phone my boss and get back to you next month.' … And I've seen a lot of that in the past."[533]

Another way that consensus generation has been facilitated was discussed by a Technical Delivery Consultant member, regarding the use of weighting tables:

> "10 categories – and agreed in advance with the Technical working Group which the 10 categories were. … it gives you the basis for a discussion… And a consensus evolves…"[534]

There are two suggestions here directly related to the above statements by the Technical Delivery Consultant. The first is **round table** contributions so that each viewpoint is heard (as listed on the agenda). The second is **weighting tables** for decision points or to generate or focus discussion.

The thirteenth recommendation, related to achieving escalation is to create: **_Templates and incentive programs_**. Templates and incentive programs may help to more quickly get the answers that are desired. More specifically, templates and incentive programs may be able to generate comparable and more useable results, keep everybody on the same page, and improve the delivery time of fabricators and installers. One suggestion given by a TWG member was that*:

> "We need the input of fabricators and installers, and the level of engagement of the big fabricators and installation contractors has been limited primarily because they're just so busy… the data was coming back in various different formats, so if there was a template they were being asked to fill out, it might make it easier for them."[535]

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[533] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 19:40
[534] Wake Effects Technical Delivery Consultant, Jan. 16th, 2012. Recording time: 17:00
[535] Foundations Technical Working Group Member, May 22nd, 2012. Recording time: 1:12:30

An area where templates might also be useful was identified by a Carbon Trust OWA Management team member who described the (at that time) newly formed Cables Guest Speaker Series:

> "some of them don't have huge commercial focus - so then they say 'we have really cool technology, look at what this thing can do,' and then the Technical Working Group says 'yeah but how much does it cost? What's the business case for offshore wind?' And then they say 'um, I don't know.' So it's good for them to get the feedback as well."[536]

There are three suggestions for achieving super-flexibility and focus in this area. The first is to have a **Template for cost estimates** for fabricators and installers. The second is to have a **Prize fund** for contractors and subcontractors so that they are rewarded for achieving the desired outcome *(strengthening activities presently underway).* The third suggestion is to have a Template for presentations from guest speakers in the Cables TWG, perhaps a **list of frequently asked questions (FAQs)**, so presenters can be better prepared.

The fourteenth recommendation, related to achieving escalation is: ***Enhancing the ability of the Steering Committee and TWG to be prepared and effective***. Maximizing information distribution and preparation before Steering Committee and TWG meetings will help to ensure that time spent in London is as effective as possible. More specifically, enhancing the ability to be prepared and effective could accelerate efficiency during meetings, ensure a high level of participation from partners, and maximize the ability of members to make informed decisions during meetings. As stated by a TWG member:

> "If the material isn't circulated early enough, I can't read it and review it, and get a consolidated approved opinion on that material, to then take to the meeting and present [our] input. And that's key. So if it arrives on the day, I've got to just turn up and take a punt really, or stand back a bit more, and not give as good input as I otherwise could on our behalf, if I don't have time to get review from the senior level."[537]

And another TWG member said:

> "we need a meeting schedule a month ahead… it's good with Doodle requests, because then you can vote for each, but then if I would like to follow this up, and if you select a date that I can't, I can't. And usually we do that maybe 2 weeks before – it's too late."[538]

At the Steering Committee level, one member stated that:

> "when you are presenting a new project, and they are ending up with a lump sum – that I don't like because it's not specified – it's a kind of optimistic way of putting forward the budget, and then saying 'ok, it's going to cost a certain amount of money,' but by the end of

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[536]Carbon Trust Offshore Wind Accelerator Manager, Jan. 28th, 2013. Recording time: 53:10

[537] Foundations Technical Working Group Member, Jan. 13th, 2012. Recording time: 6:00

[538] Foundations Technical Working Group Member, April 19th, 2012. Recording time: 07:40

the day it's going to be MUCH more expensive, because you haven't done a really good de-risking up front… projects should be much more prepared before starting – at least those more expensive projects, like demonstrations projects."[539]

There are four specific suggestions for achieving super-flexibility and focus in this area, based on interviews conducted. The first is having the agenda out **five working days** before meetings. The second is to have **advanced warning** for anticipated spending decisions and decision deadlines. The third is to set meeting dates **one month** ahead, and the fourth is to have greater **budget itemization** for large projects in particular.

The fifteenth recommendation, related to achieving escalation is to create a: ***Document register***. A document register could help Steering Committee and TWG members to have a better overview of material that has been produced through the Carbon Trust OWA program, which they would then be able to more easily distribute within their own organizations, heightening general awareness of the program. More specifically, a document register could help to ensure that work is not repeated, could make it easier to access and understand work that has been produced through the CT OWA program, and may create a greater awareness of OWA activities within the industry. As stated by a TWG member:

> "We've got the repository, but a register [could be useful], saying 'these are all the documents that have been done, these are all the studies that have been done, and here is two lines to summarize what was done in them.' So that you could go into that, and it could be, before you let a contract for example, say 'we are looking into soil interaction with piles' and then be like 'eh, let's just search this document' you know, there's a summary of it, and be like 'oh, we did the same thing for a different project,' – that sort of thing."[540]

A **Document register** could be created, briefly describing (two sentences) each piece of work that has been done so that nothing is being repeated, or will be in the future. A document register could also **identify the result classification up front** (open, restricted, confidential). The document register could also be **made public** within the industry, which could increase visibility of the program (while keeping actual documents and results confidential without requested permission), helping to streamline activities across the industry.

