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International Environmental Modelling and Software Society (iEMSs)
2010 International Congress on Environmental Modelling and Software
Modelling for Environment's Sake, Fifth Biennial Meeting, Ottawa, Canada
David A. Swayne, Wanhong Yang, A. A. Voinov, A. Rizzoli, T. Filatova (Eds.)
http://www.iemss.org/iemss2010/index.php?n=Main.Proceedings

The Northern-Global Climate Change Adaptation Dialogue

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Abstract: Although climate change adaptation can occur over various political, social, and institutional scales, the majority of adaptation decisions take place at the local level where an intimate understanding of the particularities of local circumstances (i.e. successful responses to past extremes events) exist alongside a lack of formalised expertise in projecting and analyzing future possibilities. The relationship between the experts who produce counterfactual knowledge, and the individuals who apply it, is thus central to the challenge of responding to climate change successfully. I present a deliberately polarized caricature of this relationship in an attempt to facilitate knowledge exchange (i.e. to identify barriers to knowledge exchange). Through bibliometric analysis I am able to identify various traits\characteristics of the abstract knowledge associated with the climate change adaptation literature. This "knowledge" is then placed before local stakeholders in a way that highlights its apparent implications for future economic, societal and environmental impacts, as well as its limitations and uncertainties. In this context, as derived from a philosophy, history and sociology of knowledge perspective, a framework for discussion is initiated that allows localised knowledge to be recognised and valued more explicitly in the planning process. Impacts in Northern Canada will be used as a case study for such analysis.

Keywords: climate change, adaptation, reflexivity, policy, planning, counterfactuals

1. INTRODUCTION

In his popular discussion of societal collapse, Jared Diamond (2005) examines historic societies to glean lessons from those which have, or have not, adapted successfully to their environments. He considers the well-known case of Easter Island in the south Pacific, but also discusses the lesser known historical circumstances surrounding the human settlement, and abandonment of Greenland in the Arctic. In particular he compares the Norse and the Inuit cultures, and attempts to discern why the Norse did not survive in Greenland, while the Inuit did.

> "Unlike the Norse, the Inuit represented the climax of thousands of years of cultural developments by Arctic peoples learning to master Arctic conditions. So, Greenland has little wood available for building, heating, or illuminating houses during the Arctic winter darkness? That was no problem for the Inuit; they built igloos for winter housing out of snow, and they burned whale and seal blubber both for fuel and for lighting lamps. Little wood available to build boats? Again no problem for the Inuit; they stretched sealskins over frameworks to build kayaks as well as to

> make their boats called *umiaqs* big enough to take out into unprotected waters for hunting whales." (Diamond 2005)

The exceptionally rich Inuit culture represents one of the most adaptive communities in human history, given the extreme nature of their physical environment. In many ways the Inuit exist at the pinnacle of adaptive capacity, and yet they are currently considered to be one of the most environmentally vulnerable peoples in the world.

According to the Fourth Assessment report of the IPCC (2007a, b, c), climate change has dramatically affected their environment as evidenced by a contraction in snow cover area, including increases in thaw depth over most permafrost regions, and decrease in sea ice extent. The report suggests that Arctic late-summer sea ice may disappear almost entirely by the latter part of the 21st century. And though climate change will affect the entire globe, the Artic will face some of the most severe changes. All of the 'reasons of concern' identified by the IPCC will be experienced in the North (i.e. risks to unique and threatened systems; risks of extreme weather events; distribution of impacts and vulnerabilities; aggregate impacts; and risks of large-scale singularities). These changes are particularly alarming given that northern communities are also considered to have some of the lowest levels of economic and social adaptive capacity in the world.

