

China's Environmental Challenges: The Role of International Collaboration

How China and the world can
mitigate climate change
through effective collaboration

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1. Introduction

China and the world stand at a turning point in human history. Overwhelming scientific consensus on human-induced climate change means the task of shifting from an energy intensive, fossil-fuel based existence must be attempted, or the chance to mitigate the potentially catastrophic effects of global warming will be lost. The bulk of responsibility for historical carbon emissions falls with the developed world, but as China relentlessly increases the size of its economy, its need to respond to the crisis grows. Without China, as the world's largest emitter of greenhouse gases, any global plan to tackle climate change will fail.

China's economy has been developing at a rate never seen in history; in the 30 years since reform was initiated, GDP quadrupled from 1980 to 2000 and carried on growing by double digits until late 2008; China is now the world's number three economy, and yet there is room for much more growth; China's population is still heavily agrarian, and energy consumption still stems overwhelmingly from industry compared with developed countries, where cars and domestic consumers form a majority of power use.

Energy consumption until 2000 only doubled - a commendable achievement in reducing energy intensity compared to other developing countries. However, in 2006 and 2007 China missed its energy efficiency targets, and also overtook the United States as the planet's number one emitter of carbon dioxide, most of which comes from its energy sector.

Whilst China faces many others environmental issues which will benefit from collaborative action, because of the breadth these problems this paper is in the most part concerned with China's energy sector and related factors such as energy efficiency.

Through active collaboration, not mere cooperation, China will be able to work with the rest of the world to achieve climate change mitigation. The chance for the world, and developed countries in particular, to help China develop into a low-emission, high efficiency society is a vital opportunity, but that opportunity must be carefully planned and executed so that China is invited into a collaborative web of interdependent environmental institutions, systems and projects, that ensure climate change mitigation is effectively carried out for decades to come.

The financial crisis and world recession have changed the game for environmental progress. Easy credit has disappeared as a means of financing capital-hungry environmental projects, the oil price has plunged and with it the cost-effectiveness of much renewable energy and efficiency. But with the slowdown in the world's economy comes a chance to reassess and plan environmental action. Economic stimulus plans are about to be rolled out in many countries around the world, including China, and this spending can address climate change by advancing green technologies and helping a fledgling industry become a driver of growth and jobs in the coming decades.

China's best chance for improving its own environmental conditions, for reducing its contribution to climate change and improving its energy security lies in international collaboration. This paper aims to describe the specific nature of international environmental

collaboration; how it differs from simpler, less pervasive and less creative joint working techniques such as coordination and cooperation, what results from intensive collaboration, and what kinds of environmental collaboration China and the world must carry out in the future.

2. Why Collaboration?

At this critical point in history, environmental collaboration between China and the West is necessary if we are to avert the catastrophic effects of climate change. But why is collaboration so important? How does collaboration differ from cooperation and coordination and why do those differences matter for China?

Collaboration is defined as a recursive process where two or more people or organizations work together towards an intersection of common goals—for example, an intellectual endeavour² that is creative in nature³— by sharing knowledge, learning and building consensus. Collaboration does not require leadership and can sometimes bring better results through decentralization and egalitarianism.⁴ In particular, teams that work collaboratively can obtain greater resources, recognition and reward when facing competition for finite resources.⁵

Collaboration differs from cooperation and coordination in that collaboration seeks to find new and creative solutions that would not come about through centrally directed joint working initiatives. This is especially important in the case of climate change since there are a myriad of interdependent and competing centres of interest and such a large range of possible outcomes depending on what action is taken to mitigate climate change's effects. Florian Schneider tells us that collaboration actually harnesses selfish interests; but it also produces effects more complex than we can predict.

² Collaborate, Merriam-Webster's Online Dictionary, 2007

³ Collaboration, *Oxford English Dictionary*, Second Edition, (1989).

⁴ Spence, Muneera U. *Graphic Design: Collaborative Processes = Understanding Self and Others*

⁵ Wagner, Caroline S. and Loet Leydesdorff. *Globalisation in the network of science in 2005: The diffusion of international collaboration and the formation of a core group*

Rather than through the exertion of the alleged generosity of a group made up of individuals in the pursuit of solidarity, [collaboration] often works as a brusque and even ungenerous practice, where individuals rely on one another the more they chase their own interests, their mutual dependence arising through the pursuit of their own agendas. Exchange then becomes an effect of necessity rather than one of mutuality, identification or desire.

