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Power and Politics in Decarbonization Pathways: The Case of the Climate Group's Smart 2020 Initiative

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This paper presents a case study of The Climate Group's SMART 2020 initiative for its potential to address climate change by acting as a pathway to decarbonization within Bernstein and Hoffmann's (forthcoming) framework. 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. The paper examines 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 barriers to decarbonization as well as the possible pathways to systemic change that SMART 2020 may catalyze. The focus on the politics of decarbonization presents several important lessons, including that planned decarbonization pathways with an overemphasis on technological solutions may encounter political obstacles, obstacles to the expansion and success of decarbonization interventions can be overcome by harnessing political mechanisms, and efforts to leverage a political mechanism may redirect the substance of an intervention away from decarbonization. In addition, the case illustrates potential difficulties in trying to approach a low carbon transition democratically without redirecting the intervention to substitute democracy as the intended outcome instead of low-carbon transitions.

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EXECUTIVE SUMMARY

Innovation using new applications of information and communication technology can deliver energy efficiency through like smart meters, energy efficient buildings, and more efficient transportation. The Climate Group, an international environmental not-for-profit, argued that ICT innovation could deliver a 15% reduction of global greenhouse gas emissions by 2020 based on a business as usual projection (The Climate Group, 2008). The SMART 2020 program was designed to achieve that reduction and, in this way, develop decarbonization pathways using information and communication technology. This case study analyzes whether the SMART 2020 intervention appears to be catalyzing a decarbonization trajectory.

Decarbonization is the shift away from carbon-based energy systems and supporting governance designs. This shift must disrupt heavily entrenched carbon lock-in (Unruh, 2000), which is a fundamentally political endeavor (Bernstein and Hoffmann, forthcoming). To understand that endeavor, Bernstein and Hoffmann's (forthcoming) theoretical framework identifies causal mechanisms that function along pathways to decarbonization. In the framework, political dynamics of carbon lock-in are altered through three mechanisms: creating normative change (normalization), building capacity (through resources or by changing institutions) and coalition building. One outcome of these political mechanisms is that the intervention scales up and becomes more entrenched over time. The cumulative or catalytic impact of scaling and entrenchment can create three possible trajectories: 1) Reinforced carbon lock-in, 2) Improved carbon lock-in (more efficient, but still locked into a high carbon system), or 3) Decarbonization. A priori, given the substance of the intervention, it appears as though SMART 2020 would catalyze a system improving trajectory as it seeks to inject carbon abatement goals into information and communication technology innovation efforts, although at a slower pace and potentially more narrow scope than originally was envisioned. ICT innovation influenced by SMART 2020 could enable transformation by achieving energy efficiency and enabling the expansion of renewable energy generation, but only in the context of a much broader low carbon transition effort.

About SMART 2020

The SMART 2020 initiative sought to advance and support the implementation of information and communication technology (ICT) in applications that reduce greenhouse gas emissions. SMART 2020 is one of many initiatives driven by The Climate Group, which is a not-for-profit organization focused on inspiring and catalyzing leadership for a low carbon future. The SMART 2020 initiative was launched in 2008 and had developed through roughly four phases before the research was conducted in 2014. In the first phase, SMART 2020 worked with the private sector to develop understandings of ICT as a climate solution. Though industry was interested in both the market and the environmental opportunities this implied, in the early stages there was no clear market, which led The Climate Group and the ICT industry to target cities in the second phase. In the second phase, the SMART 2020 project helped to convene industry and cities since they recognized ICT application in cities as a high impact opportunity. In many cases, at this time the industry advanced technological solutions developed during the first phase. Obstacles were encountered in this phase because cities were often not able to implement the technologies on the scale proposed by the companies. Eventually some pilot projects were implemented. In the third phase, SMART 2020 shifted to try to emphasize a 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. More pilot projects were developed in cities. Around this time, concerns were raised about power and democracy in light of proposals to overhaul energy systems in cities and establish elaborate energy monitoring and control devices that would be embedded more broadly and deeply into people's lives. In the fourth phase, the discourse on the transformative potential of ICT technology interventions shifted to focus on better data usage and increased public engagement with local government. 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. A wider political coalition supports the citizen empowerment discourse than the original group that focused on energy efficiency. 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.

