

USING THE AQAL FRAMEWORK TO ACCELERATE RESPONSES TO CLIMATE CHANGE

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ABSTRACT This article provides an overview of research that supports the use of the AQAL framework to help accelerate responses to climate change. After reviewing the challenge of climate change to demonstrate how an Integral approach can help, we discuss relevant theories that are highlighted by this lens. We go on to demonstrate how a simple analytical tool derived from the AQAL model provides vital insights on how to accelerate climate response and conclude with illustrations from a research project on low carbon technologies.

KEY WORDS: AQAL framework; barriers; climate change; lock-in; mitigation

Any response to climate change takes place in a context that offers constraints and enablers (i.e., issues that lie outside the direct scope of the project or activity in question but which have a significant effect on its outcome). Being willing and able to understand, notice, and address these contextual factors is crucial to the success of climate change responses.

Complementarities theory (Pettigrew et al., 2004) has demonstrated that a set of contextual factors needs to be addressed in major change. At any time, one factor can lag the others; at such times attention to that particular factor pays dividends and radically improves the results of actions in other areas. Indeed, without action on the lagging factor, progression may be impossible and unfocused attempts to change may actually make things worse (because an internally consistent—if unsatisfactory—system is broken up). Consistent with this, the technological dimension of climate responses is often overemphasized at the expense of personal, social, and political issues such as governmental and intergovernmental policy, investment cycles, infrastructure, social attitudes and habits, and personal mindsets. Given the will and the resources, Western society has demonstrated that it is usually well able to address technological challenges. The challenges often lie rather in understanding and managing the complex interaction of technological, individual, social, and political contextual factors *together*.

The State of the World Forum has called for a 10-year plan to de-carbonize our society, a plan for which Ken Wilber's (2000a) all quadrants, all levels (AQAL) framework has been proposed as the "operating system." In this article, we explore why and how it can be particularly helpful.

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The Challenge Of Responding To Climate Change

Polar ice records show that we are already in climatic conditions that our species has not previously experienced (Alley, 2000). However, the effects have only just begun to work their way through the climate system to impact human society and they will not be reversed quickly: raised concentrations of carbon dioxide and other greenhouse gases will not return to normal levels quickly. This means that temperatures will continue to rise for decades even if emissions were to be cut sharply and very quickly (Sterman & Booth Sweeney, 2002). A number of surveys show that the effect on economies, society, and ecosystems could be very great (IPCC, 2007; Llewellyn, 2006).

Beyond a rise in temperature, often said to be around 2°C, but in practice unknown, significant feedback effects become possible (e.g., the burning of the Amazon rainforests, the release of methane from tundra), releasing further carbon into the atmosphere. Getting to such a point is not something that our species would find at all tolerable. Many scientists believe that we might already be committed to temperature rises of 2°C or more (Anderson & Bows, 2008).¹ This climate momentum and the extent of likely change is why experts such as previous U.K. Government Chief Scientific Advisor Sir David King stress the critical importance of our working simultaneously on both the adaptation agenda (preparing human society and ecosystems to respond to a significantly changing climate) and the mitigation agenda (e.g., radically and rapidly reducing use of fossil fuels, halting and reversing deforestation).²

“Lock-In” and Climate Responses

Since adaptation, while essential, cannot be adequate in the longer run, and since the risks are so significant, the great urgency of mitigation is increasingly being recognized. However, it is not only a matter of choosing radically to mitigate, but of figuring out how we might actually do it. This will not simply be a matter of flipping a switch as we leave the room, or even of removing high carbon technology, fitting its low carbon replacement, and carrying on as before. The complexity of the human/climate interface approaches that of the climate system itself. In particular, any realistic plan for mitigation needs to recognize and to address the critical issue of socio-technical “lock-in” to our high carbon ways of living (Unruh, 2000).

According to Unruh (2000), lock-in occurs whenever aspects of a techno-industrial complex (TIC) begin to co-evolve, setting up positive feedback between technological infrastructures and the institutions that create, diffuse, and deploy them. Locked-in TICs are extremely difficult to dislodge and alternative technologies (i.e., those that offer significant carbon-efficiency benefits) may be “locked-out.” For example, our high carbon transportation systems have become locked-in, insofar as society has co-evolved with the car and the airplane to make cities more dispersed, to make businesses national and transnational in scale, to disperse families, to undermine the profitability of stores within walking distance, to remove sidewalks, to provide a gasoline distribution infrastructure (but none for batteries or hydrogen), to provide many university degrees in petroleum engineering, to make it increasingly socially acceptable to cross the Atlantic Ocean to go shopping, and so on.