The sixteenth recommendation, related to achieving escalation is to provide: ***limited spending pre-approval within partner companies***. Limited spending pre-approval could speed up the escalation process, so that time and money can be spent most effectively. More specifically, limited spending pre-approval could empower developer representatives, increase engagement,

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and create a greater sense of ownership within projects. When discussing process improvement a TWG member noted that:

> "Improvement from our perspective might be… pre-approval of a certain level of funding, so we don't have to go, or a company doesn't have to go through a certain process for a smaller spend. So you could pre-approve a spend of half a million, or something like that. And the board will say 'ok, we know what you're doing, and if it's for those purposes, yes, you've got pre approval.' That would be it."[541]

The Suggestion for achieving super-flexibility and focus would be to instate **spending pre-approval** for developer company representatives up to a certain amount for specific OWA issues.

The seventeenth recommendation, this time related to achieving integration is: ***Identifying areas that can facilitate "quick wins" for the industry partners***. Finding resourceful ways to achieve integration may help the OWA program to achieve a greater number of successes. More specifically, identifying areas that can facilitate "quick wins" for the industry partners could maximizing the benefit of industry collaboration, help to build a robust industry, and contribute to increased cooperation between partners. To demonstrate one area where "quick wins" may be achieved, a TWG member stated:

> "if at the end we would generate a certain agreement or specification even on the secondary steel items which all of us can use for the offshore projects. And you have a certain foreseeable condition of your secondary steel, which may be small items, secondary items, but important items and time consuming items. Once you have achieved this, you would be, as a business, in a very good position, and setting a base line for standardization and industrialization. And this is something which I would link with knowledge, or with things which should be changed, and with things where I would say "yes this is something where I would really see a certain amount of sharing of lessons learned."[542]

One suggestion for achieving super-flexibility and focus in this area is to identify areas where **all partners** can receive **benefit** toward advancing and sustaining the industry through **low risk activities.**

The eighteenth, and final recommendation, also related to achieving integration is: ***Moving important Carbon Trust Offshore Wind Accelerator outcomes into the industry.*** Taking the opportunity to advance the industry by integrating results where possible would be beneficial to everyone involved in offshore wind. More specifically, this would help to create a more stable environment for all partners, as well as creating the biggest impact possible through the Carbon Trust OWA program. Specifically in relation to moving OWA results into the offshore wind industry, a Steering Committee member discussed OWA results, saying:

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[541] Foundations Technical Working Group Member, Jan. 13th, 2012. Recording time: 16:55
[542] Foundations Technical Working Group member, June 13th, 2012. Recording time: 56:35

"Sometimes you just want to keep it, other times it makes no sense to keep it – you don't help things by keeping it – you help things more by getting it out there. So that's been, I suppose… the process to do that has taken a little bit of time. But now it seems to be coming to a good place as far as I can see. Where the OWA itself, and the Steering Committee, can decide what information can be put into the public domain."[543]

The first suggestion is to continue what the Carbon Trust OWA management team is already doing, namely, **publically highlighting possibilities for integration** within the industry on a continual basis (Carbon Trust website, conferences, magazine articles, linked-in etc.). Another suggestion is to re-evaluate selected **reports** with the view of making them **public.** A final suggestion is to create a **follow-up report for "Big Challenge, Big Opportunity"** highlighting major successes for the industry. The first half of this report could be a follow-up to the first report, and the second half could highlight selected subcontractors - the advantages of each concept, cost savings, etc.

To conclude, these recommendations are meant as a collection of practical suggestions for strengthening short- and medium-, as well as long-term goal alignment for the achievement of *escalation* and *integration* within the Carbon Trust OWA program. The highest impact suggestions may be seen as those from one to eight, because suggestions one through eight are linked to both escalation *and* integration.

6.4 New Understanding of Organizational Knowledge Management Processes

In keeping with the hermeneutic process that has been followed throughout this dissertation, we will now step back from the very specific focus on the primary research question and subsequent sub-questions, and explore what has been gained from this process as a whole. One of the first important conclusions drawn after an extensive review of knowledge management literature was that there is no unified definition of knowledge, and by extension no unified understanding about what knowledge management should include or exclude, or how it should be approached in theory or in practice. Because no pre-existing definition seemed sufficiently useful for the purposes of this dissertation, a new definition has been proposed, namely that ***knowledge is understanding achieved through processes of combined personal and shared information and experience.*** It is hoped that this definition may lead future research to focus more specifically on the personal and social, action oriented, aspects of knowledge management, and definitively away from an information technology (IT) focus. Also, the reclassification of IT tools (and any other "tool" leading individuals to *develop* knowledge, but not seen as knowledge in and of itself) as ***knowledge conduits*** is another contribution that can be useful for delineating what is, and is not,

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[543] Steering Committee Member, April 24th, 2012. Recording time: 8:00

knowledge. Using this term when not talking about people and their individual knowledge processes may be helpful for clearing up the somewhat fuzzy definitions of knowledge, as well as the misuse of the word in research today.

Another contribution to the field of knowledge management presented by this dissertation is the classification of knowledge management theories and tools into *Drivers*, *Obstacles* and *Critical Success Factors*. These three over-arching categories provide a structure into which meaningful, case specific information can be placed. This particular case study resulted in a group of theories and tools which are applicable to the Carbon Trust OWA program specifically, and applicable to actor oriented innovation programs more generally. This framework of drivers, obstacles and critical success factors has also provided a means by which to look at the OWA program in a holistic manner, because although the result is highly structured, these three categories provided a broad and meaningful way to examine the intricacies of what is happening in practice, and what is meaningful for the individuals participating in the processes as they unfold. It was only after this case had been examined both broadly and narrowly over time that final decisions were made about which constructs should be placed in each category.