Even more disconcerting is the underlying 'reason' for these dramatic changes. Climate change is (most likely) the result of increased green house gas concentrations in the atmosphere that are the result of industrial activities of the Western world in the 19th and 20th Centuries. These changes might be called the unwanted by-products of modernity (Beck 1992), or what economists refer to as an economic externality (Stern 2007). In other words, those who produce(d) greenhouse-gas emissions will have imposed costs upon the world and on future generations that they themselves will never have to face (Stern 2007). This is clearly unjust insofar as the peoples of the North have rarely benefited from the wealth produced by modern industrial growth. As such, the ethical dimensions of this situation are unavoidable (i.e. ethical considerations include an examination of climate change on welfare, equity and justice, freedoms and rights, and intra- and inter-generational equity (Stern 2007)).

This article is concerned with climate change adaptation in the North. It accepts the *necessity* of proactive adaptation, and adopts the *imperative* of facilitating beneficial adaptation through scientific research efforts (i.e. a post-normal sensibility). Yet this position places scientists in an interesting predicament; as a group they have: 1) enabled the conditions of climatic change through the production of physical, technical and social knowledge[1] (i.e. knowledge has been a driver of the vast industrialisation and accompanying globalisation of our planet); they have also 2) produced the knowledge which has created awareness of the possibility of climate change and its associated impacts. It is the intention of this research effort to employ the tools, techniques and methodologies of scientific rationalism to facilitate adaptation to climate change in the North. Yet it is also acknowledged that the knowledge and techniques produced, only has value if they are employed. The question is: 'Why would anyone use such knowledge, tools and techniques when similar products 'caused' the climate change problem in the first place?

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[1] "Ecological threats are the outcome of socially organized knowledge, mediated by the impact of industrialism upon the material environment. They are part of what I shall call a new risk profile introduced by the advent of modernity." Giddens 1990.

To answer this question, I will discuss the nuances of climate change adaptation from both a conceptual and operational perspective. I will then identify the key elements of a feedforward, proactive, adaptation planning system and its implications for specific acts of local adaptive agency. This will highlight the importance of the concept of 'trust' in its modern operational sense. The insights of Beck and Giddens, and their proposed 'solution' of reflexive modernity will be examined within this context. I will then extend the planning process to consider the insights of reflexive modernisation in the context of the knowledge production and exchange. I will conclude with a brief discussion of the relevance of this framework for adaptation in the North.

2. THE PROBLEM WITH ADAPTATION

The necessity of proactively adapting to climate change (as opposed to solely mitigating green house gases) is generally supported by reference to simple physics: the inherent lags in the atmospheric, oceanic system ensure that we are committed to decades of climatic change. This will occur in spite of our actions concerning green house gas emissions[2]. We therefore have an adaptation imperative which is turned by many into an imperative of planning. Unfortunately this decision to "act" or rather to "plan" does not make the task much easier for numerous reasons. First among these is the encompassing nature of the concept of adaptation[3] in subsuming information (physical. chemical, biological, ecological, etc.) not only about the environmental 'event' to which the agent is responding, but about the nature of the agent itself (i.e. individual, group, species), and the mechanisms available to it (behavioural, technical, cultural, etc.).

The term is also ambiguous with regard to its reference points. In the case of climate change as it is currently understood, much debate surrounds whether or not the changes we are seeing are out-of-the-ordinary which presumes some sense of what is natural or normal. This of course raises questions of the scale (i.e. changes since the Mesozoic, the Holocene or maybe the Anthropocene) as well as the completeness of environmental knowledge, both past and current. The concept further presumes or standardizes certain assumptions about the agent's ability to respond to environmental change. This must account for the nature of the agent (e.g. species, population, society, nation, ecosystem, etc) as well as the adaptive mechanisms available to the agent (i.e. physiological, morphological, behavioural, cultural, institutional etc.).

Equally problematic is the promiscuity[4] of the term insofar as it applies to almost any environmental response by any imaginable agent. Species of course adapt, but so do people, businesses, governments, institutions, and cultures; these entities represent different actors (individual vs group), adaptive mechanisms, currencies, constraints, histories, etc. Human adaptive behaviour therefore occurs over many levels, from the biological, to the behavioural to the institutional, and takes into account many spheres of human influence. Much adaptation is spontaneous insofar as the agent belongs to a system (evolutionary or behavioural) which responds involuntarily (or automatically). Planned responses are considered to be more efficient

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[2] IPCC Assessment Report 4, Working Group II, 748. (2007)

[3] The term has its origins in evolutionary biology and by extension, cultural anthropology Smit, B., and Wandel, J. 2006. Adaptation, adaptive capacity and vulnerability. Global Environmental Change **16**(3): 282-292.