At a more down-to-earth level, a form of lock-in happens whenever a decision is taken that is difficult to reverse and that affects responses over extended timescales. At a basic level, a typical hospital or school is built with an expected life span of 50 or more years, an average house might be expected to last for a century

or more, a pattern of streets (whose orientation is critical to the viability of photovoltaic technologies) may last for several centuries. For a short period at the beginning of a project, change to a lower carbon or better adapted trajectory is often potentially both significant and affordable. However, it is usually both very costly and a waste of usable energy to reverse such decisions. Once lock-in to poor designs has taken place, the effectiveness of other measures (e.g., of green fiscal measures such as carbon pricing or of awareness-raising measures) is greatly reduced because change in response to those measures becomes much less feasible.

A useful framework for thinking about lock-in is provided by the “Transition Framework.” This has been developed in particular by scholars and practitioners in the Netherlands and is well articulated in Frank Geels’ “multi-level perspective” (see Geels & Schot, 2007). The Transition Framework has been explored in the context of climate change by several authors (e.g., Timothy Foxon, 2003).³ The framework shows how—in many industries—a “socio-technical regime” has become established in which standards, training, economic incentives, laws, and even mindsets and cognitive shortcuts have adapted to favor the status quo and to block alternatives. The term *regime* is very similar to what is sometimes known as “the system.” In this model, pressure for change may arise from the broader “landscape” (i.e., forces that transcend regimes and which include worldviews, technological and social pressures, even the climate itself, and also from “niche experiments,” where special circumstances favor disruptive innovation for a while). Regimes, however, are typically very resistant to change once established.

Key hidden assumptions behind most regimes are that energy is cheap and easily available and that our weather changes within a broadly stable climate. This means that regime actors do not make use of the opportunities for change—indeed, this helps explain why they are so often missed. It also means that many regimes may need to be modified or changed altogether.

Undoing lock-in cannot be left to chance, because the locked-in factors include not just technology, but the wider network of institutions and actors who have optimized their operations around the status quo and who therefore typically resist change. It is important to understand that the structure of markets is itself part of the locked-in system, so “market signals” will tend to sustain rather than challenge the regime. Thus, change must at least in part be an intentional act.

Using Constraints to Action to Understand the Regime

If we need to intervene at the level of regimes, how, practically, do we come to identify and learn about a particular regime? One of Kurt Lewin’s many insights was that if we truly want to understand something, we should try to change it (Schein, 1995). And so it is with the regimes that hold high levels of carbon use in place. When we do not threaten a “locked-in” regime, change is relatively straightforward: institutions and social practices—our ways of thinking themselves—have evolved to work reasonably well within the regime’s bounds. As an illustration, think of a manager who installs a standard cooking oven in a food factory. There are plenty of ovens to choose from; there are engineers trained to install and to service the oven; the layout of the factory allows the new equipment to fit in easily; the workforce understands how to use it. Senior managers do not perceive an excessive risk, and therefore do not question the manager’s judgment. In other words, “lock-in” is often quite pervasive and can be easy to miss.

Try installing trigeneration, however, and the regime springs into life in the form of constraints.⁴ There are few examples of successful use. Optimization challenges remain; there are few courses to train engineers or users; existing suppliers of cooking equipment tend not to favor it because it may threaten their core business; the layout of factories (where cooking and chilling are typically located far apart) does not support it, and so on. Senior managements' and banks' attitudes in relation to risk come into play, and the willingness of individual managers to weigh the challenges of the project against a bigger payoff for their company, industry, or society becomes crucial.

If we do not come up against such constraints, that is a sure sign that efforts are being confined to “within regime” change. The discussion of lock-in above shows that this will certainly be insufficient to avert runaway climate change, to put in place a low carbon, energy secure economy, or perhaps even to prepare for climate impacts. This means that when one identifies constraints to change, it will often be necessary to go on to remove them, whether by changing legislation, by building coalitions for change, by changing the purchasing behavior of a government body or other significant regime actor, and so on. Although any single intervention is unlikely to be enough in itself, each can be seen as a step towards building the future regimes that will successfully respond to climate change.

The Relevance of the AQAL Framework

We define contextual issues as being those that lie outside the direct scope of the project or activity in question but which have a significant effect (typically a constraining effect) on its likelihood of achieving its purpose. Contextual constraints are, therefore, always defined in a relative and not an absolute way. Whenever we learn about a constraint and set up a project to address it, new contextual constraints are likely to emerge. Looking to context is generally an attitude of mind, a willingness not to be put off by what one learns, but rather to do what one can to deal with it, whether directly or indirectly, as one refers constraints that one cannot deal with to a colleague or elsewhere in the system.