Political Mechanisms of Decarbonization

Capacity building was a major aspect of the SMART 2020 intervention. The program sought to develop skills, tools and knowledge to act among various groups in the ICT for carbon abatement sectors. Capacity building was evident in two main formats: research reports and pilot demonstration projects. Early stage capacity building in the ICT private sector was not enough to catalyze scaling and entrenchment, so capacity was also built amongst city officials to develop a market for ICT climate solutions. SMART 2020 created ***normative change*** in the ICT industry by re-conceptualizing ICT as a solution in a time when there was a lot of discussion about the high 'carbon footprint' of ICT due to energy use. However, normalization in the private sector was not enough since it was not common sense for any potential clients yet. The effort to normalize ICT as a solution to climate change expanded in order to target a client base. Normative change was again achieved (among city officials instead of the private sector) to link the idea of applying data and innovation to environmental problems in cities. The biggest role for the ***coalition building*** mechanism for this case was related to the contestation in the meaning of 'smart city'. A few years after SMART 2020 began, new actors in the social enterprise and open data sectors joined the broad 'smart cities' discursive space, bringing a new focus on citizen engagement that created broader political support. This created broad partnerships through which SMART 2020 could attempt to inject decarbonization normative goals, but it also diluted the meaning of 'smart cities'. At the same time, the shift in emphasis from energy efficiency to citizen empowerment in the interpretation of 'smart city' may be crucial for coalition building reasons. Citizen participation is what politicians are using to sell the value proposition of ICT upgrades in cities to citizens because it resonates in ways that energy efficiency never did.

Lessons Learned

- Obstacles to scaling and entrenchment can be overcome by harnessing political mechanisms (normalization and capacity building in this case), but the process is iterative. An intervention may have to build capacity in multiple stages as new groups of actors are targeted by the initiative, for example.
- Politics and power are important elements both in terms of the mechanisms that are moving interventions forward and in terms of the obstacles encountered by interventions. Planned decarbonization pathways with an overemphasis on technological solutions will

encounter political obstacles, like the contestation experienced in the search for political support in this case.

- An attempt to overcome obstacles by harnessing one of the political mechanisms can bring new challenges. In order to leverage a political mechanism (e.g. trying to gain political support by building broader coalitions), the substance of an intervention may be redirected from decarbonization.

INTRODUCTION

Innovation using new applications of information and communication technology can deliver energy efficiency through smart meters (Hoenkamp, Huitema, & de Moor-van Vugt, 2011; Darby, Strömbäck, & Wilks, 2013), energy efficient buildings (Stoll, Bag, Rossebø, Rizvanovic, & Akerholm, 2011) and more efficient transportation (Black & Geenhuizen, 2006). The potential for carbon abatement is significant. The Climate Group, an international environmental not-for-profit, argued that ICT innovation could deliver a 15% reduction of global greenhouse gas emissions by 2020 based on a business as usual projection (The Climate Group, 2008). The SMART 2020 program was designed to achieve that reduction and, in this way, develop decarbonization pathways using information and communication technology. This case study analyzes whether the SMART 2020 intervention appears to be catalyzing a decarbonization trajectory in cities.

Decarbonization is the shift away from carbon-based energy systems and supporting governance designs. This shift must disrupt heavily entrenched carbon lock-in, which is necessarily a political endeavor (Bernstein and Hoffmann, forthcoming). To understand that endeavor, Bernstein and Hoffmann's (forthcoming) theoretical framework conceptualizes causal mechanisms that function along pathways to decarbonization. Importantly, the framework argues that a number of political processes are required to make the changes necessary to move systems along pathways to decarbonization. SMART 2020 is a case study for this politics of decarbonization framework to see how the political dynamics unfold in this particular case and to explain what kind of pathway is developing.