[4] Definition: *consisting of members or elements of different kinds grouped or massed together without order; of mixed and disorderly composition or character*" OED. 2010

in that they provide the opportunity for direct action in anticipation of future environmental conditions and impacts. Numerous 'possibilities' can be considered and those which provide the greatest utility can be chosen, and the conditions for their realisation created.

This ability to anticipate and manipulate the future has been highly successful for humans (i.e. we are naturally '*seekers of end*' according to James) but it has its limits. It is dependent upon the ability to project system behaviour into the future (i.e. to create counterfactual information). Simple systems over short time periods are relatively easy to anticipate, but the climate system is extremely complex, with numerous interacting components that occur over multiple extended scales. Needless to say, it has stretched the limits of human ability to build General Circulation Models and project climatic change in response to increases in green house gas concentrations (Weart 2003). The challenge for researchers does not end with the climate though, but also requires that we are able to simulate the relative impacts of those changes upon society, and to devise appropriate adaptational responses. This is not only a function of the physical environment but how impacts are perceived, valued and responded to.

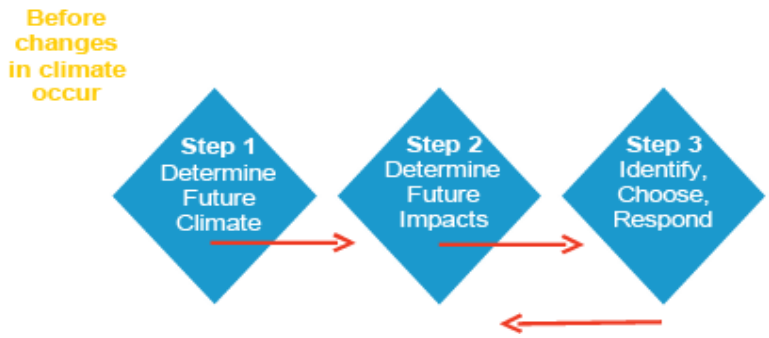

FIGURE 1: A simple feedforward system. This planning system (Fussel, H.M. 2007) changes in anticipation of the future. The system is founded upon the ability to project the future. In terms of a climate change adaptation planning system, it is composed of three basic steps: Step 1) is the most fundamental step and it wholly dependent upon the ability to project future changes in the climate. Step 2) projects changes to the system based upon the projections of the future climate. Step 3) represents the decision making process, and is based upon assessing the value of impacts and the potential for other potential futures.

In Figure 1.0 we can see a simple three stage planning system (Fussel 2007). It is a highly abstract process that is reliant upon modeled projections (counterfactual knowledge) of GCMs RCMs, and downscaled data. Large degrees of uncertainty exist in all elements of the modeled system including socio-economic factors. Models are constrained theoretically computationally, epistemologically and can ultimately prove nothing (Oreskes 1994). They are offered as guidance to aid in the decision process which must affect change (adaptation) at the local and individual level. Such inclusiveness is reflected in the nature of the adaptation planning domain

which is typically referred to as a *wicked* planning problem[5] (Rittel and Webber 1973) and certainly begs the question why anyone would *trust* in such a highly uncertain, abstract process?

3. COUNTERFACTUAL KNOWLEDGE & TRUST

Experts mediate our relationship with the environment and organise large areas of our material and social environments. They not only calculate environmental and socio-economic futures through planning, risk assessment, etc., but they create the universe in which we exist (Giddens 1990). Climate change itself is a key example of the fact that no one can '*opt out*' of the global system which modernity has created, whether you are living in New York or Iqaluit. We *trust* such systems, not because we have a choice, but rather because we have a lack of knowledge. Trust (in expert systems) is therefore much less a "*leap to commitment*" than a tacit acceptance of circumstances in which alternatives are largely foreclosed. (Giddens 1990).