Therefore, we argue for an overall action-oriented approach to climate responses that has bold goals and that recognizes learning about constraints as one of the fruits of action, since this allows later focused action to remove them. In order to do this, however, we need a framework to make sense of constraints, which reminds us to look for them in places where we might not always expect to find them. Geels' work (Geels & Schot, 2007) reminds us that these constraints are not only technological, legal, economic, political, or skill deficits. They are also social and at the level of our core assumptions. It is the complexity of constraints that has led us in recent years to appreciate the value of Wilber's AQAL model and to use it in practice (Ballard, 2005; Reason et al., 2009).

A Brief Overview of the AQAL Model

The AQAL framework was developed by Ken Wilber, who found that he could usefully simplify phenomena to three dimensions:

- *Individual/collective.* In Integral Theory, a *holon* (see Koestler, 1967, p. 48) refers to a part that is simultaneously part of another whole (Rentschler, 2006). Reality is made up of holons, which are both complete in themselves and are

parts of larger holons, as a word is both complete in itself and also part of a sentence. So, holons exist as individuals and as part of collectives.

- *Subjective/objective.* Each holon has an observable dimension and an inner experience that cannot be directly observed. *Hamlet* can be observed as a script that weighs a few hundred grams, including a few grams of ink. However, the subjective experience of a person interpreting those ink marks—while real enough—cannot be observed in the same way.

These yields a 2 x 2 matrix. Wilber asserts that the quadrants cannot be reduced to one another.⁵ However, this is not enough, since a third dimension also matters:

- *Greater development/lesser development.* Since every holon is both whole in itself and part of holons at a different level, this implies a developmental aspect to reality. Each level of reality depends on and transcends those below it.

In the remainder of this article, we show how we have used (and respectfully somewhat modified) the AQAL framework to help make sense of climate responses.

As will become apparent, we have emphasized the 2 x 2 aspect of the AQAL model more than other aspects of Integral Theory. This is primarily because we have been working across the interior/exterior divide that is so prevalent in our society. As Wilber demonstrates, and our experience supports, this is already extremely unusual. In working at the boundary between organizations, science, and policy, we felt it challenging enough to work explicitly with this simplified structure at this stage. Even to stress the developmental dimension, let alone other features such as lines of development, states of consciousness, and types (e.g., how personality plays out at each level), seemed to be a step too far. However, the developmental dimension in particular is also crucial and it would be entirely wrong to assume that we do not recognize or value it. For instance, Geels

<p>Individual Subjective Factors</p> <p>Limiting personal values, worldview, assumptions, etc.</p> <p style="text-align: center;">I</p>	<p>Individual Objective Factors</p> <p>Limitations of one’s role, skills, knowledge, relationship set, etc.</p> <p style="text-align: center;">IT</p>
<p style="text-align: center;">WE</p> <p>Group cultures, shared norms, etc.</p> <p>Collective Subjective Factors</p>	<p>ITS</p> <p>Political, economic, social, technological, legal, environmental</p> <p>Collective Objective Factors</p>

Figure 1. Contextual barriers to change. Adapted from Wilber (2000b).

and Schot (2007) describe a clear hierarchy from individual actor (whether a firm or an individual) through regime “niche” to the socio-technical regime itself and on to the wider “landscape.” So, we have paid careful attention to this dimension without necessarily always making it explicit in our work (Fig. 1).

We use the word *individual* here to mean the particular person whose actions might be open to change. We also acknowledge that the word *objective* is shorthand for what can be measured or observed through agreed-upon procedures when there are disagreements. By *subjective* we mean the inner thoughts and structures that cannot as easily be directly observed by others. We are fully aware of the epistemological minefield behind these words, but think that for our intentions their meaning is clear enough. Change efforts continually come up against such “hard” and “soft” constraints in the micro-processes that affect decision-making in organizations, communities or other groups, and they are often interlinked.

Exploring the Four Quadrants

We now summarize some of the more important factors that we have noticed at work in the four quadrants. These might be seen as expressions of the different developmental “streams” or “lines” within the various quadrants (Wilber, 2000b).

Upper-Left Quadrant: Individual Subjective Factors

I was not only passionate, I was obsessed. When I first started out, it was with a very clear sorrow in my heart, and fear for the destruction of the environment.