The categories of drivers, obstacles and critical success factors also imply looking not only at what individuals do (or do not do), but how and importantly *why* they do it. So, although individual constructs will differ from case study to case study, the overarching framework could be applied by any researcher wishing to approach knowledge management from a holistic perspective. If this was done over time, researchers would be able to compare and contrast constructs to gain more insight into how knowledge management can usefully be applied by different organizations and programs, as well as a deeper understanding of knowledge management as a field of research.

The process undertaken for this dissertation also led to the discovery of some theories and tools not directly related to the field of knowledge management, due to the nature of the case being studied. For example, the ideas presented in each of the sub-questions were discovered primarily due to the nature of the case. First, synergy formation (as adapted from Child, Faulkner and Tallman, 2005) was drawn in because of its focus on multi-partner networks. Second, the idea of strengthening interfacing capabilities came about through listening to interviewees talk about the importance of interfaces, both with relation to technical aspects, as well as managerial aspects of the OWA program. Third, the recalibration process (Bahrami and Evans, 2005) used to support practical recommendations such as those presented just above was drawn in because of its focus on the super-flexibility of organizations. Because these theories and tools were drawn in, this dissertation was able to provide practical guidelines for knowledge management processes in the

Carbon Trust OWA program, which is another main contribution of this research. Paying increased attention to context in the future should help researchers to find other useful theories and tools that could be drawn into the field of knowledge management, informing the way knowledge processes unfold under unique and evolving conditions.

This dissertation has also closed the theory - practice gap for the study of the Carbon Trust OWA program, as well as for actor oriented innovation programs more generally, through the use of integrative investigation and hermeneutics. Theory has informed practice, and what is happening in the Carbon Trust OWA program has in turn influenced the choice of theories presented. However, change is the rule rather than the exception when it comes to organizations. Therefore, this dissertation provides a method for closing the theory - practice gap with relation to knowledge management, and not a definitive list of answers about how to conceptualize or practice knowledge management – this will evolve as long as organizations do so.

6.5 Limitations and Extensions

There are also a number of limitations that should be discussed with relation to this study. First and foremost, it is important to mention generalizability. It bears restating that the specific theories and tools presented in connection with the Carbon Trust OWA program are in no way meant as a definitive list of theories for knowledge management generally. Beyond the OWA program, they may also be insightful for organizations or programs with a similar organizational structure, and within the offshore wind industry, or an industry with similar characteristics (as described in chapter two). Without these criteria, the structure of examining a case study with the use of integrative investigation, hermeneutics and an organic paradigm perspective, and then separating applicable theories and tools into categories of knowledge management drivers, obstacles, and critical success factors is likely to be useful and/or insightful. If this were done by a number of researchers over time, it would build a robust understanding about knowledge management, both theoretically and practically speaking.

It should also be mentioned that there are a number of issues that were not covered in this dissertation, although they could have provided further insight for this case study. Government subsidies, for example, have played a large part in the decision of partner organizations to get involved in offshore wind. It is the case that without governmental subsidy, the offshore wind industry would not be able to support itself at the present time. Uncertainties about what support will be available in the future also play a large part in creating cautiousness within the industry generally, and within the OWA program specifically. However, this is a very large and complex

issue, and it involves the governments of many different countries. For this reason, it was considered to be primarily outside of the scope of this dissertation.

Another important factor that was not discussed in this dissertation is that of personality. Social networks, for example, are discussed in terms of roles that individuals play. Studying roles within social networks was chosen as a useful method that is often applied within organization and management science. It is, however, acknowledged that studying personality, as well as studying this case from the perspective of social psychology generally, would add further insight. This, perhaps, could be one way to extend the research presented in this dissertation, and carry understandings which it offers further. It would also be of interest to study whether or how the suggestions made in this dissertation impact the OWA program until its conclusion, and to what degree this learning is carried back into partner organizations, or impacts future collaboration between the present partners. This would be a contribution to the field of action research, and could be of use to both researchers and to the organizations that open their doors to researchers.

References

Abbott, Andrew (1988). Transcending General Linear Reality. *Sociological Theory*, 6(2): 169-186.

Alvesson, Mats (2004). *Knowledge Work and Knowledge-Intensive Firms*, Oxford University Press, Oxford.

Alvesson, M., Karreman, D. (2001). Odd Couple: Making Sense of the Curious Concept of Knowledge Management. *Journal of Management Studies*, 38(7): 995-1018.

Alvesson, M., Skoldberg, K. (2009). *Reflexive Methodology: New Vistas for Qualitative Research*. Sage, London.

Anderson, Philip (1999). Complexity theory and Organization Science. *Organization Science*, 10(3): 216-232.

Anderson, J.C., Narus, J.A. (1990). A Model of Distributor Firm and Manufacturer Firm Working Partnership. *Journal of Marketing*, 54: 42-58.

Anderson, E., Weitz, B. (1989). Determinants of Continuity in Conventional Industrial Channel Dyads. *Marketing Science*, 8(4): 310-323.

Andersen, P., Drejer, I. (2009). Together we Share? Competitive and Collaborative Supplier Interests in Product Development. *Technovation*, 29(10): 690-703.

Bahrami, H. and Evans, S. (2005). *Super-Flexibility for Knowledge Enterprises,* Springer, New York.

Bakhtin, M. M. (1981). *The Dialogic Imagination*. M. Holquist, ed. University of Texas Press, Austin. [Translated by C. Emerson, M. Holquist.]

Bargal, David (2006). Personal and Intellectual Influences Leading to Lewin's Paradigm of Action Research. *Action Research*, 4(4): 367-388.