Nevertheless, individual 'lack of control' in the context of modernity and globalization, does not imply lack of influence. The lay[6] public is a major element in the local\global dialectic wherein local happenings may move in quite different directions from globalising influences. According to Johnston (2000) the 'local global dialectic' can be understood as: 1) a global processes that leaves its footprint on places, allowing little local choice; 2) a process where diverse local processes 'turn' global processes (i.e. global processes must fit with local cultures); or the interpretation favoured by Giddens 3) where the mechanism is somewhat between the previous two views and represents a complex interaction between globalizing and localizing tendencies (Johnston).

> In pre-modern environments, the "local knowledge" … was rich, varied and adapted to the living in the local milieu. …. Yet although "local knowledge" cannot be the same order as it once was, the sieving off of knowledge and skill from everyday life is not a one-way process. Nor are individuals in modern contexts less knowledgeable about their local milieu than their counterparts in pre-modern cultures. Modern social life is a complex affair, and there are many "filter back" processes whereby technical knowledge, in one shape or another is re-appropriated by lay persons and routinely applied in the course of their day-today activities. (Giddens 1990)

Globalizing mechanisms must necessarily interact with reembedded contexts of action or they are lost (not applied, not bought, not implemented). As such knowledge can become re-appropriated or recast to reflect local conditions of time and place. In the context of the knowledge production associated with climate change adaptation this is precisely the process we wish to strengthen.

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[5] The traits of a wicked problem: a) no correct formulations; b) numerous stakeholders, perspectives; c) no stopping rules; d) no criteria to judge 'goodness' of decisions; e) inability to test decisions except by execution; f) no enumerable or exhaustible describable set of possible solutions (Rittel 1973)

[6] Giddens (1990) notes that we are all lay individuals in the context of modernity insofar as no one can 'know' but a very small part of the overall expert or abstract system. No one can become an expert, in the sense of the possession either of full expert knowledge or of the appropriate formal credentials in more than a few small sectors of the immensely complicated knowledge systems which now exist.

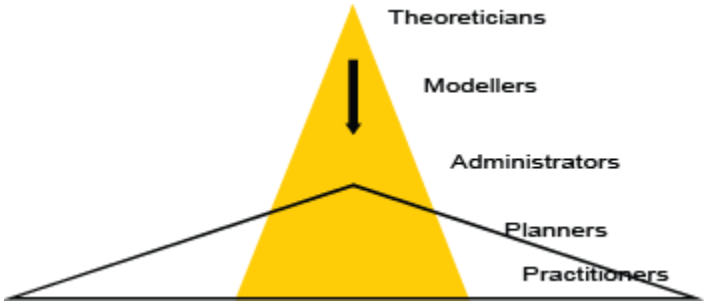

FIGURE 2: Squashing the Pyramid: An idealized relation between actors (knowledge producers and users) in the climate adaptation planning process. The solid pyramid represents the traditional understanding of knowledge production and utilization in the linear, hierarchical model. The purpose of the mechanisms proposed in this paper is to flatten (squash) these relationships so that practioners and modeler (for instance) are conceptually closer making it easier to 'interpret' and appropriate such highly abstract counterfactual knowledge locally.

Imagine our relationship with expert systems in the traditional, hierarchical, linear sense[7], where highly abstract knowledge (i.e. typically produced by the most fundamental science – physics) is produced by a very few theorists (see the solid triangle in Figure 2). This information is re-interpreted by academic intermediaries, who are then re-interpreted themselves. Knowledge moves from physics, to climate systems, to hydrological systems, to terrestrial systems, ecological systems, economic systems, to social systems, to operations researchers and management scientists, and finally it moves outside the academic realm to planners, politicians and eventually to the individual who will act, or not, based upon that knowledge. More people partake of the physical knowledge as it moves down the system to actual action (see Figure 2) but the knowledge also becomes more fragmented, isolated and fixed (unidirectional).