– *Karl-Henrik Robèrt*, founder of the Natural Step⁶

The Upper-Left (UL) quadrant explores the inner world of individuals who might act in response to climate change, particularly the potential change agent himself. How they see the world and their role within it, their values and their emotions, all affect how they view particular situations and how they frame their own potential responses. We see the following seven elements as particularly important:

1. *Climate awareness.* Awareness is not an on/off switch but something that develops over time, both cognitively and emotionally, as people learn more about the causes, impacts, scale, and urgency of climate change. By “awareness,” we do not mean detailed scientific knowledge (e.g., of feedback loops and of climate systems delays); while undoubtedly helpful, we place such knowledge elsewhere in the matrix. We mean awareness of how climate change will affect what a person cares about, now and into the future. At a low developmental level, this awareness might be limited to the perception that costs might rise and that money might be saved. At a more advanced level, awareness can be extremely painful as the implications for our children, our society, our planet—what we most care about—become ever more clear.
2. *Denial and emotions.* Climate change threatens such destruction that many people cannot face thinking about it and live in a state of denial (Macy & Brown, 1998). On the other hand, strong emotions can have an empowering and moti-

vating impact. Our capacity to recognize and face the emotional work involved in coming to terms with an issue like climate change is therefore crucial to our responses.

3. *Perceptions of “agency.”* Much research shows that without a sense of “agency” (i.e., that we can act in a meaningful way in response to information received about climate change), most people will resist increasing their awareness (see, for example, Macnaghten et al., 1995). It is clear that many people feel powerless when it comes to responding to serious environmental issues in a personally meaningful way. Such feelings lead many people to suppress their awareness of the problems on a day-to-day basis. In contrast, people actively working for low carbon solutions often create a sense of agency for themselves by identifying and creating opportunities for meaningful action. The word *meaningful* clearly has a developmental “edge”: qualifying for a potential contract by adopting a compliant climate policy is a lower form of agency than taking the opportunity to design a new school or hospital so that it will fulfil its primary purpose in a climate-impacted and energy-constrained future.
4. *Capacity to face issues that take place on a global scale over long periods of time.* With climate change, mitigation actions taken today, or not taken, will take years to bear fruit. We have found that Dutch spatial planners routinely consider potential climatic changes for several centuries into the future when making decisions (Ballard & Alexander, 2008). Climate mitigation actions need to transcend human boundaries. A ton of carbon dioxide emitted in Texas is indistinguishable in its effect on the climate from one emitted in Beijing—and vice versa. The loss of a single species has to be considered in a much wider context: it is the effect on the ecosystem that is at least as important as the species itself. It is imperative that those who seek to lead action are able to relate to the longer-term future (decades, centuries, and more) and to place events in a wider context.
5. *Ability to conceptualize and hold a higher purpose or creative vision.* Those who lead our responses to climate change need the capacity to develop and hold a vision of human possibilities that reaches beyond the everyday of their dominant regime. They need to regard the present situation with an unflinching truth, while also developing a vision of creative possibilities, which they hold to in the face of challenges and difficulties. Creativity follows from holding that tension and bringing creative novelty into the world (Fritz, 1989). In contrast, progress is easily blocked if the vision collapses and the challenges are met by an inadequate response or if the current reality is represented uncritically. This can result in a “business as usual” mentality, which does not move us forward in the climate challenge.
6. *Level of personal development.* We suggest that these personal subjective factors demonstrate that advanced personal development into second tier (i.e., post-formal level) is crucial for those leading climate responses (whether directly or through trusted advisers) (Beck & Cowan, 2005).⁷ Wilber himself makes this

point strongly (Wilber, 2000a). We would largely agree that second-tier consciousness is extremely helpful for change leadership, although we have seen enough examples of helpful action by people below that level to be clear that the whole spectrum has its place in our responses. In addition, we have seen people whom we know to be at very high developmental levels who do not seem to act in a way even indirectly helpful to the agenda. A high level of personal development is therefore extremely helpful but not sufficient in and of itself.

7. *Capacity to engage across the spectrum of development.* The number of people in the second tier of development is relatively low—perhaps 5% or fewer of the managerial population (Cook-Greuter, 1999). The arguments above demonstrate that it is clearly essential for those leading action to have access to such levels of consciousness. However, many other people will feel called to participate and their energy and skills will often be of great value. Playing their part may also be part of their own developmental journey and that of our species at this crucial time in history. It is therefore essential that leaders are able to “translate” from their own level to that of the group or individual they are working with. To be able to do this is, of course, itself a sign of advanced levels of personal development to the second tier and beyond.

Upper-Right Quadrant: Individual Objective Factors

In addition to the subjective world of the individual, there are also those aspects of individuality that are measurable—the world of the Upper-Right (UR) quadrant. Wilber’s writings on this quadrant often emphasize the functioning of the brain, where development is clearly highly relevant. He also identifies observable differences in behavior (where tactical behaviors are more common than the strategic behaviors that are enabled by a worldcentric consciousness). Besides these, we have identified several other clear and measurable issues that are relevant to each individual’s work on climate change that can usefully be included in this quadrant. We outline some of these below.