The SMART 2020 intervention largely aims to catalyze a system improving trajectory that would improve the efficiency of the system without overcoming carbon lock-in. In the context of a much broader low carbon transition effort, ICT innovation influenced by SMART 2020 could enable transformation by achieving energy efficiency and enabling the expansion of

renewable energy generation. As this paper argues, the history and trajectory of SMART 2020 uncovers barriers to decarbonization as well as possible pathways to systemic change. Overall, this case study shows the importance of politics and power when conceptualizing decarbonization pathways. Several lessons are drawn from the analysis of the politics of decarbonization in this case and the conceptualization of the political mechanisms at play as an intervention seeks to disrupt carbon lock-in.

This paper first describes the theoretical framework on the politics of decarbonization (Bernstein and Hoffmann, forthcoming) in which this case study is embedded. The subsequent section reviews literature on the potential for carbon abatement through ICT innovation and then explains the history of the SMART 2020 intervention. In the analysis, the paper lays out how we can use the transformative political mechanisms to understand this case and how these mechanisms catalyze system effects in terms of scaling up and entrenchment of the intervention. Finally, the paper analyzes system outcomes in this case and what we can understand about trajectories to decarbonization before concluding.

THEORETICAL FRAMEWORK

This paper uses Bernstein and Hoffmann's (forthcoming) theoretical framework on the politics of decarbonization. The framework seeks to explain the trajectories of interventions, or intentional attempts to catalyze decarbonization in a particular system. This paper acts as a case study within the politics of decarbonization research project to further understand both the obstacles to decarbonization and the causal mechanisms that could trigger multiple pathways 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 is not simply a problem of particular technologies, but instead it is integrated into modern societies across economic, transportation and energy sectors. As a result, decarbonization will need to take place along multiple pathways spanning across society (Levin et al., 2012). Disrupting carbon lock-in is a fundamentally political endeavor (Bernstein and Hoffmann, forthcoming). Instead of taking a deterministic or structural view of change to understand low-carbon transitions, the politics of decarbonization

framework argues that a number of political processes are required to achieve the technological and behavioural change necessary to move systems along pathways to decarbonization.

Bernstein and Hoffmann's (forthcoming) theoretical framework identifies causal mechanisms that function along pathways to decarbonization. The political dynamics of carbon lock-in are altered through three mechanisms: creating normative change (normalization), building capacity (through resources or by changing institutions) and coalition building. Normalization is the alteration of the common sense of a system. Capacity building is developed through new skills, tools, institutions, and/or knowledge to act, and it can be developed as direct capacity or as new capacity through partnerships. Coalition building is the development of political support for action by building constituencies and empowering people who have an interest in climate change. It can be done through actions like altering incentives or using market forces. These three mechanisms determine how and whether interventions and/or the technologies and policies they target will scale up or become entrenched.

In this framework, an intervention catalyzes pathways to decarbonization by scaling up or more deeply entrenching the intervention itself and/or particular technologies and policies. The cumulative or catalytic impact of scaling and entrenchment system effects can create three possible trajectories 1) Reinforced carbon lock-in, 2) Improved carbon lock-in (more efficient, but still locked into a high carbon system), or 3) Decarbonization. Scaling and entrenchment can analytically be broken down to consider different forms. Bernstein and Hoffmann (forthcoming) articulate 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 (Bernstein and Hoffmann, forthcoming). 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).

This case study analyzes whether the SMART 2020 intervention appears to be catalyzing a decarbonization trajectory by identifying the political mechanisms of normative change, capacity development and political coalitions in this case and by analyzing the system effects in terms of scaling and entrenchment. For this particular intervention, we consider how the ICT technologies and policies targeted by SMART 2020 are being scaled up or entrenched (or not) with a particular concern for the decarbonization trajectory of cities. The next section introduces the potential for carbon abatement through ICT innovation from the literature before introducing the history of the SMART 2020 program.

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 number of areas. 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.

THE HISTORY OF 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. 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). The SMART 2020 initiative was launched in 2008 and had developed through roughly four phases before the research was conducted in 2014.