I propose that successful, planned adaptation will require continual interpretation of knowledge (multi-directional), and the interaction of all these players using *trust* as a critical currency. This will require that we re-embed social relations locally, by minimising the barriers that separate the abstract thinkers from the users of knowledge. What we want to do is to squash the pyramid in Figure 3 (see the outline of the squat pyramid) so that the users are much closer vertically to the theoreticians, and can 'understand' the limitations and nuances of what is being said, thereby making the information more applicable and more readily available to many more people.

[7] For an interesting discussion on Organisations see Hindle (2006).

4. REFLEXIVE MODERNITY AS SOLUTION

How do you squash the pyramid, and re-embed social global relationships into the local context? The answer appears to be associated with the question of trust, which according to Giddens is tied to knowledge, or the lack thereof. When individuals have more information about the abstract systems on which they depend they will be in a better position to make local decisions that not only take new, global, abstract information into account, but embed it in such a way that it reflects the character of the local particularities to which they are apart. The pyramid is squashed by providing knowledge in a way that makes it more accessible. Though this is not necessarily a new insight, the work of Giddens and Beck points to a novel way in which it can be accomplished.

Their suggestion is essentially to dig even deeper into the rabbit hole. This is somewhat counter-intuitive insofar as the notion that we further scientize our social relationships would appear to make things more complicated, more rigid, more hierarchical and less understandable. In reality, this actually means that we expose the limitations of science itself. It does not imply giving oneself up to the traditional image of science as a purveyor of truth, or to accept its practioners as final authorities on human reality or our relationship with the environment. It is rather to turn scientists' own microscopes back upon themselves, not only with regards to the epistemological status of the products of science, but with respect to the position of scientists within society today. An important trend in the literature is the realisation that scientists should actually become part of an environmental solution, helping resolve the negative environment impacts of the by-products of their profession.

> In the reflexive phase, the sciences are confronted with their own products, defects and secondary problems, that is to say, they encounter a second creation in civilisation. The developmental logic of the first phase relies on a truncated science, in which the claims of scientific rationality to knowledge and enlightenment are still spared from the application of scientific scepticism to themselves. The second phase is based on a complete scientization, which also extends scientific scepticism to the inherent foundations and external consequences of science itself. In that way both the claim to truth and the claim to enlightenment are demystified. (Beck 1993)

Beck realizes that science in the context of a major environmental crisis such as climate change, is no longer concerned with truth, but is rather concerned with decision-making (Beck 1993). In particular, scientists should be concerned with the major problems associated with decision making or planning. As we have seen in the context of climate change adaptation, these include a conceptual ambiguity, inclusiveness and promiscuity associated with the concept of adaptation. It also includes handling complex interactions between different planning modules or components, multidimensional interactions between numerous factors and thereby between numerous disciplines, etc etc. And it includes consideration of the goals or ends of the final users of such highly abstract and counterfactual knowledge. It is a wicked problem.

The solution I propose is to idealise the relations between the producers and the users of knowledge to such an extent, that these relationships become open to critique, and evolution. To formalize knowledge relationships so that knowledge pathways can be more easily identified and facilitated. In other words I wish to structure these relationships between actors, and the knowledge associated with them, so that they are open to reflexive considerations in light of the goals of climate change adaptation. Figure 3 represents information components as tied to the goals of climate change adaptation planning. In other words, the relationships implied in this diagram reflect the lens of knowledge utilization in the context of adaptation planning.