1. *Demographic factors.* First, we need to recognize that there is no overwhelming link between socio-demographic factors such as age, education, social class, or gender and a person’s environmental behavior (Olli & Grendstadt, 2001). However, such issues might be expected to have an impact on the field of action. As European, white, middle-class, middle-aged and highly educated individuals ourselves, we are only too aware of the advantages that we have been given that many others have not experienced.
2. *Knowledge of climate change issues.* No single person can have a complete understanding of climate science, nor of the intricate interdependencies that hold a socio-technical regime in place. However, effective action depends on having access to adequate understanding of the significance of carbon in climate change and of system qualities that hold the current regime in place (lock-in, potential delays, runaway feedback, etc.). This measurable knowledge can be distinguished from awareness, as described above.

3. *Technical and interpersonal skills.* Measurable technical competence is obviously needed to be effective in certain climate change roles. In addition, we have found that effective actors in this field appear to have significant political and interpersonal competencies, although they are not always aware that they do, nor have the language to describe them. They are able to operate outside assumed boundaries and have the resources, contacts, and skills to do so. Not only can they identify windows of opportunity, but they are then able to make things happen by working with both formal and informal organizational systems (Reason et al., 2009).

Lower-Left Quadrant: Collective Subjective Factors

How discussions of climate change are framed in a society, community, or organization—and the capacity of that grouping to generate and support creative and original action—is a facet of the Lower-Left (LL) quadrant. There is some important research in this quadrant, outlined below:

1. *The importance of groups in change.* There is a great deal of evidence that membership in a pro-environmental group is a very strong determining factor for many people in adopting pro-environmental behavior at the personal level. For instance, a large Norwegian study provides compelling evidence (Olli et al., 2001). Conversely, of course, the absence of such a group is a serious barrier to change, and the processes of any particular group may not necessarily be strong at converting individual behavior to effective collective action.
2. *Shared mindsets.* Renewable energy expert Hermann Scheer (2007) writes of mental hurdles that pervade discussion and cannot withstand closer scrutiny. They are based on fundamental assumptions that are regarded as established facts and, therefore, require no additional justification. These questionable assumptions are shared by society's functional elites, who practically close ranks around them; they are taken for granted as if they were predetermined, rock-solid facts (Scheer, 2007). The discussion on "lock-in" and on the multi-level perspective on change above supports this. For instance, we would argue that most socio-technical regimes are predicated on assumptions that may once have been useful but which are now clearly significant barriers to change towards a climate-responsive society (e.g., of the continuing availability of abundant and cheap energy, the strategic irrelevance of carbon, or on a climate that is broadly stable and beneficent). Insofar as this is the case, it is clearly necessary for some individual practitioners to develop the requisite skill to be able to help people identify their own assumptions and test alternatives.
3. *Cultural theory.* This sociological approach describes the socially constructed world of different "solidarities" (Thompson et al., 1990). Three are active: the "Hierarchist" (typically found in bureaucracies), the "Egalitarian" (found in social movements), and the "Individualist" (typical of entrepreneurial business organizations). There is also the "Fatalist," which is excluded from influence and

social connections, and inactive. Through an integral lens, these four might be seen as social types, capable of different interpretation at different levels of development (Wilber, 2000a).⁸ These cultural groupings respond to similar information in very different and mutually incomprehensible ways. It is claimed that the differences can never be resolved and that policymakers need to accept that “muddling through” based on diverse approaches is the best that can be hoped for. This approach has been used in climate policy formulation (Rotmans & De Vries, 1997). The change agent needs to recognize the solidarity within which s/he is working so as to navigate within its rules and to make connections with other solidarities where necessary.

