Decarbonization Pathways Using Information and Communication Technology: The Climate Group's SMART 2020 Initiative

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SMART 2020 is an initiative of The Climate Group, a not-for-profit organization, which is seeking to reduce greenhouse gas emissions through the application of information and communication technologies (ICT) to improve energy efficiency in sectors like energy, transportation, buildings and industry. A SMART 2020 report published in 2008 contended that ICT improvements could lead to a 15% reduction in global greenhouse gas emissions by 2020. This paper analyzes The Climate Group's SMART 2020 initiative for its potential to address climate change by acting as a pathway to decarbonization. Addressing climate change by shifting to a low-carbon future will require destabilizing carbon lock-in. Given the entrenchment of carbon in current systems, multiple pathways will need to be developed at multiple scales simultaneously to achieve decarbonization. In this paper, I analyze one case that has the potential to act as such a pathway. Using public documents, media reports, and interviews with key participants in the program, I examine how the Climate Group's SMART 2020 initiative emerged and the ways in which it has scaled up or enabled entrenchment of new technologies, policies, institutions and behaviours. The analysis of the history and trajectory of SMART 2020 uncovers the barriers to decarbonization as well as the possible pathways to systemic change that SMART 2020 may catalyze.

1. Introduction

Innovative applications of information and communication technology (ICT) could have a transformative impact on energy and greenhouse gas emissions. Examples of applications include automated systems in building that increase energy efficiency and smart meter technology to support the integration of renewable energy technology in electricity grids. The greenhouse gas emission reduction potential of ICT technology innovation has been quantified in the power generation and transportation sectors as approximately 7.8 GtCO22, or 15% reduction of global greenhouse gas emissions, by 2020 based on a business as usual projection (The Climate Group, 2008). This potential comes from both energy efficiency opportunities within the ICT industry and from the application of ICT to other sectors such as transportation and buildings in order to achieve increased energy efficiency in those sectors (The Climate Group, 2008). Additional literature on the carbon abatement potential of ICT has focused specifically on areas like smart meters (Hoenkamp, Huitema, & de Moor-van Vugt, 2011; Darby, Strömbäck, & Wilks, 2013), energy efficient buildings (Stoll, Bag, Rossebø, Rizvanovic, & Akerholm, 2011) and transportation (Black & Geenhuizen, 2006). Given this emission reduction potential, why has the implementation of ICT technologies proceeded slowly? Like in many sectors, decarbonization has not taken place in the ICT sector despite detailed knowledge both on the implications of climate change impacts and extensive technical capacity for low-carbon technologies (Bernstein & Hoffmann, 2013). This paper forms a part of a larger research project seeking to understanding both the obstacles to decarbonization, and the causal mechanisms that could trigger multiple pathways to decarbonization (Bernstein & Hoffmann, 2013). To this end, this paper develops a case study of SMART 2020, an initiative of the not-for-profit organization The Climate Group that seeks to advance the implementation of information and communication technology (ICT) in applications that reduce greenhouse gas emissions.

In this paper, I will first present a descriptive picture of the SMART 2020 initiative, analytically describing the emergence and evolution of the initiative as well as the activities undertaken by the initiative. Secondly, this paper will present preliminary analysis on the interim mechanisms of transformation (normalization, capacity building, and coalition building) and their observable traces through scaling and/or entrenchment. This analysis is based on (as yet preliminary) interviews with practitioners in the SMART 2020 initiative and the ICT technology sector.

2. Theoretical Framework

The shift away from fossil fuel entrenchment in society could be characterized as a transition to new socio-technical systems. In the socio-technical transition literature, it is theorized that it is the interactions between a nested hierarchy of three levels of forces (the landscape made up of large-scale cultural and political forces, socio-technical regimes made up of sets of rules, and niches or protected space where innovation occurs (Smith, Voß, & Grin, 2010)) that cause systems to change (Geels & Kemp, 2007; Smith et al., 2010). This multi-level perspective on socio-technical transitions has been criticized for ignoring political and governance aspects of socio-technical transitions (Meadowcroft, 2009). To address this lacuna, analysts have incorporated complex adaptive systems theory and theories of governance to socio-technical transition approaches in a framework called transition management (Burch, Shaw, Dale, & Robinson, 2014; Loorbach, 2010). Socio-technical transition and governance can be drawn together in the purposive politics of transition management with the recognition that "political action provides a channel for society to exert 'selective pressure' on existing socio-technical regimes—pressure that can help propel their transfiguration into patterns that more successfully fulfill collective aspirations" (Meadowcroft, 2009). The purposive politics of transition management necessitates the consideration of governance mechanisms in analyzing socio-technical transitions. However, the preceding literature does not posit specific causal mechanisms for how we might get from governance experiments in niches to extensive low-carbon socio-technical

system change. What does effective “political action” and “selective pressure” (Meadowcroft, 2009) look like?