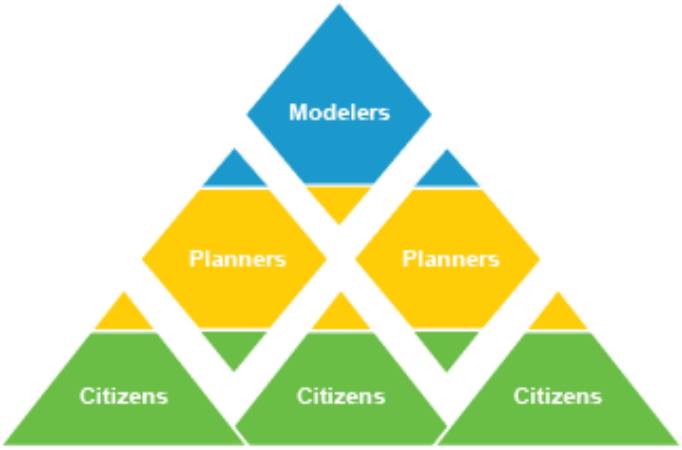

FIGURE 3: An idealized representation of the relationships between groups or teams of knowledge producers and users in the context of climate change adaptation planning. Teams are focused upon a particular subset of the overall goal (i.e. to facilitate adaptation to clim,ate change) These relationships are necessarily idealized, cartooned, to make the relationships open to critique and evolution. The relationship to Figure 2 should be readily apparent.

As we can see, the pyramid in Figure 2 is decomposed into relationships of knowledge producers and users (cartoons) in Figure 3. The diamonds represent the fact that any specific idealized activity (e.g. planning) actually has ties to the activities above (unless you are a physicist) and below it (unless you are considered to be a member of the lay public in the context of the planning exercise – the component shape for citizens is of course a triangle). Although the majority of those involved in the activity of planning have little direct affiliation with climate modelers for instance, there is, and must be some association (e.g. through researchers into planning systems) with climate modeling so that the products of modelers are correctly interpreted. Similarly, planners do not always have direct relationships with the lay public, but interact with representatives of them (e.g. politicians).

The glue that brings these structured, formalised components together is knowledge, but not in the manner that is typically produced by experts. In a sense we step back from this raw information and interpret these products specifically in the context of CCA through the use of bibliometrics. Bibliometrics is a way of laying bare what a field is up to using simplistic categorizations that have meaning within the larger context of the planning problem. It allows a common language that everyone concerned with the planning issue speaks, while at the same time providing access to more detailed information for those who need to dig deeper into the claims of knowledge. It is essentially knowledge about knowledge. It creates the context and structure for the components of decision making, showing clearly where we think a component sits in relationship to a larger schema, thus making relationships open to examination. In this sense bibliometrics facilitates reflexive behavior both in terms of the knowledge itself and the relationships between various forms of knowledge in the context of the system goal which itself is open to critique.

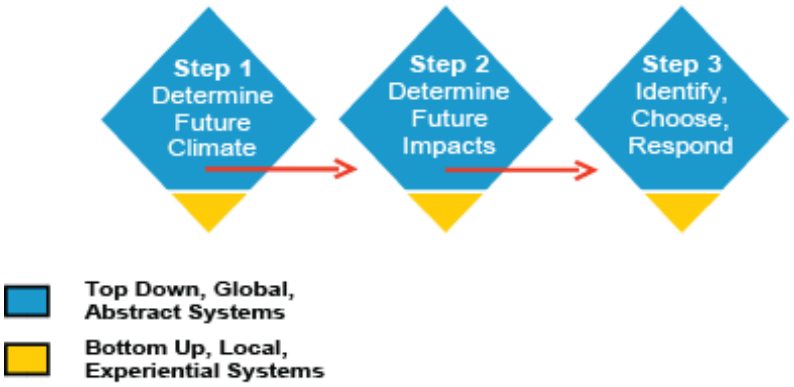

FIGURE 4a: A three step adaptation planning process based upon Figure 1. The blue shaded area represents the activities of experts, while the yellow represents the involvement of stakeholders. In this sequence the traditional roles of those who produce abstract knowledge and the local users\producers of knowledge. This version represents a uni-directional process from the experts to the public.