This entails an initial level of differentiation between cooperation and collaboration: in contrast to cooperation, collaboration is driven by complex realities rather than romantic notions of common grounds or commonality.

Due to the complexity of the problem it would be impossible for the countries of the world to coordinate a solution for climate change mitigation using existing methods of joint working. Instead, for perhaps the gravest problem ever to face mankind, collaboration is the key to unlocking both man's creativity and his selfishness.

Chris Huxham and Siv Evy Vangen, in their book 'Managing to Collaborate' set out several reasons why organisations should undertake collaborative ventures. Their first factor influencing the decision to collaborate is a lack of resource within organisations. This can be simple resources such as people and finance, or for more creative collaboration, expertise or technology. Risk is Huxham and Vangen's second factor, principally where the risk of a project is too high for organisations to consider attempting it alone. Their third element for collaboration is efficiency, a factor with more overlap with other joint working styles since it can be argued that this falls within the realm of coordination. The kinds of collaboration that result in efficiency typically leverage economies of scale. A less tangible factor in Huxham and Vangen's collaboration factors is learning, and whilst many

collaborative efforts are ostensibly to fulfil a pre-agreed goal, the level of interaction at which true collaboration takes place creates an environment in which learning is often accelerated beyond preconceived goals. Learning can also be the stated aim of collaboration; Huxham and Vangen point to the example of vehicle manufacturers who act as trainers and consultants for component supply companies, and draw attention to that fact that often learning is the hidden aim of alliances or joint ventures, so reducing the need for access to resource in the future.

Huxham and Vangen's final factor in collaboration may be the most important one when considering China and international environmental collaboration: the moral imperative. "This rests on the belief that the really important questions facing society -poverty, crime, drug abuse, conflict, health promotion, economic development and so on- cannot be tackled by any organisation alone. These issues have ramifications for so many aspects of society that they are inherently multi-organisational."⁶ It is perhaps unfortunate that the authors missed climate change from their list of societal challenges, as it may best fit the description of a complex societal problem.

However, collaboration is not the panacea that will solve the world's problems in one fell swoop. Firstly, collaboration is not necessarily an easy, or a cheap option, both in terms of time and money. Encouraging stakeholders to not merely coordinate efforts, but genuinely invest in creative collaborative partnerships can be a daunting task. Secondly, sometimes the costs of collaboration are greater than the possible gains, for instance in stifling competition in an industry or when organisations do not have the correct synergies.

⁶ Huxham and Vangen 2005 p17

However, Huxham and Vangen's criteria for whether collaboration is worthwhile give a good indication that China's climate change policies would benefit from international collaboration. "Unless you can see the potential for real collaborative advantage (i.e. you can achieve something really worthwhile that you couldn't otherwise achieve) it's often more efficient to do it on your own."⁷

Since mitigating climate change is something that can only be achieved if China buys into a methodology and pursues it alongside the world's largest economies, the costs of not collaborating (runaway global temperatures) will be far higher than the costs of collaborating (the effort of organising the most ambitious cross-disciplinary, multi-institutional, international collaboration in mankind's history). As in all successful collaboration ventures, unforeseen benefits may arise – the aim may be climate change mitigation, but increased political and cultural understanding, as well as increased sustainable trade would likely occur if China and the world were to find more creative and lasting ways of working together.

⁷ Huxham and Vangen 2005 p44

3. China's Environmental Challenges

China's environment has paid a significant price for the country's economic transformation, and the world cannot afford to ignore the challenge of helping China develop new environmental approaches. However, due to limitations on resource combined with the urgency of making significant contributions to mitigating climate change, efforts concerning new and existing international collaborations with China must be highly targeted for maximum effect. Priority must be given to factors that:

- a) Contain the highest potential for reducing emissions
- b) Benefit most from international collaboration.