In addition, the impact of climate governance experiments like SMART 2020 has not yet been ascertained in either material or governance terms (Castán Broto & Bulkeley, 2012; Hoffmann, 2011). It is difficult to assess the effectiveness of climate change interventions because it is early in their development, but it is not feasible to wait until outcomes are well-developed because by that time it may be too late to try a different approach (Levin, Cashore, Bernstein, & Auld, 2012). Though some interventions have internal goals or indicators of progress, analysis focusing on these measures assumes that experiments have found the path to decarbonization. Interventions are explicitly experimenting with social and technical innovations that are not proven and so internal measurements of success (e.g. number of companies participating in a cap and trade market, number of cities participating in transnational governance networks, etc.) are not inherently indicators of progress toward decarbonization. Instead, assessments of effectiveness must engage with an intervention's potential to catalyze a pathway to decarbonization. Decarbonization is the reversal of the entrenchment of fossil-fuel energy systems that has resulted from the co-evolution of technological and institutional systems in industrial economies or “carbon lock-in” (Unruh, 2000). Carbon lock-in creates a policy inertia that makes it difficult to make systemic change. In order to overcome the fossil fuel dependence of society's technological and institutional systems, decarbonization will need to take place along multiple pathways spanning across society (Levin et al., 2012). Society’s global and individual systems are currently locked-in to a high carbon state, but, importantly, there are three possible future states for these systems: 1) Reinforced carbon lock-in, 2) Improved carbon lock-in (more efficient, but still locked into a high carbon system), or 3) Decarbonization. This paper is one case study for a larger research project analyzing how proposed transformation mechanisms trigger decarbonization pathways – or trigger reinforced or improved carbon lock-in pathways (Bernstein &

Hoffmann, 2013). Bernstein and Hoffmann (2013) propose scaling and entrenchment as conditions that contribute to whether or not transformative pathways are built. Scaling and entrenchment are the observable traces of transformation used in this framework in the interim, connected to the proposed transformation mechanisms of normalization, capacity building and coalition building. These mechanisms may help explain the 'how' that is missing from transition management.

Literature on scaling up of innovations has an extensive history across environmental policy literatures, such as, for example, pathways for state environmental policy to expand globally (Bernstein & Cashore, 2012). Hoffmann (2014) provides an expanded articulation of scaling by highlighting four varieties of scaling: simple scaling, self-organized scaling, modular, and isomorphic scaling. Simple scaling is the process by which an intervention grows larger or extends its influence by adding members or activities. Self-organized or ecosystem scaling takes place when an intervention creates an opportunity or governance niche for a new initiative that is not necessarily directly related. Modular scaling takes place when a new initiative is developed that emulates or learns from an existing initiative. Finally, isomorphic scaling consists of multiple, similar experiments being developed at the same time in various contexts due to the same structural pressures (Hoffmann, 2014) .

In conjunction, the literature on entrenchment of policy changes highlights mechanisms that could be used to achieve low-carbon path-dependent processes. Levin et al. (2012) the importance of the durability of changes, the expansion of populations the changes cover, and the impact of progressive incremental changes for transformative effects in considering how a policy becomes more durable over time (Levin et al. 2012). Levin et al. (2012) propose four pathways for entrenchment. *Lock-in* occurs when a policy has immediate durability for structural or institutional reasons. *Self-reinforcing entrenchment* occurs when the costs of reversing the intervention increase over time, which can take place when people would lose invested resources if the policy was reversed (Levin et

al., 2012). *Increasing returns* occurs when people gain increasing benefits from the policy and reversal would result in a loss of those benefits (Levin et al., 2012). Finally, *positive reinforcement* takes place when people choose to join the target population of the policy, reinforcing the original target population (Levin et al., 2012). The scaling and entrenchment mechanisms described here may be important causal mechanisms catalyzing pathways to decarbonization (Bernstein & Hoffmann, 2013).