4. *Social constructions of environmental risk.* Cultural theorists argue that there are several fundamentally different approaches to risk that can be mapped directly onto the cultural “solidarities.” It is clear that there are different approaches to risk which are social constructs and which need to be understood in framing actions (Holling, 1986). However, the evidence for their close correlation with the solidarities of cultural theory seems to be weak (e.g., Sjöberg, 1996).
5. *Organizational culture.* There is much managerial research on this topic, often based upon the work of E.H. Schein (2004). Cultures are seen as reinforcing patterns of behavior, superordinate goals, emotions, and assumptions or mindsets that are held in place by symbols marking the boundary between domains of meaning. The solidarities of cultural theory (see point 3, above) might be seen as meta-examples of this. It seems evident that an organizational culture with a mindset that is relatively rigid and closed, and caught up in its own assumptions, is less likely to be able to respond creatively to the challenges of climate change. Such organizations may experience themselves as relatively powerless within their supply chain, for example. In contrast, organizations that see the challenges of climate change as key contextual issues to which they can respond strategically are more able to be active and creative regarding climate change challenges. Again, it is up to the change agent to read what cultures can handle and to frame interventions accordingly.
6. *Organizational developmental stage.* Organizational responses to the climate agenda can clearly be differentiated in terms of their developmental level. The multi-level perspective (Geels and Schot, 2007) helps to structure this: an organization that ignores regime pressures such as regulations and customer preferences is clearly working at a lower developmental level than an organization that is optimizing its own response within a regime. Such an optimizing organization is itself working at a lower level than another that is working to reconfigure a regime and so needs to work across a whole set of organizations. Recent work on capacity development for climate decision making has integrated Geels’ work with stage models such as those of Dexter Dunphy and colleagues (2003) and other theory and research to develop PACT (Performance Acceleration for Climate Tool), a matrix framework that has been empirically tested across a wide

number of organizations, showing its relevance in assessing capacity and planning interventions (Ballard, 2007; Ballard & Alexander, 2008).

Lower-Right Quadrant: Collective Objective Factors

The Lower-Right (LR) quadrant includes the PESTLE (political, economic, social, technical, legal, and environmental) factors that condition the objective opportunities for low carbon change. Although Integral Theory appropriately focuses on all four quadrants, and while all four are vital for change, theories of lock-in do underline just how important it is for leaders to understand some of the forces at play in this quadrant if skilful action is to follow. These include:

1. *Technological possibilities.* There is often a limit to the improvements that are possible by improving a given technology. For instance, coal-powered generation has a thermal efficiency of under 40%, and this limit is biophysical—it cannot be overcome by trying harder. More disruptive types of innovation are required (e.g., combined heat and power (CHP), with waste thermal energy being used in district heating schemes), but these typically require reconfiguration of systems at a level beyond the individual organization.
2. *Infrastructure and its replacement.* Such new technological possibilities take place within an investment cycle, and the economics are typically best when older capital assets are due for replacement. The replacement process is closely connected to the way technological choices are locked in to socio-technical regimes. If the replacement opportunity coincides with the emergence of a new low carbon technology, a low carbon trajectory is more possible and likely.
3. *Economic barriers to change.* In a “locked-in” socio-technical regime, the economic barriers to innovation at the level of the firm become increasingly great (Unruh, 2000). Since regime players have co-evolved better to serve each others’ needs, significant change by one of the players is typically counter to the interests of other players, who might, for instance, need to retire plants and processes that they regard as pragmatically fit for purpose, even exemplary. In such cases, there is a danger that patents will be acquired and retired, that the scope of joint projects will be collapsed, or that other disruptive activities will take place.
4. *System delays.* Quite apart from the delay inherent in the cycle of capital replacement, there are always delays built into the decision process. For instance, decisions may go on hold in the years prior to an election. For many reasons, delays in market and technology responses can be much longer than economic theories or mental models expect (Meadows et al., 2004). It takes time for people in communities and organizations to move ideas into action—to learn, build, try out, and put new processes into practice.
5. *Legal and regulatory issues.* Laws and regulations lock thinking into a particular historical moment and clearly constrain or enable behavioral responses.

6. *The limited availability of energy and capital.* Systems analyses of the limits to growth (Meadows et al., 2004) suggest that as environmental challenges accumulate, we need to divert scarce resources to deal with stresses. Over time, the energy and capital required to make the transition to a lower carbon society are no longer available, or may only be available for a limited time. Similarly at an organizational level, the challenges of developing low carbon strategies require managerial and technical attention as well as financial capital, which will be more available in successful companies.

Using the Four-Quadrant Matrix in a Research Project

With colleagues from the University of Bath in the United Kingdom, and other leading research universities, and with funding from the United Kingdom's research councils, we have recently completed a significant research project that looked at how low carbon innovation can be accelerated. Using a "learning history" approach (Bradbury, 1998), we worked with managers from industry and local government who had been working for low carbon breakthroughs. During the project, we used the four-quadrant matrix presented above as an overall orientation to the research. For example, we used it as a way of gathering evidence for the "learning histories" we constructed of the various projects. We also used this as part of our intervention strategy in some of the projects. At various stages of the project, and in other settings, we and our colleagues have used it in conferences to help people think through their own situations.

In this article, we examine one example: MAS Intimates, a low carbon lingerie factory in Thurulie, Sri Lanka. This is a clear example of change in a particularly transformative project. In this case, we used the framework more as a way of conceptualizing changes that we observed than as a way of intervening ourselves. However, examples of more active use are presented in the project report (Reason et al., 2009).