Given these factors, there are two sets of challenges concerning China's pursuit of improved environmental performance. Firstly, technological challenges such as cleaner fossil fuels, energy efficiency and renewable energy, but secondly, and just as importantly, the challenge of implementing laws and policy in a country with regional and provincial governments who have a relatively high degree of autonomy.

3.1 Technological Challenges

First let us consider the technological factors in China's environmental development. The most important factor here is coal. Chinese coal is cheap and plentiful; it powers China's sprawling heavy industries, unending factories and rapidly growing cities. Over 70% of

China's energy comes from coal and if current trends continue, by 2020 China will be using 2.17 trillion tons of coal per year, up from 650 billion tons in 2000.⁸

China will find it very hard to replace coal as a power source by any meaningful amount since China's economic success is built on cheap coal, and China is extremely unlikely to willingly give up that advantage. A shift to gas-powered plants is unlikely given the volatile nature of natural gas prices. The large initial investment and safety considerations of nuclear power plants, allied to the lack of domestic uranium reserves, makes building enough plants to make a meaningful contribution to China's energy supply an unlikely prospect. Renewable energy will be important, and much investment is being made, however discounting hydro power, renewable energy's contribution will struggle to compete with coal on price.

Coal brings many external costs, from respiratory diseases and carbon emissions to river pollution and landscape destruction. Therefore, helping China to clean up its coal production and consumption is a vital priority in any international collaboration. Carbon capture is a field of necessary international collaboration, given its technical complexity and relative immaturity and available sites for sequestration. Coal plant efficiency will also be vital, and whilst China has made great strides in this direction, there is still more to be achieved with international help.

The second factor in China's carbon mitigation is energy efficiency. China has great opportunity to make easy savings in energy consumption. Achieving the government's

⁸ Oberheitmann, Andreas. *Economic growth, energy efficiency and possible CO2-emission reductions in China by 2020* Presentation at the University of International Business and Economics. Beijing, 12 February 2009

current goal of reducing national energy intensity 20 percent below 2005 levels by 2010 would create an annual greenhouse gas reduction of more than 1.5 billion tons, making it one of the most significant global carbon reduction efforts.⁹ The great majority of China's energy is used in industry, and here is where further gains can be made. China's 1997 Energy Conservation Law started a number of programmes to create efficiencies in industry, China's fuel economy standards are more stringent than those in the US, Canada and Australia, average economy reaching 36.7 miles per gallon by 2008.¹⁰ Efficiency improvement can also be brought about through buildings and appliance standards, an area of great potential in China.

Smart grid technology is an area which can bring about great gains in carbon mitigation through the supply of renewable energy and securing reliable sources of power. The resource and wind-rich north and west of China could be connected with the power-hungry east and south. Shanxi, China's largest coal producing province, plans to invest RMB100bn in a huge project that will include 25 mine-mouth coal power stations and three more ultra-high-voltage (UHV) power lines before 2012.¹¹

Renewable energy is of course very important for China's long-term energy plan, and these technologies are vital for realising a low-carbon energy future from a wide variety of Chinese energy sources. An expanding sector of companies will manufacture and install these technologies, providing new domestic "green-collar" jobs. China is already one of the

⁹ Jiang Lin, Nan Zhou, Mark Levine, and David Fridley, "Taking Out 1 Billion Tons of CO₂: The Magic of China's 11th Five Year Plan?", *Energy Policy*, no. 36, 2008.

¹⁰ An Feng and Amanda Sauer, *Comparison of Passenger Vehicle Fuel Economy and GHG Emission Standards Around the World*, The Pew Center on Global Climate Change, December 2004. http://www.pewclimate.org/global-warming-in-depth/all_reports/fuel_economy.

¹¹ Proactive Investors, http://www.proactiveinvestors.com.hk/proactive/news_view_2_232_UHV-lines-from-Shanxi-as-China-transport-electricity-not-coal.shtml accessed 26 February 2009.

world's renewable energy leaders, obtaining 17 percent of its electricity, and seven percent of its total energy, from renewable sources (if we include hydro power). The installation of other forms of renewable energy has room for growth, and it is here that collaboration can yield most results.