3. Carbon abatement through ICT innovation

In 2008, the SMART 2020 report from the climate group and GeSI quantified the greenhouse gas emission reduction potential of ICT technology innovation in the power generation and transportation sectors as approximately 7.8 GtCO22, or 15% reduction of global greenhouse gas emissions by 2020 based on a business as usual projection (The Climate Group, 2008). A subsequent follow up report, published in 2013 by GeSI without The Climate Group, increased that estimate to 9.1 GtCO2e by 2020, or a 16.5% greenhouse gas emission reduction (GeSI, 2013). This emission reduction potential can be found both in the ICT industry itself through more energy efficient products and reduced energy use from industry operations (reducing the energy use of large computer servers, for example), and from the application of ICT to other sectors like transportation and buildings in order to achieve increased energy efficiency in those sectors (The Climate Group, 2008).

Literature on the carbon abatement potential of ICT has focused on areas like smart meters (Hoenkamp, 2011; Darby et al. 2013), energy efficient buildings (Stoll et al., 2011), and transportation (Black & van Geenhuizen, 2006). ICT enabled monitoring of energy through smart meters allows for detailed information to be gathered about electricity supply and demand. In this way, demand can be matched more precisely to increase efficiency and allow the grid to better integrate electricity from

intermittent renewable sources like sun and wind (Hoenkamp, 2011). Darby et al. (2013), for example, quantify carbon dioxide reduction potential from smart grid development as up to 7% in Spain, 8% in Great Britain and Portugal, and 13% in France. Other literature has focused on ICT applications in buildings to increase efficiency, such as through active interaction between the electricity consumer and the utility (Stoll et al., 2011). However, Moyer and Hughes (2012) caution that widespread ICT implementation will lead to a rebound effect due to increases in electricity demand and increased competition of fossil fuels with new renewable energy, which undercuts ICT's carbon reduction potential. Nonetheless, they conclude that the net impact of ICT implementation will still be greenhouse gas emission reduction and the rebound effect could be counteracted with a policy like a tax on carbon (Moyer & Hughes, 2012). In short, ICT implementation has been linked to economic growth (Hagén, Glantz, & Nilsson, 2008; Moyer & Hughes, 2012) and, therefore, ICT implementation may simply lead to high-carbon growth unless larger socio-economic low-carbon transition processes and policies are also in place.

4. History of SMART 2020

This paper develops a case study of a climate experiment intervention called SMART 2020. The SMART 2020 initiative seeks to advance and support the implementation of information and communication technology (ICT) in applications that reduce greenhouse gas emissions. Examples of applications include automated systems in building that increase energy efficiencies and smart meter technology to increase the energy efficiency of electricity grids and develop their ability to integrate renewable energy technology. SMART 2020 is one of many initiatives driven by The Climate Group. The Climate Group is a not-for-profit organization focused on inspiring and catalyzing leadership for a low carbon future. The organization maintains a membership of large companies and states and regions; their sub-national government partners represent ½ billion (or 1 in 14 people) and corporate members have combined revenue of $1 trillion USD (The Climate Group, 2014a). The Climate Group

was founded in 2004 and has operations in China (Beijing and Hong Kong), Europe, India and North America (The Climate Group, 2014b).

Origins

The SMART 2020 initiative launched in 2008 with the release of the SMART 2020 report (The Climate Group, 2008). The Climate Group, on behalf of the Global e-Sustainability Initiative (GeSI), published this report, in which analysis was completed by McKinsey. The report claimed that it is possible to save 15% of global greenhouse gas emissions in 2020 through the ICT sector (The Climate Group, 2008). ICT-enabled solutions can be applied to sectors like transportation, buildings, logistics, telework and telepresence to improve energy efficiency.