Bartunek, J. M. (1988). The dynamics of personal and organizational reframing. Qumn, R.E., Cameron, K.S. (eds.) *Paradox and Transformation*. Ballinger, Cambridge, MA: 137–162.

Bateson, G. (1972). *Steps to an Ecology of Mind*. Jason Aronson, Northvale, NJ.

Becerra, M., Lunnan, R. & Huemer, L. (2008). Trustworthiness, Risk, and the Transfer of Tacit and Explicit Knowledge Between Alliance Partners. *Journal of Management Studies*, 45(4): 691–713.

Beech, N., MacIntosh, R., MacLean, D., Shepherd, J., Stokes, J. (2002). Exploring Constraints on Developing Knowledge: On the Need for Conflict. *Management Learning,* 33(4): p. 459-475.

Berger, P., Luckmann, T. (1966). *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Penguin Books, London.

Blanche, M.T., Kurrheim, K., Painter, D. (eds) (2006). *Research In Practice.* University of Cape Town Press (Pty) Ltd, Cape Town.

Bohm, D. (1996). *On Dialogue*. Routledge, London.

Boje, David M. (2001). *Narrative Methods for Organizational & Communication Research.* Sage Publications Ltd., London.

Boje, David M. (2008). *Storytelling Organizations*. Sage Publications Ltd., London.

Boland, R.J., Tenkasi, R.V. (1995). Perspective Making and Perspective Taking in Communities of Knowing. *Organization Science*, 6(4): 350-372.

Brown J.S., Duguid, P. (2000). Balancing Act: How to Capture Knowledge Without Killing It. *Harvard Business Review*: 73–80.

Brown, J.S., Duguid, P. (2001). Knowledge and Organization: A Social-Practice Perspective, *Organization Science,* 12(2): 198-213.

Brown, J.S., Duguid, P. (2002). Local Knowledge: Innovation in the Networked Age. *Management Learning*, 33(4): 427-437.

Burt, Ronald (1992). *Structural Holes: The Social Structure of Competition*. Harvard University Press, Cambridge.

Burt, R.S., Gabbay, S.M., Holt, G., Moran, P. (1994). Contingent Organization as a Network Theory: The Culture-Performance Contingency Function. *Acta Sociologica*, 37(4): 345-370.

Carbon Trust home page (2013). http://www.carbontrust.com/home (accessed on: Sept. 17, 2013)

Carbon Trust "News & Insights" (2013). Carbon Trust launch race for next generation of offshore wind cables, May 23, 2013 http://www.carbontrust.com/news/2013/05/carbon-trust-launch-race-for-next-generation-of-offshore-wind-cables (accessed on: Sept. 16, 2013)

Carbon Trust "Offshore Wind Accelerator" (2013). http://www.carbontrust.com/our-clients/o/offshore-wind-accelerator (accesses on: Sept. 17, 2013)

Carless, S. A., DePaola, C. (2000). The measurement of cohesion in work teams. *Small Group Research*, 31(1): 71-88.

Carlile, Paul R. (2002). A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development. Organization Science, 13(4): 456-457.

Carron, A.V., Widmeyer, W.N., Brawley, L.R. (1985). The Development of an Instrument to Assess Cohesion in Sport Teams: The Group Environment Questionnaire. *Journal of Sport Psychology*, 7: 244-266.

Chang, A., Duck, J., Bordia, P. (2006). Understanding the Multidimensionality of Group Development. *Small Group Research* 37(4): 327-350.

Chao, G.T., Moon, H. (2005). The Cultural Mosaic: A Metatheory for Understanding the Complexity of Culture. *Journal of Applied Psychology*, 90(6): 1128-1140.

Child, John, personal communication with the authors Bahrami and Evans, found in: Bahrami, H. and Evens, S. (2005) *Super-Flexibility for Knowledge Enterprises* Springer, New York.

Child, J., Faulkner, D., Tallman, S. (2005). Cooperative Strategy: Managing Alliances, Networks, and Joint Ventures. Oxford University Press, Oxford.

Chowdhury, S. (2005). The role of affect- and cognition based trust in complex knowledge sharing. *Journal of Managerial Issues*, 17(3): 310–327.

Cliffe, S. (1998) Knowledge Management: The Well-Connected Business. *Harvard Business Review*, 76(4): 17-21.

Coghlan, D., Brannick, T. (2010). *Doing Action Research in Your Own Organization: 3rd Edition*, Sage, London.

Cook, S.D., Brown, J.S. (1999). Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing. Organization Science, 10: 381-400.

The Crown Estate "Round 3 wind farms" (2013). http://www.thecrownestate.co.uk/energy-infrastructure/offshore-wind-energy/our-portfolio/round-3-wind-farms/ (accessed on: Sept. 17, 2013)

Das,T. K., and Teng, B-S., (1998). Between Trust and control: Developing Confidence in Partner Cooperation in Allianaces. *Academy of management Review*, 23(3): 491-512.

Davenport, T.H., Prusak, L. (2000). *Working Knowledge: How Organizations Manage What They Know.* Harvard Business School Press, Boston.

Deal, T. E., Kennedy, A. A. (1982). *Corporate cultures: The Rites and Rituals of Corporate Life*. Addison-Wesley.

Delay, Tom (2010). "Working with you to open up low carbon opportunities," UK, January 2010, http://www.carbontrust.co.uk/Publications/pages/publicationdetail.aspx?id=CTC763 (accessed on: Nov. 1, 2010)

Dictionary.com (2012). Interface. http://dictionary.reference.com/browse/interface. (accessed on: Oct. 12, 2012)

Ding, Q., Akoorie, M., Pavlovich, K. (2009). Understanding the Specificity and Complexity of Inter-Firm Knowledge Flows in Alliance Networks. *Interdisciplinary Journal of Contemporary Research in Business,* 1(7).