For these technologies to have a chance of being effectively implemented, emissions must be quantified and projected. Without this data, suitable opportunities cannot be identified, goals and policies cannot be structured correctly and progress cannot be measured. Viable goals are vital for collaboration in any context.

3.2 Implementation Challenges

The second set of challenges facing China's attempt at carbon mitigation are those of implementation. China's environmental laws often encounter problems at the local level; the old saying 'the mountains are high and the emperor is far away', to some extent, still holds true. The Ministry of Environmental Protection replaced the State Environmental Protection Administration (SEPA) in March 2008. One of the new ministry's aims is to help the government stop more of its environmental policies falling by the wayside because of difficulties with local enforcement. The New Circular Economy law is a good case in point, well drafted in terms of methods for establishing the three 'R's into the economy (Reduce, Reuse, Recycle), but without the specific enforcement mechanisms with which government agencies can implement the law. This is of course a problem (albeit to a lesser extent) in both the European Union and the United States, and collaboration is needed to circumvent this 'local implementation' issue.

3.3 The Challenge of Chinese Civil society Collaboration

Although few genuinely autonomous, self-regulating organisations yet exist in China, the political and socio-economic landscape has been changing steadily over the past three decades. In order to achieve their aims, Chinese social organisations have worked with the state, and also circumnavigated the state, in a relationship that has been described as symbiotic¹². A number of independent and semi-independent environmental groups have thus emerged, as the relationship between state and society becomes more complex, as various areas of society begin to overtly lobby the government for favourable policy. Opportunities for collaborative ventures between international and Chinese NGOs have therefore grown.

Friends of Nature, which established in 1994 is China's oldest environmental NGO, is one group that operates in a generally autonomous way; this group mobilised public support to protect the Golden Monkey in Yunnan province, under threat from illegal logging. Indeed many environmental groups are permitted to operate in a broadly free space, using context-specific methods of protest that. It is worth noting however that this occurs in areas from which the state wishes to retreat, of which the environment is one; indeed, allowing some NGOs to flourish provides the government with an inexpensive tool to monitor the environment¹³. SEPA however is yet to establish comprehensive collaboration with domestic NGOs, leaving tremendous space for joint projects with international groups.

¹² Saich, 2000

¹³ Economy, 2004

The government has developed its own form of NGO, known paradoxically as government-organised non-governmental organisations, or GONGOs¹⁴. For instance, the SEPA has a number of GONGOs under its auspices, including the China Environmental Science Association and the China Environmental Protection Industry.

While GONGOs can be front organisations for government ministries or retirement-alternatives for officials whose offices have been downsized, some GONGOs are a means for establishing collaborative projects with overseas counterparts. Naturally, the boundary between NGOs and GONGOs has become blurred, as some GONGOs have become independent NGOs, securing their own financing sources, while some NGOs have been taken gradually under the wing of the state.

Increasingly, Chinese civil society is developing a consultative and collaborative role in the apparatus of the Chinese state, generating publicity via the local media, and gaining access to partnering opportunities with international NGOs. International NGOs, such as the Worldwide Fund for Nature (WWF) have developed roles as consultants for the Chinese government. While the relationship between the Chinese state and market has been widely discussed, the role of civil society groups in mobilising public support for environmental projects, and disseminating information about environmental damage has a central role to play both in environmental awareness in general and creating the markets for green products. The necessary flexibility of NGOs in raising funds often presents some of the broadest collaborative opportunities, between state, market and the civil society sectors.

¹⁴ Economy, 2004

4. International Collaboration Case Studies

There are a number of existing international case studies which contain valuable lessons for China's collaborative initiatives. For example, recent research on the effectiveness of the International Energy Agency (IEA) and other agencies in fostering collaboration suggests two primary conclusions. Firstly, the work of a number and range of stakeholders, including businesses, is vital to success for technological associations. Secondly, the participation of developing nations is also vital.

CDM, ETS and CCS

The Clean Development Mechanism (CDM) represents the broadest area of environmental collaboration yet undertaken. The arrangement, under the Kyoto protocol (which will be described in more detail later), allows industries in developed countries with an emissions reduction obligation to fund projects that lower emissions in developing nations, through the purchase of credits.