The original SMART 2020 report focused mainly on energy efficiency applications of ICT technology in areas like motor systems, logistics and transportation, building design construction and operation, and smart grids (The Climate Group, 2008). The report focused on just a subset of potential applications of ICT technology for greenhouse gas mitigation. It left out, for example, deforestation where better satellite and mobile data collection technology could have a large impact. These applications were knowingly left out in favour of applications where a market opportunity was likely to be a significant lever instead of an expected dependence on government regulation[1]. As the next section describes, the type of ICT activity that was targeted for innovation shifted over time away from these energy efficiency applications. When the original SMART 2020 report was released in 2008, the updated Intergovernmental Panel on Climate Change report had been recently released in 2007 and *The Economics of Climate Change: The Stern Review* (Stern, 2007) had also been recently released. The SMART 2020 report mentions both documents. In addition, to set the political global governance context, the SMART 2020 report also expresses hope that the targets in the Kyoto

[1] Author Interview, May 7, 2014

Protocol would be met, mentions various greenhouse gas emission reduction targets from the Kyoto Protocol specifically, and it suggests that business will have to adapt to the resulting pressure from government (The Climate Group, 2008).

SMART 2020 Activities

The SMART 2020 initiative went through a few stages over the next several years, but the activities under the intervention focus on 1) demonstrating the environmental and economic opportunity of carbon abatement using information and communication technology through reports and case studies, 2) efforts to influence policy nationally and internationally to support ICT, and 3) accelerating solutions deployment in cities and regions (The Climate Group, 2014c).

First, The Climate Group works with other partners to highlight the opportunities that exists both in terms of market opportunity and environmental opportunity for greenhouse gas emission reduction (The Climate Group, 2014c). The Climate Group co-publishes reports, case studies, and maintains websites as a part of the SMART 2020 program. The demonstration of opportunity is targeted at private businesses and city governments and feeds into The Climate Group's efforts to accelerate solutions. As was previously described, this work began with publishing the SMART 2020 report in 2008. In 2009, The Climate Group published a short report called SMART 2020: Pathways to Scale that highlighted specific case studies and pilots that were posted on the smart2020.org website (Webb, 2009). This follow up report begins to target government policy to support ICT expansion with the following recommendations: 1) Provide real-time energy information for all 2) Develop a global set of 'smart grid' standards for open communications and interoperability 3) Set policies for 40% energy efficiency in all sectors, and 4) Develop pilot projects for market transformation in urban areas (Webb, 2009). Also in 2009, the GSM Association (representing mobile operators worldwide), with support of The Climate Group, published Mobile's Green Manifesto, which set out how the mobile industry

planned to lower its greenhouse gas (GHG) emissions (GSMA, 2009). The reports in 2008 and 2009 emphasized the opportunity for the ICT industry. In 2011, The Climate Group began to develop reports demonstrating the opportunity from the perspective of cities instead. In 2011, The Climate Group published the Information Marketplaces report, in partnership with Accenture, Arup and Horizon (The Climate Group, 2011c). The report investigates the economics of smart cities, and how technology can be used in cities to meet the growing challenges of expanding urbanization. The Agile Cities Report was published in 2013 as a part of the Agile Cities Partnership (The Climate Group, CityMart, Metropolis, & Technology Strategy Board, 2013). The report is framed with the finding that although cities are aware of the opportunities to become 'smart' by using ICT to enable and provide city services, they are not particularly 'agile', defined as fast and flexible in identifying challenges and procuring innovative solutions from the ICT sector. The report looked at challenges, actions, and barriers reported by 50 cities. Over the first few years of operation of the SMART 2020 initiative, The Climate Group shifted focus from demonstrating the opportunity to the private sector looking to sell ICT solutions, to demonstrating the opportunity to cities that could buy ICT solutions.

Second, the Climate Group participates in policy development related to ICT (The Climate Group, 2014c). Broadly speaking, The Climate Group works with private sector partners to influence national or international policy or industry norms. From 2009-2012, Google and The Climate Group worked with a group of companies to open up access to energy information, contributing to the development of the Green Button policy (The Climate Group, 2014c). In addition, ICTs for Sustainable Energy Partnership (ISEP) has committed to supporting policies attempting to double energy efficiency and renewables using ICT innovation (ISEP, n.d.). ISEP is an initiative under the umbrella of the UN's Sustainable Energy For All (UNSE4All)[2], which is an action-focused global network launched by UN Secretary-General Ban Ki Moon. Recognizing that the ICT industry cannot overcome barriers

[2] http://www.se4all.org

to implementation on its own, ISEP is creating a global platform and country specific projects to attack the barriers. ISEP is a partnership between The Climate Group (which will provide the secretariat), The Digital Energy & Sustainability Solutions Campaign, the Center for Climate and Energy Solutions and the UN Foundation (The Climate Group, 2014c). The activities of ISEP include information provision (case studies, methodologies, educational materials to influence government policy) and demonstration of ICT-enabled solutions. The current commitment was made in 2012, and they expect to report on initiatives in 2015 (ISEP, n.d.).