Phase 1 – SMART 2020 Report (approximately 2008-2010)

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.[1] Businesses like Cisco engaged in work with The Climate Group through their Corporate Social Responsibility departments during this early phase.[2] Though industry was quickly on-board, in the early stages there was no clear market since there was no obvious demand from consumers that companies could respond to with specific ICT products. This lacuna led The Climate Group and the ICT industry to target cities as a customer base more specifically.

Phase 2 – Integrated Systems in Cities (approximately 2010-2012)

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 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.[3] The SMART 2020 project recognized that the integrated solutions that could be applied in cities would be high impact applications of ICT and so the project helped to convene industry and cities through sub-initiatives like the Connected Urban Development Program.

This analysis about the opportunities available in cities inspired varied responses from industry. Some companies completed research and development work while others built up their consulting capabilities to pitch ICT solutions to city officials. In some cases, companies proposed to overhaul the whole energy system of a city and proposed dashboards offering significantly increased central management and control to allow for achievement of efficiencies in sectors across the city.[4] 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.[5] Obstacles were encountered in this phase because cities were often not able to implement the technologies on the

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[1] Author Interview, May 7, 2014
[2] Author Interview, May 14, 2014
[3] Author Interview, May 7, 2014
[4] Author Interview, May 7, 2014
[5] Author Interview, May 14, 2014

scale proposed by the companies.[6] An interview characterized this phase as "supplier-led"[7], where industry pitched solutions that were not always aligned with the ways that cities procured or operated. 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 (approximately 2012-2013)

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 transition should happen, but how it would happen and exactly what would be implemented technologically had to be "driven by people".[8]

In this phase, the SMART 2020 program shifted to try to emphasize a more "demand-led"[9] 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 (approximately 2013-2015)

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.[10] 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 of support 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

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

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"[11] and 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.[12]

As this description demonstrates, the theory of change associated with the SMART 2020 program is focused on improving the efficiency of the system rather than reinforcing or overcoming carbon lock-in. In order to trigger decarbonization, SMART 2020 and ICT for carbon abatement initiatives would need to be embedded in broader low-carbon transition. Nonetheless, ICT for carbon abatement could be implemented as a key part of decarbonization by, for example, enabling widespread expansion of renewable energy.

TRANSFORMATIVE POLITICAL MECHANISMS

Capacity change, coalition building, and normative change are thought to be causal mechanisms that determine how and whether interventions scale up or become entrenched. These mechanisms can help one determine whether interventions are on trajectories that can reinforce systems lock-in to carbon, improve the efficiency of the system without addressing carbon lock-in, or overcome carbon lock-in in the targeted system. In practice, these mechanisms interact, but they are separated in the following section for analytical purposes. These mechanisms can be used to help one make sense of how an intervention is disrupting carbon lock-in both within the system it is targeted as well as broader disruptive effects catalyzed beyond the targeted system.

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[11] http://www.llga.org

[12] Author Interview, May 7, 2014

Capacity Changes

Capacity building was a major aspect of the SMART 2020 intervention. The program sought to develop skills, tools and knowledge to act among various groups in the ICT for carbon abatement sectors. Capacity building was evident in two main formats: research reports and pilot demonstration projects. SMART 2020 originally targeted capacity building within the ICT industry itself in order to increase the uptake of ICT technologies. Despite success in this endeavor, new barriers were encountered that limited the implementation of ICT technologies. Therefore, the SMART 2020 intervention shifted focus to target capacity building among city officials as well.

Research reports released in 2008 and 2009 focused on developing capacity in the ICT industry. Both the original SMART 2020 report published in 2008 and reports like the 2009 Mobile's Green Manifesto, which set out how the mobile industry planned to lower its greenhouse gas (GHG) emissions (GSMA, 2009), sought to build the capacity of the private ICT sector. This capacity building was successful and companies in the industry began to present ICT as a carbon abatement solution. This capacity was not enough to scale up or entrench ICT for carbon abatement, however, and a market for the ICT solutions did not materialize. Cities were targeted as prime markets, but cities lacked the skills and capacity to find and implement ICT solutions. Therefore, SMART 2020's focus shifted to helping cities write RFPs that were more technology agnostic, to find new ideas, to pilot them, and to implement them.[13] SMART 2020 continue to try to build capacity on both sides of these relationships with reports like the 2011 Information Marketplaces report (The Climate Group, 2011). As one SMART 2020 employee described:

> "The companies weren't equipped, as you saw in the information marketplace report, the companies weren't selling what the cities wanted to buy, the companies didn't understand how they operated. That they couldn't change and entire city at once, that they might have to focus on one or two office buildings air conditioning to start."[14]

Research reports like the Information Marketplaces report (The Climate Group, 2011) and the Agile Cities report (The Climate Group, CityMart, Metropolis, & Technology Strategy Board,

[13] Author Interview, June 6, 2014
[14] Author Interview, May 7, 2014

2013) sought build new skills and knowledge to bridge these gaps between companies and cities. Over the first few years of operation of the SMART 2020 initiative, The Climate Group shifted focus from building capacity in the private sector to understand and sell ICT as a carbon abatement solution, to developing the capacity of cities to buy and implement ICT solutions.

Once both the ICT industry and city government officials had the knowledge and capacity to see the opportunities for ICT for carbon abatement, implementation proceeded through the development of demonstration pilots. These pilot projects in cities tried to facilitate learning among government officials and ICT companies as they worked out how ICT could be implemented in cities both technically and politically. This was a central part of the Connected Urban Development program, which was folded into SMART 2020. The whole idea was to prove the claim that a connected city is a green city through research, pilots, knowledge sharing.[15] These lessons did take root. When government officials start to call the city a 'smart city', they "learn to see how…ICT technology solutions can help and the benefits that they can bring"[16]

Normalization

Normalization is necessary in order to achieve scaling and entrenchment of ICT technologies. This requirement was recognized explicitly within the SMART 2020 initiative. As the Information Marketplaces report described, "Capturing the benefits of converging technology to solve social, economic and environmental challenges is not straightforward in practice, and will happen once those technologies make 'common sense'" (The Climate Group, 2011). The business community reacted very favorably from the beginning of the intervention and ICT as a climate solution became the new common sense within the industry. As one employee of SMART 2020 explained, "I think in terms of putting the ICT role in decarbonization on the map, SMART 2020 did that, and… the industry got really excited about it"[17]. SMART 2020 normalized the re-conceptualization of ICT as a solution in a time when there was a lot of discussion about the high 'carbon footprint' of ICT due to energy use. However, normalization in the private sector of ICT as a climate solution was not enough (just as capacity building in only the private sector was not enough) since it was not common sense for any potential clients yet.

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[15] Author Interview, May 14, 2014

[16] Author Interview, June 9, 2014

[17] Author Interview, May 7, 2014

The effort to normalize ICT as a solution to climate change expanded in order to target a client base for the industry. Normative change was again achieved, but within a different group of actors. SMART 2020 was part of a broader effort that successfully linked the idea of applying data and innovation to environmental problems in cities. After normalization occurred for both sellers and buyers, scaling and entrenchment was more successful. Pilot projects were implemented and the SMART 2020 initiative expanded. At the same time as this was occurring, SMART 2020 contributed to a broader movement establishing and contesting the idea of the 'smart city'.

The term 'smart city' was normalized through the work of many organizations, including SMART 2020, and is now in fairly widespread use. However, it is a term that enjoys considerable "functional malleability" (Gledhill, 1994). Functionally malleable terms are vague and ambiguous, which can be seen as their strength since they draw it allows them to draw wider support, and are "there to be contested and struggled with" (Walker & Shove, 2007). Clearly, smart city means different things to different people: "Because smart cities are nebulous and very amorphic, in a sense, everybody's got a smart cities hat on"[18]. As the previous section described, the pushback on the technological approach contested the meaning of smart city and expanded the definition beyond the energy efficiency focus to include ICT for citizen empowerment. Though this may improve the democratic potential of ICT implementation in cities, it also means that the decarbonization aspect of 'smart city' is no longer the focus of processes of normalization. This is important because Bernstein and Hoffmann (forthcoming) argue that heavy contestation instead of normalization of a new idea means that an intervention will not scale or entrench.