The EU-wide Emissions Trading Scheme (ETS) is the world's largest multinational emissions trading scheme, and covers more than 10,000 installations in the energy and industrial sectors, constituting 40% of total EU emissions. Yet despite the implementation challenges being faced by the ETS and other CDM schemes, these are early collaborative attempts to factor an emissions price into environmental financing, and form a prototype for pricing pollution externalities. Therefore, this initiative can be said to constitute the most important collaborative work so far.

One vital sector that is likely to be made more financially viable by the broadening of CDM is Carbon Capture and Storage (CCS), a methodology for capturing and storing carbon

from large emission facilities, especially power stations. This methodology promises to have substantial uptake in China due its reliance on coal. A range of collaborative initiatives have already begun around CCS.

One such initiative is the Carbon Sequestration Leadership Forum, established for national governments, businesses and industries to share data on CCS technology. Working in isolation, governments have had difficulty establishing frameworks for policy to cover the costs of entire CCS demonstration projects; just one such project requires several million dollars more than a non-CCS power station.

The Near-Zero Emissions Coal Initiative in between the EU and China is one well-established example of continuing inter-governmental environmental collaboration. This project will develop China's first 'near-zero' emissions coal power station, the first CCS development outside of an OECD country.

Public-Private Collaboration

The invisible hand of the market cannot be relied upon for the development of environmental industries. Governments need to take an active role in driving through longer-term investments and encouraging clean tech initiatives which may not give be financially viable. One way this can be achieved is through the creation public-private partnerships using an increasing range of methods.

The taxes levied on Norway's Statoil for example, spurred it to develop the first commercial-scale programme for underground CO₂ storage, demonstrating a domino effect from carbon taxation to cleantech innovation.

Until the 1970s Vancouver was a mining, timber and fishing port, now it is Canada's most successful cleantech hub.¹⁵ There are a number of measures that will appear especially important for aiding green collaboration and market growth, that involve government undertaking a goal-oriented collaborative agenda with researchers, entrepreneurs and financiers.

R&D support is central to green development; university or state research institutes and laboratories are able to generate the collaborative work that leads to technological breakthroughs and business spin-offs. China's best example of this to date is at Tsinghua University, where Beijing's main cleantech and venture capital cluster has developed at the Tsinghua University Science Park. The park is home to Tsing Capital, China's only entirely cleantech dedicated venture capital company, wholly-owned by Tsinghua University. Tsinghua provides the company with sources of technical expertise, legal backing for its patents, and a hub for civil society and environmental-advisory contacts.

Academic-industrial partnerships frequently support the commercialisation of research. A contemporary example is the SETsquared Partnership¹⁶, set up to facilitate collaboration between two American and four British universities in research and subsequent commercial opportunities. The SETsquared Partnership universities are collectively the largest source of academic knowledge transfer to the private sector in Britain, and this collaborative venture has created a wide range of spin-off businesses.

A particular benefit public-private environmental collaboration is that as local governments produce and use huge amounts of energy, have large transport programmes, treat and

¹⁵ Pernick and Wilder, 2007 p239

¹⁶ Stern, 2006 p598

supply water and process waste, they have the opportunity to integrate local clean technologies into their own economies and activities. Government can become beacons for environmentally sound practices and can collaborate freely with private companies and other organisations, without the commercial limitation of retaining competitive advantage.

5. Problems of Collaboration

In the rich history of collaboration, one fact remains particularly salient: most collaborations fail. The reasons for this, which we will address, are manifold. Some collaborations are poorly planned from the outset, but even many of those that are ostensibly well-designed, still fold after fruitless attempts at cooperative work. In much collaboration, initiators and participants should feel that there is really little alternative to collaboration: work is more likely to succeed if those involved know they *have* to be around the table.

R. Moss Kanter¹⁷ has described the collaborative process as consisting of five phases, all of which are ripe with hazard. These are courtship, engagement, housekeeping (during which they discover they have different ideas about how the partnership should work), bridging and ‘old marrieds’ (when partners realize they have changed as a result of the partnership itself). ‘Marriage’ is a doubtful term with which to describe what may be a short-term contract, not least because in collaborations it can be hard to see phased beginnings and ends. However her template is a useful guide to understanding why there are so many stages at which conflicts can occur.