Third, SMART 2020's focus on accelerating ICT solutions deployment emphasizes connecting private sector business opportunity with public, sub-national government needs for technological innovation for greenhouse gas emission reduction (The Climate Group, 2014c). The main approach is enabling pilot projects and facilitating their subsequent scaling up. These efforts began when SMART 2020 took over Cisco's existing program called the Connected Urban Development (CUD) Alliance of cities in June 2010. Connected Urban Development brought together ICT companies and cities and provided resources to support the implementation of ICT pilot projects in the cities. Seven pilot projects were constructed.[3] It is now inactive, but many of the original partners are now involved in the other sub-programs of SMART 2020. Another initiative, the Climate Smart Precincts Program, was launched after the Climate Smart Precincts report in identified principles for 'climate smart' development (The Climate Group, 2011b). The program was originally launched in Australia and it has developed into an initiative in Australia with corporate partners and state governments South Australia, Queensland and Victoria to test replicable policies in precincts before they are scaled up. The Climate Group is also accelerating ICT solutions deployment as a part of The China Redesign Program, launched in March 2011 (The Climate Group, 2011a). A major part of the program is bringing ICT expertise into city development strategy and projects that deliver China's 5 Year Plan's

[3] Author Interview, May 7, 2014

low carbon objectives. This is a three-year program focuses on five specific cities. The program plans to offer capacity building for city management, demonstration projects, and "scaling-up the deployment of low carbon technologies and their associated regulatory and finance solutions" (The Climate Group, 2011a). In addition, the Agile Cities partnership was announced in early 2012 between The Climate Group and social enterprise CityMart, city association Metropolis, and the UK Technology Strategy board. The Agile Cities Partnership is framed by The Climate Group as the second phase of testing ICT-enabled solutions in cities after the disbandment of the Connected Urban Development Alliance of Cities and it aims to improve the transparency of the city services market opportunity, enable innovation, and ideally shorten the time and money required to deploy sustainability solutions in cities. A report called 'Faster, Smarter, Greener: The state of city innovation on climate change and other urban challenges' compiled the results from a survey to 50 cities on their challenges, how they are finding solutions, and what barriers they find in implementing those solutions (The Climate Group et al., 2013). Large cities listed environmental issues as their biggest challenges and small cities listed economic development (The Climate Group et al., 2013). Furthermore, the LLGA Cities Pilot the Future Awards (run by Citymart with the participation of the Agile Cities Partnership) launched in 2009. In the award process, cities issue 'smart cities' challenges in the areas of citizen participation, energy, social inclusion and empowerment, and private businesses respond with solutions that could be piloted in the city if they are chosen. The awards have supported global cities to publish 60 challenges and 20 pilots have been completed or are underway with an additional 24 pilots in planning (CityMart, 2014a). The cities issue the calls and are involved in the judging process, but do not pay for the pilot's implementation; the award winning solution provider is responsible for finding their own funding. One of the eight selection criteria is international scaling potential since the goal of the awards is scaling up widely beyond the pilot implemented through the awards process (CityMart, 2014b). The Climate Group also added a special award outside of the city

challenge awards - the Revolutionary Low Carbon Leader award - to highlight a company that is disrupting our energy systems using information technology (The Climate Group, 2013).

Evolution of SMART 2020 Activities

The work of SMART 2020 can be separated into four phases with respect to the changing emphasis from a focus on the ICT industry to a focus on accelerating the implementation of (pilot) solutions, particularly in cities.

Phase 1 – SMART 2020 Report

In this phase, SMART 2020 worked with the ICT industry to develop markets for specific technologies for energy efficiency. Cities were not emphasized in this phase. Instead, the Climate Group worked with ICT businesses like Cisco and consulting firms like Arup to quantify the market opportunity of ICT innovation for carbon abatement in a number of sectors (The Climate Group, 2008). The private sector partners were highly responsive to these efforts and were very interested in both the market and the environmental opportunities.[4] Businesses like Cisco engaged in work with The Climate Group through their Corporate Social Responsibility departments during this early phase.[5] Though industry was quickly on-board, in the early stages there was no clear market, which led The Climate Group and the ICT industry to cities.