Donaldson, L. (2001). Reflections on Knowledge and Knowledge-Intensive Firms. *Human Relations, Vol.* 54(7): 955-963.

Doney, P., Cannon, J. (1997). An Examination of the Nature of Trust in Buyer-Seller Relationships. Journal of Marketing, 61(2): 35-51.

Dong Energy "Wind Power," (2013). http://www.dongenergy.com/en/business%20activities/renewables/pages/renewables.aspx (accessed on: Oct. 15, 2013)

Drucker, Peter F. (1999) Knowledge-Worker Productivity: The Biggest Challenge. *California Management Review*, 41(2):79-94.

Dunbar, K. (1997). How scientists think: On-line creativity and conceptual change in science. T. N. Ward, S. M. Smith, J. Vaid, (eds.) *Creative Thought*. Amer. Psych. Association, Washington, DC: 461–494.

Eisenhardt, K. M. (2000). Introduction to special topic forum: Paradox, spirals, ambivalence: The new language of change and pluralism. *Academy of Management Review*, 25(4): 703-705.

European Commission, *Communication from the Commission - Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU* (COM(2008) 0791 final), http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0791:FIN:EN:HTML (accessed on: Sept. 16, 2010)

Fjeldstad, Ø., Snow, C., Miles, R., Lettl, C. (2012). The Architecture of Collaboration. *Strategic Management Journal*, 33: 734-750.

Foss, N.J., Mahnke, V. (2011). Knowedge Creation in Firms: An Organizational Economics Perspective. *Handbook of Organizational Learning and Knowledge Management, 2nd Edition,* Easterby-Smith, M., Lyles, M. (eds). Wiley, Oxford.

Gadamer, Hans-George (1994). *Truth and Method*. Continuum, New York.

Geertz, Clifford (1973). *The Interpretation of Cultures*. Basic Books, New York.

Gergen, M. M., Gergen, K. J., Barrett, F. (2004). Appreciative Inquiry as Dialogue: Generative and Transformative. *Advanced Appreciative Inquiry,* 13–27.

Glass, Niel (1996). Chaos, Non-linear Systems and Day-to-day Management. *European Management Journal,* 14(1): 98-106.

Gleick, J. (1987). *Chaos: Making a new science.* Penguin Books, New York.

Glucksberg, S., Manfredi, D. A., McGlone, M. S. (1997). Metaphor Comprehension: How Metaphors Create New Categories. Ward, T. N., Smith, S. M., Vaid, J. (eds.) *Creative Thought*. American Psychology Association, Washington, DC: 327–350.

Goffin, K., Koners, U., Bater, D., van der Hoven, C. (2010). Managing Lessons Learned and Tacit Knowledge In New Product Development, *Research and Technology Management*, July-August.

Gordon, G.G., DiTomaso, N. (1992). Predicting Corporate Performance from Organizational Culture. *Journal of Management Studies*, 29(6): 783-798.

Granstrand, O., Sjolander, S. (1992). Internationalization and diversification of multi-technology corporations. Granstrand, O., Haakanson, L., Sjolander, S. (eds.), *Technology Management and International Business*. Wiley, London.

Gu Y. (2004). Global knowledge management research: a bibliometric analysis. *Scientometrics,* 61(2): 171-190.

Gummesson, Evert (2000). *Qualitative Methods in Management, 2nd rev. ed.*, Sage, Thousand Oaks, California.

Hajiro, Aida (2009). Corporate Culture: What Do We Know and Where Do We Go From Here? European Journal of Cross-Cultural Competence and Management, 1(1): 34-41.

Hamel, G., Prahalad, C.K. (1994). Competing for the Future. *Harvard Business Review*, 122-128.

Hampton, J. A. (1997). Emergent Attributes in Combined Concepts. Ward, T. N., Smith, S. M., Vaid, J. (eds.) *Creative Thought*. American Psychological Association, Washington, DC: 83–110.

Hargadon, A., Sutton, R.I. (1997). Technology Brokering and Innovation in a Product Development Firm. *Administrative Science Quarterly*, 42: 716-749

Harris, S.G., Sutton, R.I. (1986). Functions of Parting Ceremonies in Dying Organizations. Academy of Management, 29(1): 5-30.

Hazlett, S., McAdam, R., and Gallagher, S. (2005). Theory Building in Knowledge Management: In Search of Paradigms. *Journal of Management Inquiry*, 14(1): 31-42

Hislop, Donald (2009). *Knowledge Management in Organizations: A Critical Introduction*. Oxford University Press, New York.

HM Government a (2011). "Carbon Plan,"
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47621/1358-the-carbon-plan.pdf (accessed on: Sept. 16, 2013)

HM Government b (2011). "The Carbon Plan: Delivering our low carbon future,"
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47613/3702-the-carbon-plan-delivering-our-low-carbon-future.pdf (accessed on: Sept. 16, 2013)

Hoegl, M., Proserpio, L. (2004). Team Member Proximity and Teamwork in Innovative Projects. *Research Policy*, 33(8): 1153-1165.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values.* Sage, Beverly Hills.

Hofstede, G. (1994). The Business of International Business is Culture. *International Business Review*, 3(1): 1-14.

Huang, Chi-Cheng (2009). Knowledge sharing and group cohesiveness on performance: An empirical study of technology R&D teams in Taiwan. *Technovation*, 29(11): 786-797.

Inkpen, A. and Tsang, E.W.K., (2005). Social Capital, Networks, and Knowledge Transfer, Academy of Management Review, 30(1) 146-165.