Collaboration is only to be attempted when the stakes make it genuinely worthwhile. Creating and running a project with a range of other people, with whom the initiator may have varied relationships, and who may come from various cultural backgrounds, is a process that tends to become considerably more time consuming than is apparent at the outset. Huxham and Vangen tell us that concerning collaboration: ‘don’t do it unless you

¹⁷ In Huxham and Vangen, 2005, p.10

have to'. Although some 'collaborative thuggery'¹⁸, the political and manipulative behaviour in group work, is inevitable and indeed healthy, in excess this can create often terminal friction. The achievement of 'collaborative advantage' over 'collaborative inertia' relies on the advancement of a shared vision, or visions, for co-achievement by both or all parties in a shared project, as opposed to the perception of one party having gained rather than (or worse, at the expense of) others.

Intercultural Issues of Collaboration

The pitfalls of cross-cultural groups in collaboration are of course infinitely broad, and we shall not attempt an exhaustive list between Chinese and western parties. Some common areas however are worth addressing, not least because collaborations are certain to increase in number, and because the atrophying of a venture into collaborative inertia, rather than the creation of collaborative advantage, is common.

While in many western cultures participants can openly and directly disagree, for senior Chinese group members to be directly contradicted in front of subordinates is a sensitive issue. Even within groups that have similar environmental views and known shared goals, disagreements are best put indirectly to avoid showdowns. This can limit creative collaboration where free and frank exchanges of views and ideas are key.

Connected with this, one of the primary organisational problems in China is the difficulty of achieving flows of information and ideas *up* the group (through suggestions moving from lower to higher status members). Collaboration is intended to provoke not just thought

¹⁸ Huxham and Vangen, 2005, p.8

but discussion, and relies on the distillation of good ideas not just downwards, but from lower ranking individuals.

In any group, hidden agendas may exist, but these are especially likely when working with the poorly-defined and dynamic structures that typify environmental collaboration across cultures and political systems. While group management involves politicking between individuals, capital 'P' political difficulties, seen and unseen, are often a keener challenge in China than elsewhere. As described in part four, many partners will have political links or relationships that will remain unknown to their foreign partners, which may limit the scope of their work. On the other hand, these connections may facilitate unforeseen opportunities for success.

Collaborative Failure Case Studies

i) Danone and Wahaha

In February 1996, Hangzhou's Wahaha Food Group, French Corporation Danone and Baifu, a Hong Kong conglomerate, initiated a Joint Venture (JV). Danone and Baifu created Jin Jia Investment, in which Wahaha owned 49% of the shares, Danone owned 25.5% and Baifu 25.5%. This structure started immediate misunderstandings. Wahaha believed it was the majority shareholder, and transferred its trademark.

Public statements of the time make clear that Wahaha did not understand the ownership implications when they began the JV, and the 1998 takeover produced great ill-feeling on the part of Wahaha, who concluded that Danone had deceived them from the outset. The JV resulted in years of on-going litigation and ill-feelings.

While this is not an environmental collaboration, it is important to focus on the lessons of collaboration attempts. Whether or not Danone originally intended to take majority control of the JV, it appears they never made the various possible outcomes sufficiently clear to Wahaha. We also cannot know the internal dealings between the two companies, but events on a number of levels turned against a collaboration that was improperly planned from the outset, and suffered from a serious lack of intercultural understanding on both sides.

ii) The US Clean Coal Technology Programme

The lack of environmental cooperation between the western countries and China to date is in itself a failure of collaboration. The US has had great difficulty in developing the potentially huge Chinese market for American clean coal technologies¹⁹. The Department of Energy (DOE) requested US\$1.4bn for a global clean coal programme, one quarter of which was to be for China. However the US Congress, in contrast to the European Union and its similar clean coal programme, declined to fund the programme, asking the US Agency for International Development (USAID), the Overseas Private Investment Corporation (OPIC) and the Import-Export Bank (EX-IM Bank) to sponsor it instead. This turned out to be impossible as USAID and OPIC were barred from doing business with China. This is an important lesson in making sure that stakeholders are aware of the necessity and benefits of collaboration before projects are initiated.