Phase 2 – Integrated Systems in Cities

The SMART 2020 initiative developed a focus on cities because 1) there was political will expressed by mayors to work on this issue 2) cities present opportunities to intervene in socio-technical systems in an integrated manner, which offers the most effective application of energy

[4] Author Interview, May 7, 2014
[5] Author Interview, May 14, 2014

efficiencies 3) cities offer big markets for ICT companies and 4) because an increasing number of people live in cities, which means that interventions that increase energy efficiency for cities will have a larger impact in energy and greenhouse gas terms.[6] Industry and cities were convened through sub-initiatives like the Connected Urban Development Program.

During this phase, the industry advanced technological solutions developed during the first phase. They often proposed to overhaul the whole energy system of a city at once and proposed dashboards offering significantly increased central management and control to allow for achievement of efficiencies in sectors across the city.[7] The ICT companies also began to move their participation from the CSR department to the sales team and began to develop it as a business area.[8] Obstacles were encountered in this phase because cities were not able or willing to implement the technologies on the scale proposed by the companies, and they tended to prefer incremental projects and pilot projects.[9] An interview characterized this phase as "supplier-led"[10], where industry attempted to tell the city what they should buy with ineffective feedback on what the city was able or willing to buy. These obstacles, in addition to the end of the resources that supported the program, resulted in the disbandment of the Connected Urban Development program.

Phase 3 – Push-Back on Technological Approach

The wholesale overhaul of energy systems and the establishment of elaborate energy monitoring and control devices embedded more broadly and deeply into people's lives triggered concerns about power and democracy. Many people responded to the previous phase by arguing that

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[6] Author Interview, May 7, 2014
[7] Author Interview, May 7, 2014
[8] Author Interview, May 14, 2014
[9] Author Interview, May 7, 2014
[10] Author Interview, May 7, 2014

transition should happen, but how it would happen and exactly what would be implemented technologically had to be "driven by people".[11]

In this phase, the SMART 2020 program shifted to try to emphasize a more "demand-led"[12] model, where cities were placed more centrally in networks and partnerships and asked more directly what kinds of challenges they were looking to address using ICT innovation. To this end, SMART 2020 became involve in the Agile Cities partnership (The Climate Group et al., 2013). The other partners were more focused on innovation in city services more generally, but The Climate Group attempted to inject the SMART 2020 focus on low-carbon outcomes into the partnership.

Phase 4 – Citizen Engagement

The discourse on the transformative potential of ICT technology interventions shifted from an emphasis on energy efficiency in Phase 1 to a broader definition by Phase 4 that could mean better data usage and increased public engagement with local government.[13] In particular, the term 'Smart Cities' began to encompass any efforts to implement innovative ICT technologies in cities and began to emphasize ICT applications aimed at increasing citizen engagement. This shift grew out of the push back to the technological approach and a broadening of the coalition to include individuals and organizations interested in open data and grassroots participation in governance. In this usage, the concept of 'Smart Cities' and related ICT technologies can be applied in a number of ways, including many applications that have little to do with energy efficiency and urban sustainability. In the LLGA Cities Pilot the Future awards that the SMART 2020 initiative participated in, for example, cities are asked to asked to issue challenges with solutions that will "improve the lives of their citizens"[14] and

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[11] Author Interview, May 7, 2014
[12] Author Interview, May 7, 2014
[13] Author Interviews, May 14, 2014, May 7, 2014
[14] http://www.llga.org

challenges related to energy efficiency in cities co-mingle with challenges to enable local governments to better engage with their citizens.

Future Prospects

The emphasis on cities has drifted from the core mission of The Climate Group and its focus on companies, states and regions, so the next phase of SMART 2020 will likely be housed in a different institutional location. This may involve splitting some of the other work on ICT policy and national/international governance work through the ICTs for Sustainable Energy Program to maintain this work in The Climate Group, and organizing the solutions deployment in cities work to another governance structure like a city network.[15]

5. Observable Traces of Transformation

5.1. Scaling

Scaling up is demonstrated in the simple scaling of both implemented pilots and simple scaling of participants in networks.