Isaacs, W. (1999). *Dialogue and the Art of Thinking Together*. Currency, New York.

Isaksen and Lauer (2002). The Climate for Creativity and Change in Teams, *Creativity and Innovation Management*, 11(1): 74-86.

Kelley, T., Littman, J. (2001). *The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm*. Currency Books, New York.

Kelley, T., Littman, J. (2006). *The Ten Faces of Innovation: IDEO's Strategies for Beating the Devil's Advocate & Driving Creativity Throughout Your Organization*. Currency Books, Croydon.

Kotter, J.P., Heskett, J.L. (1992). *Corporate Culture and Performance*. Free Press, New York.

Kostova, T., Athanassiou, N., Berdrow, I. (2004). "Managing Knowledge in Global Organizations." Lane, H., Faznevski, M., Mendenhall, M., McNett, J. (eds.) *The Blackwell Handbook of Global Management: A Guide to Managing Complexity*, Blackwell Publishing, Oxford.

Kuhn, T.S. (1970). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Kvale, Steinar (1996). InterViews: An Introduction to Qualitative Research Interviewing. Sage Publications, London.

Lakoff, G., Johnson, M. (1999). Philosophy in the Flesh. Basic Books, New York.

Lam, Alice (2000). Tacit Knowledge, Organizational Learning and Societal Institutions: An Integrated Framework. Organization Studies, 21(2): 487-511.

Leonard, Dorothy (1998). *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*. Harvard Business School Press, Boston.

Leonard, Dorothy (2007). "Knowledge Transfer Within Organizations." Ichijo, K., and Nonaka, I. (eds.), *Knowledge Creation and Management: New Challenges for Managers*, Oxford University Press, Oxford.

Leonard-Barton, D. (1992). Core Capabilities and Core Rigidities: A Paradox in Managing New Product Development. *Strategic Management Journal*. 13: 111-125.

Lewin, Kurt (1946) Action Research and Minority Problems, *Journal of Social Issues*, 2(4): 34-46.

Liao, S. (2003). Knowledge Management Technologies and Applications: Literature Review from 1995 to 2002. *Expert Systems with Applications*, 25(2): 155-164.

Lindsley, D. H., Brass, D. J., Thomas, J. B. (1995). Efficacy-Performance Spirals: A Multilevel Perspective. *Academy of Management Review*, 20: 645-578.

Liebowitz, Jay (2009). Knowledge Retention: Strategies and Solutions. CRC Press, New York.

Lopez, S.P., Peon, J.M.M., Ordas, C.V.J. (2004). Managing Knowledge: The Link Between Culture and Organizational Learning. Journal of Knowledge Management, 8(6): 93-104.

Luckmann, Thomas (1990). Social communication, dialogue and conversation. Markova, I., Foppa, K. (eds.) The Dynamics of Dialogue. Harvester Wheatsheaf, Hemel Hempstead, UK, 45–61.

Maaløe, Erik (2004). In Case of Case Study Research: Different Approaches Within Social Research to Generalization, Self-Awareness and Nearness to the Field of Study, *Working Paper 2004-9 (REV.ED.)* Aarhus School of Business, Aarhus.

Maaløe, Erik (2009). Explorative Integration: The Expansive Cyclic, Multi-Theoretical Approach to Case Research, *Working Paper 2009*, Aarhus School of Business, Aarhus.

Martin, J. (1982). "Stories and Scripts in Organizational Settings." Hastorf, A., Isen, A. (eds.), *Cognitive Social Psychology:* 255-305. Elsevier, New York.

Martin, J. (1992). *Cultures in Organizations: Three Perspectives*. Oxford University Press, Oxford.

Mayer, R. C., Davis, J. H., and Schoorman, F. D. (1995), An Integrative Model of Organizational Trust. *Academy of Management Review*, 20(3) 691-713.

Maznevski, M., Athanassiou, N. (2007). "Bringing the Outside In: Learning and knowledge Management Through External Networks." Ichijo, K., Nonaka, I. (eds.). *Knowledge Creation and Management: New Challenges for Managers*, Oxford University Press, Oxford.

McNeish, J., & Mann, I. J. S. (2010). Knowledge Sharing and Trust in Organizations. [Article]. *JCIS-IUP Journal of Knowledge Management*, 8(1/2): 18-38.

Mead, G. H. (1934). *Mind, Self, & Society*. C. W. Morris, ed. Chicago University Press, Chicago.

Mintzberg, Henry (1979). The Structuring of Organizations: A Synthesis of the Research. *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.

Moffett, S., McAdam, R., Parkinson, S. (2002). Developing a Model for Technology and Culural Factors in Knowledge Management: A Factor Analysis. *Knowledge Process and Management Journal*, 9(4): 237-255.

Moitra, Deependra (2002). Knowledge Management Across Borders, *Knowledge and Process Management*, 9(1): i-ii.

Morgan, R., Hunt, S. (1994). The Commitment-Trust Theory of Relationship Marketing. *Journal of Marketing*, 58: 20-36.

Murphy, G. L. (1997). Polysemy and the creation of novel meanings. Ward, T.N., Smith, S.M., Vaid, J. (eds.) *Creative Thought*. American Psychological Association, Washington, DC: 235–266.

Murray, P., Blackman, D. (2006). Managing Innovation through Social Architecture, Learning, and Competencies: A New Conceptual Approach. *Knowledge and Process Management*, 13(3): 132-143.

Nahapiet, J., Ghoshal, S. (1998). Social Capital, Intellectual Capital, and the Organizational Advantage. *Academy of Management Review*, 23(2): 242-266.