Coalition Building

The biggest role for coalition building mechanisms in this case was related to the contestation in the meaning of 'smart city'. A few years after SMART 2020 began, new actors in the social enterprise and open data sectors joined the broad 'smart cities' discursive space, bringing a new focus on citizen engagement that created broader political support. Industry and city governments remained involved, but the targeted outcomes of smart city transitions broadened. 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

[18] Author Interview, May 14, 2014

attempt to inject decarbonization normative goals, however it has resulted in dilution of 'smart cities' such that the term is "nearly useless".[19] 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. This transition was more substantive than the capacity building target transition, but both transitions occurred because of the feedback between the political mechanisms and the intervention's goals and activities.

At the same time, however, the shift in emphasis from energy efficiency to citizen empowerment in the interpretation of 'smart city' may actually be crucial for coalition building reasons. As one participant in the research stated, citizen empowerment and citizen led activity is "extremely important for buy-in for broader smart city initiatives, potentially, and it is important from a mayor's perspective because if their citizens are empowered or engaged, then they're getting votes."[20] Citizen participation is what politicians are using to sell the value proposition of ICT upgrades in cities to citizens. Politicians believe that references to citizen engagement goals increase political support for city government officials and for increased ICT expansion.

SYSTEM EFFECTS

Scaling

Internally within SMART 2020, the intervention reached an increasing number of organizations through the expansion of network participation. Self-organized scaling occurred as groups clustered around the idea of ICT innovation for carbon abatement and worked together to reach further. One example is the combination of Cisco's Connected Urban Development program with SMART 2020 in order to continue expansion. In addition, the intervention scaled up from individual projects to consideration of ICT solutions for a whole city. The following quote from a SMART 2020 employee explains the approach:

> "Individual solutions are not where you get the most impact, it would be through integration in a particular geographical context, in fact as small as a neighbourhood or even a broader city and we needed to understand the linkages between all of these quote unquote silos so that your

[19] Author Interview, May 7, 2014
[20] Author Interview, May 7, 2014

> transportation system and your energy system were somehow linked together."[21]

This was simple scaling in the straightforward increase in the scope targeted by the intervention. Pilot projects were a major part of this expansion. 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 in the number of pilot projects. However, the next stage of scaling up from pilots to programs is not yet achieving success. A City of Bristol representative identified this stage of scaling as a key problem that they had not yet been overcome.[22] 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[23], but it is difficult to actually quantify the impact of attempts to innovate with ICT for carbon emission reduction.

Externally to SMART 2020, the discursive space of 'smart cities' laid out a framework for extensive self-organized scaling. SMART 2020 was one of many organizations that participated in the early development of smart city ideas and further experimentation took place as other groups filled out and expanded from the niches set out by the original ICT for energy efficiency in cities concept. A progress report issued by the transnational municipal network C40 Cities in early 2014 (C40 Cities & Arup, 2014) 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).

Entrenchment

The SMART 2020 intervention itself, may be significantly reformatted within the Climate Group in the future, but the policies and technologies that SMART 2020 advocated for are entrenched in target systems in some ways. The durability of implemented pilot projects suggests some material durability of ICT technologies within the cities. It is not yet clear whether

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[21] Author Interview, May 7, 2014
[22] Author Interview, June 6, 2014
[23] Author Interview, May 7, 2014

these pilots will remain small-scale experiments or whether they will expand across the cities and be entrenched more deeply. Furthermore, some institutional entrenchment appears to have taken place as cities have created government departments and positions dedicated to data, innovation and sustainability. The City of Bristol, for example, established a Future City department in 2011 because city leadership determined that "Bristol's viable economic future would be built on digital innovation and sustainable technologies".[24] A significant part of the departments work focuses on running smart city pilot projects (focusing on both inclusivity and sustainability) in the city. ICT companies also experienced entrenchment within their institutions through the development of 'smart' sales departments in ICT companies. At Cisco, for example, early participation in the Connected Urban Development program "was just a part of corporate social responsibility work, but then suddenly it morphed into an actual go to market campaign".[25] It is not clear yet whether these departments are generating the kinds of increasing returns or self-reinforcing effects that would lead to increased durability.