Pilots

A major focus of the SMART 2020 initiative is the development and testing of pilot projects in niches to accommodate experimentation with new applications of technology. ICT solutions for carbon abatement have been piloted in a number of cities as a result of the SMART 2020 initiative. The Connected Urban Development program resulted in 7 pilots and the Agile Cities work with CityMart has resulted in 20 pilots, demonstrating simple scaling (Hoffmann, 2014) in the number of pilot projects. However, the next stage of scaling up from pilots to programs is not yet achieving success. A

[15] Author Interview, May 7, 2014

City of Bristol representative identified this stage of scaling as a key problem that they had not yet been overcome.[16] On an aggregated level, it is difficult to tell if anything significant is actually happening on the ground in cities with ICT to catalyze low carbon transitions. A progress report issued by the transnational municipal network C40 Cities in early 2014 (C40 Cities & Arup, 2014) provides some quantified insight into ICT action in cities specifically. C40 Cities reports that ICT action is increasing and comments on the rise of 'Smart Cities' as a new and growing concept: "There has been a significant focus on the concept of 'smart' cities - the use of information technology to increase the efficiency and effectiveness of urban systems - since the inaugural 2011 survey, and the 2013 report logs an increase in activity in this area" (C40 Cities & Arup, 2014). That being said, the number of ICT actions is not large; 348 of over 8000 reported actions, which is 4% of all reported actions. It is important to note that the scale of an action could vary and the actions are self-reported from the cities. The most prevalent actions included in this statistic focus on data accessibility and are not necessarily conducive to decarbonization: increasing wireless hotspots, increasing access to internet connection, and increasing public access to computers (C40 Cities & Arup, 2014).

The implementation of actual on-the-ground ICT solutions did proceed slower than The Climate Group originally thought that it would when they published the SMART 2020 report[17], but it is difficult to actually quantify the impact of attempts to innovate with ICT for carbon emission reduction. However, early work through the SMART 2020 Report created opportunities for new discussions and partnerships between the private sector, the not-for-profit sector and sub-national governments.[18] It catalyzed a foundation for normalization by triggering discussions between these actors about what a low-carbon city might look like, creating the space to envision and negotiate what a new low-carbon city might be.

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[16] Author Interview, June 6, 2014
[17] Author Interview, May 7, 2014
[18] Author Interviews, May 7, 2014, May 14, 2014

Scaling Up the Coalition

The SMART 2020 program increased the reach of the network through partnerships. Combining the language of both scaling and coalition building, SMART 2020 scaled up its supporting coalition. Rather than adding new members directly, The Climate Group built partnerships to access other like-minded networks. At first, partnerships and networks were accessed to develop the business opportunity of ICT upgrades in cities. However, when businesses encountered too many barriers to pull this lever on their own, The Climate Group began participating in more city-oriented networks to become more active in troubleshooting barriers and brokering city-business relationships. In these partnerships, SMART 2020 specifically advocated the opportunities offered by ICT for greenhouse gas emission reduction, even in situations where it is not necessarily the focus of the other partners. The SMART 2020 program reached an increasing number of organizations through the expansion of network participation, however, as sections 5.2 and 5.3 elaborate on, this expansion may have moved the focus of the coalition's work away from decarbonization.

5.2. Power and Politics in Low-Carbon Transitions

Early work to decarbonize cities using ICT through the SMART 2020 initiative used a technical focus and fostered mainly technical/commercial oriented partnerships. These coalitions did trigger some successful pilot projects in cities themselves and did achieve some expansion of the partnership to other technical and commercial partners. The partnerships appeared to function well during early exploratory stages where the market was being established. At a certain point, however, this scaling up of activities triggered a counter coalition from other actors who were not involved in the intervention's activities. The key element of concern was the lack of consideration of democracy and power in the technological solutions proposed by the technical/commercial partnerships.

In this case, a technical focus was inadequate to catalyze a broad transition in urban energy systems using ICT innovations. Concerns were raised about precisely *who* was transitioning *what*. As has been suggested in the transition management literature, governance and power must be explicitly included to understand socio-technical transitions for sustainability. Early efforts in the SMART 2020 program followed a path similar to much of the work in the socio-technical transition literature with a marked focus on the material dynamics of transition. Using this approach, the initiative could only scale up and build a supporting coalition to a certain point before external actors questioned the lack of reflexive treatment of power in the proposed solutions. Supporting the theoretical arguments advanced in transition management literature, in this case politics and power were clearly important aspects of transition.