3. The Kyoto Protocol

The Kyoto Protocol is a useful example of international collaboration where despite major problems with achieving cooperation from all parties, progress was still made towards

¹⁹ Economy, 2004, p.192

climate change mitigation. Here, states came together to agree a method for mitigating climate change, and to a large extent, that was achieved. Industrialized countries agreed to reduce their collective green house gas (GHG) emissions by 5.2% compared to the year 1990.²⁰ The protocol's five concepts are: commitments to GHG reduction, policy implementation – for example the Clean Development Mechanism (CDM), minimising effects on developing countries by establishing an adaptation fund, improved data collection and analysis to ensure proper implementation and compliance through a committee with enforcement powers.

Although a strategy was agreed and implemented for mitigating climate change, the collaboration has been said by many to have been a failure because the US did not sign up to the protocol, and as the world's largest emitter of GHG (until 2007) this has seriously limited the possible achievements of the protocol as well as undermining the motivations of the protocol's existing signatories. Through the hard work of collaborative interaction a creative and encompassing attempt at mitigating climate change was reached at Kyoto, however the protocol's practical achievements were less impressive: from 1992 to 2007 GHG emissions increased by 38% worldwide, with the US increasing its emissions by 20%.²¹

Kyoto is a blueprint for future action, a first-run of possible future collaborations, and as such was a success. From the viewpoint of its stated aims, however, it was a failure, and that failure was as much a direct failure of collaboration as of the actual policies that came

²⁰ United Nations Environment Programme (12 November 1997). *Industrialized countries to cut greenhouse gas emissions by 5.2%*. <http://unfccc.int/cop3/fccc/info/indust.htm>. Retrieved 15 February 2009

²¹ Canadell JG, Corinne Le Quéré, Michael R. Raupach, Christopher B. Field, Erik T. Buitenhuis, Philippe Ciais, Thomas J. Conway, RA. Houghton, Gregg Marland (2007) Contributions to accelerating atmospheric CO₂ growth from economic activity, carbon intensity, and efficiency of natural. *Proceedings of the National Academy of Science*, 0702737104

out of Kyoto. For China, and its international collaboration goals, it is an important reference for the necessity of inclusion of all stakeholders and a realistic setting of goals, as well as a creative test bed for policies that China may use in the future.

Collaboration and Concerns about loss of Intellectual Property

Intellectual property rights (IPR) are a well understood issue for collaboration between foreign and Chinese parties. Although the OECD regards Chinese IPR law as ‘quite sophisticated’, the OECD perceives the main problem as being weaknesses in enforcement; green products therefore often need a first mover advantage, or, more challengingly, strong legal enforcement of their patents. While weak IPR is a problem for foreign partners and has slowed technology transfers, it is as much of a problem for Chinese parties: weak enforcement deters them from adopting or developing new technologies, through the assumption that other companies will soon copy it.

A lack of trust and understanding concerning IPR issues is holding developed countries back from collaborating with China: Chinese wind turbine manufacturers still use ten year old technology due to foreign manufacturers’ unwillingness to share patents. While the attitude of top officials to the problem of IPR enforcement has been called ‘encouraging’ however²², the situation is likely to change only gradually, and IPR will remain a collaborative area requiring a great deal of resource commitment and investigation on a case-by-case basis by foreign partners.

²² Baker and Mackenzie, 2007, p.59

6. Recommendations for Future Collaboration

Collaboration is not an easy option, and international collaboration, as we saw in the previous chapter on its limits is harder still. The complex and challenging nature of China's international environmental collaboration is equal to its importance. In this chapter we set out which collaboration methodologies could be most effective for China, which climate change mitigation policies should be jointly developed, and how.

6.1 Collaboration Methodology Recommendations

This paper lacks the necessary scope for a full discussion of collaborative methodologies, and can only allude to those techniques the authors think most useful for China's journey in international environmental collaboration. Chris Huxham and Siv Vangen's book, *Managing to Collaborate: The Theory and Practice of Collaborative Advantage*, sets out an exhaustive methodology for effective implementation of collaborative theory. If we consider the problems of collaboration as set out in the previous chapter, and draw upon the lessons from Huxham and Vangen's practical research, some important but generalised recommendations can be made.