MAS Intimates, Thurulie, Sri Lanka

In 2007, leading U.K. retailer Marks and Spencer launched Plan A, its five-year "eco-plan," containing 100 action points. One of the actions was to invite selected suppliers to create low carbon production facilities. In response to this, lingerie manufacturer MAS Intimates, a division of a large Sri Lankan apparel manufacturing company, commissioned and built a low carbon factory.

The learning history traces how the project manager and a group of colleagues became "champions" who were able to seize the opportunities of the moment in a way that enabled the project to become more innovative than it might otherwise have been. The project was clearly stepping well beyond "business as usual." First, there was a commitment to take risks together and experiment to discover what team members did not already know. The project team was sufficiently confident in their own capacity to realize that if they did not know how to do something, it was because they were taking an uncharted course. In the words of one member of the project team, it became "a wonderful experience."

The team started with an ambitious plan to create a philosophical document to underpin the design and practical decisions, outlining three principal dimensions they would try and incorporate:

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1. Respect for the context (physical, commercial, and cultural)
2. Respect for the user of the factory (particularly the predominantly female workforce who would be sewing the garments)
3. Respect for other life forms (the existing ecology into which the factory was being introduced)

They decided that they would try and build a factory that sat lightly on the land, sited beside an existing man-made lake, with minimal physical impact, and enabling the site to “return to nature” when the factory was not in use, at night and during weekends. They resolved to use traditional, low-technology approaches to managing temperature and water use, drawing on ideas that would be recognizable to many villagers in Sri Lanka. Trees would be planted all around the walls of the building to create a cool micro-climate, and the roof would overhang to provide shade. Windows would be open where possible to increase air flow and aid natural lighting. The intention was that all the operatives would be able to see out of windows to have a visual connection with their surroundings.

The measurable results were as impressive as the experience. Among many innovations, designing the building in such a way as to minimize heat accumulation, in conjunction with “evaporative cooling,” avoided the need for air conditioning, resulting in a factory that needed 40% less energy. The remaining energy requirements were generated locally from renewable sources, making the factory “carbon neutral” in a meaningful sense. In order to achieve these results, however, the project needed to constantly recognize and deal with constraints. For instance, there existed no scheme to allow customers to buy renewable energy in Sri Lanka—one had to be negotiated from scratch. These constraints were not only “objective”: the project team created an enabling culture for the construction contract that was highly unusual in that part of the world and which was necessary in order to allow creative responses to the many challenges that were recognized. In addressing such constraints, managers consciously used the moment to create an easier pathway for those who followed them. In so doing, they were aware that they had an opportunity to influence how future apparel factories would be constructed, both in Sri Lanka and in other countries.

Looking at Thurulie through a four-quadrant matrix demonstrates how a fast and transformative response becomes possible when the four quadrants come together cohesively and strongly. The enabling external factors were of great importance: a significant opportunity arose through the Marks and Spencer Plan A (LR). This was supported by the strategic ambitions and placing of the company and its history of quality initiatives (LL), and also by the requirements of the Sri Lankan national economy (LR). The individual abilities of the project manager—his capacity and willingness to take initiatives (UL), his own knowledge of the relationship between climate and business strategy (UR), and his general capacity to work across the four quadrants—were clearly important in seizing the opportunity. But his work was significantly helped by the capacities of other members of the team, who were excited by the opportunity (UL) to get involved in the project and together had the necessary skills and knowledge (UR). All this was supported and indeed amplified by the culture of MAS which encouraged risk taking, thereby enabling a high level of creative and collaborative work that was experienced by everyone involved with the project (LL). The MAS Intimates story, with fuller analysis of the quadrants and recommendations, is available as a full report (Reason et al., 2009) and online.⁹

Discussion

Accelerating Human Responses Through an AQAL Lens

Significant change for sustainability is crucial and urgent and it depends to a significant extent on timeliness. It requires seizing, creating, or adapting opportunities in the external environment, and interpreting them in a way that makes sense in the context of an organization's culture and situation. Such opportunities are often quite brief: in the case of MAS Intimates, the opportunity to respond to the call from Marks and Spencer for green manufacturing facilities was only a few weeks, and we have found the same to be true in other contexts (e.g., in major construction contracts) (Ballard, 2005). Organizations need to develop a capacity over time so they are in a position to respond to such low carbon opportunities when they arise.