Nonetheless, the swing from a technological orientation to a social and governance orientation was made in such as way that it actually changed the goals. Efforts to incorporate democracy shifted the discourse such that the process of engagement replaced the outcome of low-carbon cities as the end goal. Though those involved with SMART 2020 are still focused on low-carbon outcomes, the ICT innovation space and popular 'smart city' discourses into which much of this work now falls for practitioners has an expanded participant population that appears to now associate energy efficiency ICT technology with undemocratic, technocratic intervention. ICT to enable citizen empowerment is therefore often targeted instead, employing the logic that empowered citizens will be more engaged in policy, therefore the policy is more likely to be environmentally friendly, therefore implemented actions are more likely to be environmentally friendly, including lower-carbon.[19] Though this chain of impact seems tenuous, it is important to note that many city politicians have taken up this citizen participation discourse enthusiastically since it provides language to communicate the value of ICT to citizens in a way that technical energy efficiency discourses could not accomplish. Overall, it begs the question,

[19] Author Interview, May 7, 2014

how can one approach a low carbon transition democratically without substituting democracy as the intended outcome instead of low-carbon transitions?

3. Coalitions

The partnership-building efforts of SMART 2020 went through three stages. After building a partnership focused primarily on the ICT industry, the SMART 2020 program found that there was no market uptake for the industry's supply. This led to shift from industry to cities as a targeted market for ICT energy solutions. Though industry was still involved in the new formal coalition, the dynamics were more driven by the supply side than the demand side in this market-based approach to low carbon transitions. The third stage was triggered after this market-based approach was criticized for its technological and commercial focus. New partners in the social enterprise and open data sectors joined the broad 'smart cities' coalition, bringing a new focus on citizen engagement with broader political support. Again, industry and city governments remained involved in the coalition, but the goals of the coalition shifted.

As is demonstrated in this pattern of coalition development, gaining buy-in from an expanded population can become an end in itself. In this case, broadening the coalition went hand in hand with shifting the goals of 'smart city' transitions. This created broad partnerships through which SMART 2020 could attempt to inject decarbonization normative goals, however it has resulted in dilution of 'smart cities' such that the term is "nearly useless".[20] Most recently, it is ICT technology and open data ideas that seem to be scaling most successfully through this coalition, not decarbonization through ICT innovation for energy efficiency.

6. Conclusion

[20] Author Interview, May 7, 2014

This paper presented a preliminary analysis of The Climate Group's SMART 2020 initiative for its potential to address climate change by acting as a pathway to decarbonization. Addressing climate change by shifting to a low-carbon future will require destabilizing carbon lock-in. Given the entrenchment of carbon in current systems, multiple pathways will need to be developed at multiple scales simultaneously to achieve decarbonization. Like in many sectors (Bernstein & Hoffmann, 2013), decarbonization has not taken place in the ICT sector despite detailed knowledge both on the implications of climate change impacts and extensive technical capacity for low-carbon technologies. In this paper, I examined how the Climate Group's SMART 2020 initiative emerged and the ways in which it has scaled up or enabled entrenchment of new technologies, policies, institutions and behaviours.

In this case study, an early stage focus on the technical aspects of ICT innovation for greenhouse gas emission reduction was inadequate to catalyze a broad transition in urban energy systems using ICT innovations. Early technical/commercial partnerships developed pilot projects in niches in cities, but the scaling up of their activities triggered a counter coalition from other actors who were not involved in the intervention's activities. The key element of concern was the lack of consideration of democracy and power in the technological solutions proposed by the technical/commercial partnerships. The subsequent expansion of the coalition to include those with concerns resulted in a swing from a technological orientation to a social and governance orientation, however it was made in such as way that it actually changed the goals. Efforts to incorporate democracy shifted the discourse such that the process of engagement replaced the outcome of low-carbon cities as the end goal. As this demonstrates, gaining political support from an expanded population can become an end in itself, shifting the normative goals of the coalition.

Further research will be conducted to interview other individuals that participated in various stages of the SMART 2020 intervention, both directly and through partnerships, including

representatives from ICT industry, cities attempting to implement ICT, and additional representatives from The Climate Group and partners. This research will allow for an expansion on these findings.

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