The most effective collaboration methodologies are those that:

1. Accept tension and 'good enough' solutions in order to make progress.

Collaborators should 'accept that coping with multiple dilemmas of management is 'reality''.²³ This is especially important for a problem as complex as climate change

²³ Huxham and Vangen 2005 p226

mitigation where countless stakeholders are competing for what often seem like irreconcilable differences; there will of course be no ‘magic bullet’ to China’s environmental problems.

2. Attempt to bring everyone’s aims into the open, and to clarify motivations. China and the world must have a clear understanding of each other’s goals if the complex reality of collaboration is to have any chance of success. This is particularly important if our next recommendation is to work
3. Commit enough resources to trust building. This technique may not appear to bear much fruit initially, but it is particularly important for western collaborators to invest in trust building, since it is something the Chinese do naturally.
4. Appeal to the selfish side of collaborators, and in doing so, encourage unintended creative and altruistic results. China is seeking technology transfer to further its clean technology industry, but this is not a zero-sum game and Chinese technological progress will yield many unexpected benefits.
5. Ensure as many of the six main reasons in the decision to collaborate are addressed as possible: access to resource, risk mitigation, efficiency, learning and the moral imperative. These seem to be fairly easily included in most international collaborations concerning climate change and China, but it is worth being specific about them.

6.2 Policy and Technological Recommendations

China already has a range of international policy collaborations, many of them aimed at policy design and reform. Foreign governments, international governmental organisations, international non-government organisations and multinational companies all have partnerships with Chinese ministries on energy and carbon emission issues. Worthwhile as these partnerships are, a deeper level of collaboration is needed, one that is more inclusive and wider ranging and that can act as a structure to an increasing number of more concentrated collaborations. China and the world must forge wider-ranging forms of collaboration in technology and policy, so that collaboration is the norm rather than the exception.

Technology and policy recommendations for China's international collaboration efforts could fill many volumes of academic texts. A more useful exercise is to use our exploration of China's efforts to discover what kind of collaborative practice can galvanise China and the world into making the kind of paradigm-changing leap towards wholesale climate change mitigation. These kinds of practices are cross-disciplinary, international and on-going. Elements which could make up this type of new collaboration are carbon trading, the clean development mechanism, ETS and CCS, all of which are valid collaboration efforts on their own, but need to be coordinated in a fashion that allows for aggregative achievement to be much greater than constituent parts.

China requires a coordinated collaboration effort if it is to work with the rest of the world to achieve its environmental aims. Policies therefore need to concentrate not just on the nuts

and bolts of technical climate mitigation, but on combining the disparate government institutions, state-owned companies, private companies, and civil society actors into a network which not only eliminates overlapping areas of work, but also harness creativity to make progress on a complex and often intractable issue.

6. Conclusion

China is undoubtedly making steady progress in the direction of climate change mitigation: energy efficiency is improving, well thought out environmental laws are on the statute book and public and private recognition of the problem is growing. However, time is short, and the world is already nearing the ‘tipping point’ at which climate change causes unpredicted effects and global temperatures rise at an unprecedented rate. China’s efforts towards climate change mitigation require not only more international collaboration, but better and new forms of collaboration.

Any new form of international collaboration that China may attempt has to be well planned and executed; climate mitigation faces the problems of world economic recession, vested business interests and the difficulties of government coordination. In order for strong and effective collaboration to take place, various factors must come into play at once: the most pressing challenges must be identified and measured, the value of collaboration methodology for creating solutions for climate change must be demonstrated, lessons have to be drawn from previous and current attempts at international collaboration, including the limits and problems associated with collaboration, and finally a plan should be drawn up with China to allow for a coordinated international collaborative attempt at climate change.

China’s new plan for international collaboration will have to combine the most successful elements of past collaboration efforts detailed in Chapter 4, in terms of bilateral governmental collaboration, supra-governmental collaboration, company to company collaboration, and collaboration between academia, government and business. The greatest

threat to modern society requires China to develop a new paradigm of aggregated international collaboration.

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