Our work suggests that at certain times, a skilled change agent can identify that a set of contextual factors are coming together, or can help bring them together, to create a window of opportunity when individuals and groups are more likely to be able to act effectively for transformative change. "Agency," the capacity to take action that will make a difference, is therefore not simply a personal or a social construct, but occurs at moments, often fleeting moments, when individual and collective, subjective and objective factors come together. This means that the success of projects that seriously challenge a socio-technical regime or aim to build capacity within a niche depend strongly not only on technological competence but also on the personal capacity to spot and capitalize on opportunities in the wider context; and on the ability to foster and build relationships and networks for support. There is therefore a systemic interplay between the "hard" objective world of technology and the "soft" world of the individual actors making replacement choices. Any theory of change must embrace both aspects.

Thus change is facilitated when an individual's sense of themselves as being ready and able to take action (UL) and having relevant knowledge, skills, and capacities (UR) occurs alongside cultural impetus toward change (LL) and an opportunity in the outside world arises (LR). Such an opportunity might occur, for example, at the end of an investment cycle when an industrial plant must be replaced and/or at times of major policy revision such as might follow an election.

We have argued that changes in the external world (LR factors such as the replacement of infrastructure or the response to a customer's invitation to put forward proposals) need to be treated with great seriousness because of the risk of lock-in. Opportunities for similar change may not arise again, literally for decades. We cannot afford to make mistakes at such times: there is no point in campaigning to build a low carbon housing development just after the last brick has been put in place.

The climate crisis is so severe, and processes of lock-in are so far advanced, that it is usually a complete waste of time to work in one quadrant without looking for how it can link to the other quadrants, especially to those in the LR. We are not privileging the LR here, but rather stating that irreversibility is hugely important, that decisions of substance are typically only open for a very short period of time (often without even recognizing them), and that the effect of unskillful LR processes on the other quadrants are very much too important for UL, UR, and LL initiatives not to be targeted onto them.

As change agents, we need to accept that timing is crucially important, to be prepared to recognize and seize moments of opportunity when they arise. At a practical level, this implies looking carefully at what projects

are likely to arise in forthcoming months and years so that it is possible to take advantage of them when the time comes. It would be wrong to see this as a fatalistic endeavor, as passively waiting for change, as unduly emphasizing the LR quadrant over the other quadrants. In order to spot these opportunities, to ensure that the other quadrants are aligned (e.g., by working on the culture of projects; by ensuring that change agents with requisite skills, knowledge, sense of agency, and awareness are in place; by aligning with managerial agendas ahead of time; and by developing processes to leverage what is learned in later action), it is essential that all of the quadrants are carefully thought through in *developmental depth* as well as across their *breadth*.

We conclude that the AQAL framework provides an extremely helpful model for thinking through the context in which vital low carbon (and climate adaptation) initiatives are taken. As we learn to more skillfully employ the model, the capacity to implement initiatives will become more widely available. As this happens, future changes will potentially become easier—an exciting prospect.

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NOTES

¹ See also “World will not meet 2°C warming target, climate change experts agree,” by David Adam in *The Guardian*. Available at: <http://www.guardian.co.uk/environment/2009/apr/14/global-warming-target-2c>.

² For example, at a Royal Society Discussion held on November 22, 2005: *Climate Change: Technology for Mitigation and Adaptation*.

³ The first European Conference on Sustainability Transitions was held in Amsterdam in June, 2009. See <http://www.ksinetwork.nl/conference2009/>.

⁴ Trigenation uses waste heat from electricity generation to cook and then converts the remaining waste heat to provide cooling. The thermal efficiency is potentially over 90% (compared to 40% or less for electricity generation).

⁵ He does, however, bring together the objective individual and the objective collective to form a tripartite division of reality—the “Big Three”: objective, subjective, and cultural. In our work, however, we have stayed with the 2 x 2 form of the matrix.

⁶ As quoted in Bradbury (1998), p. XXX.

⁷ According to Wilber (2000b), second-tier consciousness is reached when the overall process of development is appreciated, and with it the potential value of the various levels of development along the way, thereby allowing the individual to associate himself less completely with the level of his own personal development and to engage more skillfully with others wherever they might be.

⁸ A fifth solidarity, the “Hermit,” is also proposed. Such individuals observe the interplay of the four other solidarities and realize that nothing can be done to resolve them. They are therefore inactive. This solidarity seems very similar to the “green vMeme” of developmental theory—indeed, all the solidarities can be mapped relatively easily onto the developmental spiral (Ballard & Malnick, 2006). However, cultural theory does not recognize a second wave of consciousness, in which understanding can also be linked to purposeful action. We might perhaps propose a sixth solidarity, the “Integralist,” to remedy this apparent gap.

⁹ A short video of the results can be viewed at <http://www.youtube.com/watch?v=8Y6FxKbeZVE>.

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