The concept of a 'smart city' seems to be firmly entrenched. Notably, it appears as though local government politicians expect that citizen empowerment through ICT will deliver political returns, suggesting continued entrenchment through increasing returns. In addition, positive feedback entrenchment occurred as more populations adopted the smart city term beyond the original energy efficiency technocrat audience. The functional malleability of the smart city term allows for this form of entrenchment by letting new participants extend the term in new ways, but it also makes it difficult to talk about what outcomes might be expected when it comes to decarbonization. Since smart city means different things to different people, the durability of the concept does not provide many clues yet about the direction urban systems might be headed.

SYSTEM OUTCOMES: POWER AND POLITICS IN DECARBONIZATION

It appears as though SMART 2020 would catalyze a system improving trajectory as it seeks to inject carbon abatement goals into information and communication technology innovation efforts, although at a slower pace and potentially more narrow scope than originally was envisioned. ICT innovation influenced by SMART 2020 could enable transformation by

[24] Author interview, June 5 2014
[25] Author interview May 14 2014

achieving energy efficiency and enabling the expansion of renewable energy generation, but only in the context of a much broader low carbon transition effort.

This case shows that it was only by harnessing the political mechanisms of capacity building and normalization that SMART 2020 could overcome barriers. In response to barriers that brought expansion to a halt, multiple stages of normalization of ICT as a climate solution and building relevant capacity took place among different actors. The private sector began to see ICT as a climate solution and developed the capacity to sell the technology in this way under the influence of SMART 2020, but there was still no market. The same political mechanisms had to be supported among city officials to overcome the barrier and to achieve successful pilot projects.

In addition, contestation in the search for political support was a central feature of this case. The key element of concern was the lack of consideration of democracy and power in the technological solutions proposed by early actors. Using an approach with a marked focus on the material dynamics, 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. Concerns were raised about precisely *who* was transitioning *what*. Despite the technological focus of the intervention at the outset, this analysis using the political mechanisms of decarbonization pathways demonstrates that politics and power were clearly important elements in the obstacles faced by SMART 2020.

Finally, this case shows that an attempt to overcome obstacles by harnessing one of the political mechanisms can bring new challenges. In order to leverage a political mechanism (e.g. trying to gain political support by building broader coalitions), the substance of an intervention may be redirected. Efforts to incorporate democracy into ICT innovation for carbon abatement 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 has an expanded population that appears to associate energy efficiency ICT technology with undemocratic, technocratic intervention. Nonetheless, it may be that this contestation reveals a stronger political lever to achieve broader citizen political support. 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, how can one approach a low carbon transition democratically without substituting democracy as the intended outcome instead of low-carbon transitions?

CONCLUSION

This paper 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. The pathway unfolding in the SMART 2020 case appears to be developing a system improving trajectory, where the target system is made more efficient, but still locked into a high carbon system. However, ICT innovation influenced by SMART 2020 could be a key element that enables transformation to overcome carbon lock-in if it is pursued in the context of a larger decarbonization effort.

Several important lessons can be gleaned from this paper's focus on the politics of decarbonization and the conceptualization of the political mechanisms at play as an intervention seeks to disrupt carbon lock-in. First, politics and power are important elements both in terms of the mechanisms that are moving interventions forward and in terms of the obstacles encountered by interventions. Planned decarbonization pathways with an overemphasis on technological solutions will encounter political obstacles, like the contestation experienced in this case in the search for political support. Second, obstacles to the expansion and success of decarbonization interventions can be overcome by harnessing political mechanisms (normalization and capacity building in this case), but the process is iterative. For example, an intervention may have to build capacity in multiple stages as new groups of actors are targeted by the intervention. Third, an attempt to overcome obstacles by harnessing one of the political mechanisms can bring new challenges. In order to leverage a political mechanism (e.g. trying to gain political support by building broader coalitions), the substance of an intervention may be redirected from decarbonization. Finally, this case study clearly introduced the difficulties in trying to approach a low carbon transition democratically without redirecting the intervention to replace low-carbon transitions with democracy as the intended outcome.

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