As an example, circumstances exist where the utility of expert knowledge versus local experiential knowledge is not self-evident. In these circumstances knowledge crosses boundaries (i.e. it can be produced by either specialists or by lay individuals) and the above framework can be used for the identification and refinement of these choices (Maclellan 2007). In Figure 4, we have isolated the relationship from Figure 3 between highly abstract, top down abstract systems and more bottom up, experiential systems in the context of a three step adaptation planning system (Fussel 2007). It is clear from this diagram that experts can be enlisted to: 1) determine the future climate regime; 2) determine future impacts; and 3) to select a course of action for a given locality (Figure 4a). In the first instance, the process clearly is meant to represent the activities of climate modelers; in the second researchers and academics typically interpret the output of climate modeling in the context of their given specialty (i.e. biodiversity), while in the third instance decision analysis can be performed by either economists or management scientists to reveal optimal planning options.

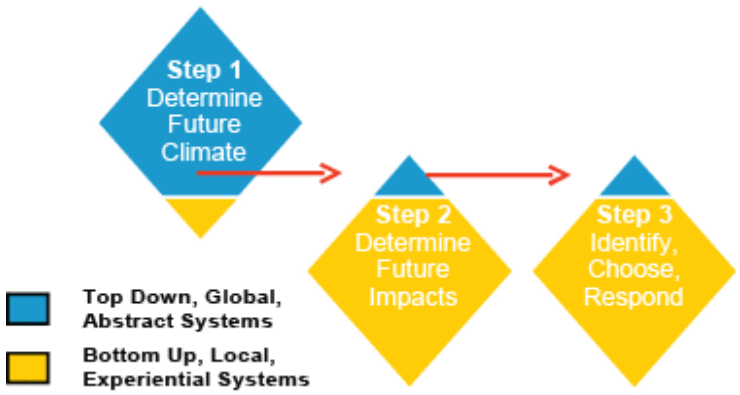

FIGURE 4b: A three step adaptation planning process based upon Figure 1. The blue shaded area represents the activities of experts, while the yellow represents the involvement of stakeholders. In this sequence the public, stakeholders, or consumers of abstract knowledge have a role in the process. Clearly the public cannot produce projections of climatic change over decades, but they can identify impacts based upon past experience with weather and they can choose possibilities which are amenable to their local circumstances and values. The currency that facilitates this shift in roles is more strategic form of knowledge.

In Figure 4b, we can see that while Step 1 remains the domain of climate modelers (and must in the sense that they have created our awareness of the potential for climate change), Steps 2 and 3 have shifted to a more bottom up, experiential perspective. There are numerous reasons why this makes sense (MacLellan 2007), needless to say, local experience may be more profound and more reliable in this context. The dialectic may require that local knowledge is considered as a means of interpreting the information products of climate scientists. An exercise in planning would then be comprised of utilizing both forms of knowledge as facilitated by bibliometrics on the one hand, and consultation (and archiving of local experience) on the other hand (see Flyvbjerg (2006) for a discussion case studies).

5. CONCLUSION

Giddens suggests that we have four choices when it comes to our relationship with expert systems and the knowledge they create:

1) Pragmatic acceptance: concentration on surviving, the events as they occur are outside the realm of individual influence

2) Sustained optimism: a continued faith in providential reason – technological solutions can be found

3) Cynical pessimism: cynicism used to dampen the anxieties of potential catastrophes

4) Radical engagement: a practical contestation towards perceived sources of danger – we can and should mobilise either to reduce the dangers or transcend them – not necessarily a faith in rational analysis, but in action.

Radical engagement requires that as lay individuals (and we are all lay individuals in the modern context) we become engaged to minimise environmental and social dangers. I propose that this be made possible by facilitating reflexive modernisation, through the formalisation of knowledge exchange processes in climate change adaptation planning. The end result should 'lay bare' the limitations of modern science and to provide the knowledge produced by these processes in a meta-format so that they are easily grasped within the context of the end goal of science, which in this case is climate change adaptation. The implications for northern communities are clear insofar as science loses its traditional status and pre-eminence while local, traditional is elevated to the status which first nations groups have long understood it deserves.

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