Napier, N.K., Bahnson, P.R., Glen, R., Maille, C.J., Smith, K., White, H. (2008). When "Aha Moments" Make All the Difference. *Journal of Management Inquiry*, 18(1): 64-76.

Newell, S., David, G., Chand, D (2007) An Analysis of Trust Among Globally Distributed Work Teams in an Organizational Setting. *Knowledge and Process Management*, 14(3): 158-168.

Newell, S., Robertson, M., Scarbrough, H., and Swan, J. (2002). *Managing Knowledge Work*, London, Palgrave.

Nonaka, Ikujiro (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science*, 5(1): 14-37.

Nonaka, I., Peltokorpi, V. (2006). Objectivity and Subjectivity in Knowledge Management: A Review of 20 Top Articles. *Knowledge and Process Management,* 13(2): 73-82.

Nonaka, I., Takeuchi, H. (1995). *The knowledge creating company: how Japanese companies create the dynamics of innovation*. New York: Oxford University Press.

Nonaka, I., Toyama, R., Konno, N. (2000). SECI, Ba and Leadership: A Unified Model of Dynamic Knowledge Creation. Long Range Planning, 33(1): 5-34.

Nonaka, I., von Krogh, G., Voelpel, S. (2006). Organizational Knowledge Creation Theory: Evolutionary Paths and Future Advances. *Organization Studies,* 27: 1179–1208.

Offshore Wind Accelerator Newsletter, September 2012. Issue 6 (available upon request)

Offshore Wind Accelerator Newsletter, March 2013. Issue 7 (available upon request)

Ortony A. (1993). *Metaphor and Thought, 2nd edition*. Cambridge University Press: Cambridge.

Osborn, R.N. Hagedoorn, J. (1997). The institutionalization and Evolutionary Dynamics of Interorganizational Alliances and Networks. *Academy of Management Journal*, 40(2): 261-278.

Parkhe, Arvind (1993), Strategic Alliance Structuring: A Game Theoretic and Transaction Cost Examination of Interfirm Cooperation. *Academy of Management Journal*, 36(4): 794-829.

Peters, T.J., Waterman, R.H. (1982). *In Search of Excellence: Lessons from American's Best-Run Companies*. Harper & Row, New York.

Polanyi, M. (1958). *Personal Knowledge.* The University of Chicago Press, Chicago.

Polanyi, M. (1966). *The Tacit Dimension.* Routledge & Kegan Paul, London.

Polanyi, M. (1975). "Personal Knowledge." Polanyi, M., Prosch, H. (eds.), *Meaning*. University of Chicago Press, Chicago.

Politis, J. (2003). The connection between trust and knowledge management: what are its implications for team

performance? *Journal of Knowledge Management,* 7(5): 55–67.

Powell, W.W., Koput, K.W., Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology. *Administrative Science Quarterly,* 41(1): 116–145.

Provan, K., Fish, A., Sydow, J. (2007). Interorganizational Networks at the Network Level: A Review of the Empirical Literature on Whole Networks. *Journal of Management,* 33: 479-616.

Rawls, A.W., David, G.C. (2005). Accountably Other: Trust, Reciprocity and Exclusion in a Context of Situated Practice. *Human Studies*, 28(4): 469–497.

Reychav, I., Weisberg, J. (2009). Good for Workers, Good for Companies: How Knowledge Sharing benefits Individual Employees. *Knowledge and Process Management*, 16(4): 186-197.

Ribeiro, R., Collins, H. (2007). The Bread-Making Machine: Tacit Knowledge and Two Types of Action. *Organization Studies,* 28(9): 1417–1433.

Rochlin, Gene I. (1989). Informal Organizational Networking as a Crisis-Avoidance Strategy: U.S. Naval Flight Operations as a Case Study. *Organization and Environment*, 3(2): 159-176.

Rommel, G., Kluge, J., Kempis, R., Diederichs, R., Bruck, F. (1995). *Simplicity Wins: How Germany's Mid-Sized Industrial Companies Succeed*. Harvard Business School Press, Boston.

Rousseau, D., Sitkin, S., Burt, R., Camerer, C. (1998). Not So Different After All: A Cross-Discipline View of Trust. Academy of Management Review, 23(3): 393-404.

Sackmann, Sonja A. (1992). Culture and Subcultures: An Analysis of Organizational Knowledge. Administrative Science Quarterly, 37(1): 140-161.

Sackmann, S., Phillips, M. (2004). Contextual Influences on Culture Research: Shifting Assumptions for New Workplace Realities. *International Journal of Cross Cultural Management*, 4(3): 370-390.

Sawyer, R. K. (2007). *Group Genius*. Basic Books, New York.

Senge, Peter M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*, Century Business, London.

Schein, E. (1985). *Organizational Culture and Leadership.* Jossey-Bass, San Francisco.

Shotter, John (2006). "Dialogue, Depth, and Life Inside Responsive Orders: From External Observation to Participatory Understanding." Goranzon, B., Hammaren, M., Ennals, R. (eds.) *Dialogue, Skill & Tacit Knowledge*, John Wiley and Sons Ltd., West Sussex.

Sommer, Robert (2009). Dissemination in Action Research, *Action Research*, 7(2): 227-236.

Stacey, R., Griffin, D. (2005) "Introduction: Researching Organizations from a Complexity Perspective." *A Complexity Perspective on Researching Organizations*. Stacey, R., Griffin, D. (eds.) Routledge, London.

Sykes, Benj (2010). Carbon Trust; Innovation Programme - *Energy* www.energyresearch.uhi.ac.uk/CarbonTrust_supporting_innovation.pdf (accessed on: Sept. 16, 2013)

Sørensen, J.B. (2002). The Strength of Corporate Culture and the Reliability of Firm Performance. *Administrative Science Quarterly*, 47(1): 70-91.

Tapscott, D., Ticoll, D. (2003). *The Naked Corporation: How the Age of Transparency Will Revolutionize Business*. Free Press, New York.

Taylor, C. (2002). Understanding the Other: A Gadamerian View on Conceptual Schemes. J. Malpas, U. Arnswald, J. Kertscher, (eds.) *Gadamer's Century: Essays in Honor of Hans-Georg Gadamer*. The MIT Press, Cambridge, MA, 279–298.

Thagard, P. (1997). Coherent and creative conceptual combinations. Ward, T. N., Smith, S. M., Vaid, J. (eds.) *Creative Thought*. American Psychological Association, Washington, DC: 129–141.

Thietart, R.A., Forgues, B. (1995). Chaos Theory and Organization. *Organization Science*, 6(1): 19-31.

Todeva, Emanuela (2006). *Business Networks: Strategy and Structure*. Routledge, New York.

Tsoukas, Haridimos (1996). The firm as a distributed knowledge system: A constructionist approach. *Strategic Management Journal.* 17 (Winter Special Issue): 11-25.

Tsoukas, H., Chia, R. (2002). On organizational becoming: Rethinking organizational change. *Organization Science,* 13(5): 567–582.

Tsoukas, H. and Vladimirou, E. (2001). What is Organizational Knowledge? *Journal of Management Studies,* 38(7): 973-993.

Tsoukas, Haridimos (2009). A Dialogical Approach to the Creation of New Knowledge in Organizations. Organization Science, 20(6): 941-957.

Ulhøi, John (2004). Open Source Development: A Hybrid in Innovation and Management Theory. *Management Decision*, 42(9): 1095-1114.

United Nations Global Compact, "Seal the Deal! – CEO Statements" (2010). http://www.unglobalcompact.org/Issues/Environment/Seal_the_Deal_Statements.html (accessed on: Oct. 14, 2013)

von Foerster, H. (1991). Through the Eyes of the Other. F. Steier, ed. *Research and Reflexivity*. Sage, London, 63–75.

von Krogh, Georg (1998). Care in Knowledge Creation. *California Management Review*, 40(3): 133-153.

von Krogh, G., Ichijo, K., Nonaka, I. (2000). *Enabling Knowledge Creation*. Oxford University Press, New York.

Watzlawick, P., Bavelas, J.B.B., Jackson, D.D. (1967). *Pragmatics of Human Communication*. W. W. Norton, New York.

Weick, Karl E. (1995). *Sensemaking in Organizations*. Sage Publications, Thousand Oaks.

Weick, K.E., Sutcliffe, K.M. (2007). *Managing the Unexpected: Resilient Performance in an Age of Uncertainty*. John Wiley & Sons, Inc., San Francisco.

Wenger, Etienne (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press, Cambridge.

Wenger, Etienne (2003). "Communities of Practice and Social Learning Systems." Nicolini, D., Gherardi, S. and Yanow, D. (eds.) *Knowing in Organizations: A Practice-Based Approach*, M.E. Sharpe, Inc. New York.

Wiig, Karl (2004). *People-Focused Knowledge Management: How Effective Decision Making Leads to Corporate Success*. Elsevier Butterworth-Heinemann, Oxford.

Wisniewski, E. J. (1997). Conceptual combination: Possibilities and Esthetics. Ward, T. N., Smith, S. M., Vaid, J. (eds.) *Creative Thought*. American Psychological Association, Washington, DC: 51–82.

Zaccaro, S. J., Lowe, C. A. (1988). Cohesiveness and Performance on an Additive Task: Evidence for Multidimensionality. *Journal of Social Psychology*, 128: 547-558.

Zaccaro, S. J., McCoy, M. C. (1988). The Effects of Task and Interpersonal Cohesiveness on Performance of a Disjunctive Group Task. *Journal of Applied Social Psychology*, 18: 837-851.

Zachary, G. P. (2003). *The Diversity Advantage: Multicultural Identity in the New World Economy*. Westview Press, Boulder.

Zaheer, A., McEvily, B., Perrone, V. (1998) Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance. *Organization Science*, 9(2): 141-159.

The contributions of this PhD dissertation are three-fold. Theoretically, this dissertation provides a reconceptualization of *knowledge*. As a consequence, 'knowledge' repositories and all other means of facilitating knowledge are re-classified as '*knowledge conduits*.' The purpose of this new terminology is to give scholars and practitioners a means to avoid the common trappings of considering knowledge as a thing outside of human understanding, a pitfall that has often led to simplifying organizational and management processes and overlooking the most important, tacit, dimension that is part of all knowledge.

Secondly, a new framework is presented, classifying knowledge management *drivers*, *obstacles* and *critical success factors*. Using this framework to examine the management of knowledge processes adds specificity and meaning to knowledge management theory and practice, as well providing the means to answer the following research questions:

Which drivers, obstacles and critical success factors exist for managing knowledge processes in the context of organizations involved in offshore wind energy innovation?

- **To what degree can synergies be formed for the development of the organizations' knowledge resources?**
- **How can dynamic capabilities be harnessed, providing both super-flexibility and focus?**

The last contribution of this dissertation is to provide practical guidelines for enhancing knowledge management processes within the Carbon Trust Off-shore Wind Accelerator program, toward the end of helping involved actors to better achieve their common objectives and goals. In line with this last contribution, this case study also contributes to research on the subject of *actor-oriented* innovation collaborations, which is a new organizational form emerging as a response to the increasing global demands of the twenty-first century.

BREAKING NEW GROUND

AALBORG UNIVERSITY