Diffusion and innovation for transition:
Transnational governance in China's green bond market development

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Abstract: Green bonds, a new instrument of Chinese environmental economic policy, represents an important step in the country's effort to systemically transform towards 'ecological civilization'. The involvement of transnational actors alongside Chinese state actors make for a compelling case in examining green finance transitions as a phenomenon in global environmental governance. This paper leverages the transition management framework, adapting concepts from transnational governance, to develop a 'transnational transition management' lens with which a longitudinal analysis of the policy development cycle is viewed. In combination with social network analysis, we use this framework to explore the evolution of green bonds with diverse forms of secondary evidence. We identify a relationship between the rapid expansion of the Chinese green bond market with coalitions of policy makers and organizations in transnational spaces that catalyze policy diffusion and innovation through consensus building, coordinated experimentation, and distributed monitoring and evaluation; predominantly steered and led by the People's Bank of China. In addition, the political economy of actors in these networks help explain resistance to convergence with global green bond standards. This research suggests an agenda for examining the governance of green finance as an entry point to analyze and develop strategies for sustainability transitions in finance.

Key Words: Green Bonds, China, policy diffusion, transition management

Introduction

One of the fundamental challenges of addressing climate change and environmental sustainability is mobilizing the necessary resources. In the context of the society-spanning (and planet-spanning)

measures required to transition to a low-carbon economy, the capacities and capital required extend beyond the institutions and coffers of government. This challenge of mobilization has made the issue of financing action on climate change and sustainability an increasingly central concern for policy makers across contexts. Transnational organizations and partnerships are resultantly forming to generate integrated and financially-focused solutions including the G20Green Finance Study Group, UNEP Inquiry, and the OECD Centre on Green Finance and Investment. Along with a rising tide of active leadership from the private sector as environmental degradation and climate risk become increasingly legible on balance sheets and ledgers, 'green finance' represents an area of growing transnationalism where solutions like green credit and bonds are leading to new governance arrangements across sectors and borders.

China has created one of the more attention-grabbing stories in the evolution of green finance. The green bond market (GBM) in China went from zero to USD $37 billion in outstanding bond issuances between 2015 to 2017 (Meng, Lau, & Boulle 2018); an immense transformation. Green bonds, for the majority of their existence in the world of environment and finance, has been an arc dominated by European innovation: the commitments of sovereign wealth funds and institutional investors within the "Investment Group on Climate Change", the EU Project Bond Initiative to support offshore wind development, the Neighborhood Investment Facility, etc. (EEA 2014). These examples represent diverse strategies across countries, including the participation of state and non-state actors, to overcome financial barriers to eco-innovation, including the perceived risks and uncertainties associated with new environmental technologies and projects (Ghisetti et al 2017). China, however, does not follow the European model economically and politically. It raises questions about how exactly this dramatic transition emerged and to what extent transnational governance arrangements are responsible for the rapid expansion of the Chinese GBM. This paper works to track two overlapping functions of

transnational networks in the case study: *policy diffusion* (defined as coercion, learning, competition, or emulation carrying exogenous policy content into domestic policy arenas (Dobbin, Simmons & Garrett 2007)), as well as the process of *policy innovation* (defined for our purposes, and discussed in more depth in further sections, as novel reform of institutions or practices arising through the transition governance functions of consensus-building, agenda-making, coordinated experimentation, and reflexive monitoring and evaluation (Loorbach, 2010)).

In the process, this paper contributes to adapting conceptual frameworks to evaluate policy processes in the context of green finance. We look primarily to the sustainability transitions literature, which has provided extensive resources for the evaluation of system-level sectoral transformations involving institutional and/or technological change across contexts. Academic work in this area has developed robust conceptual models to understand the interplay of policy, market actors, norms, institutions, and innovations across the macro (domain) meso (regime) and micro (niche) level (Geels 2002). For these reasons, transitions thinking has made inroads in policy and planning, whether in the case of Dutch national energy policy (Kemp 2010), or in evaluating pathways to greener economies (UNEP 2011). In our case, finance is the socio-technical domain, China's banking and finance sector is the regime in focus, and green bonds are the niche innovation. We build on the Transition Management framework (TM) specifically, an analytical tool for understanding governance in sustainable development. We integrate concepts in policy diffusion and transnational governance to generate a synthesis, 'transnational transition management', used to support a longitudinal analysis of the case study.

We hypothesize that the rapid expansion of the green bond market is at least partially a function of growing transnational networks of think tanks, state actors, and corporations that, through boundary-spanning epistemic communities and specific organizational coalitions, have innovated, adapted and

diffused policy. We also theorize that the broader context of governance in green finance explains the non-convergence of Chinese green bonds standards relative to global rulemaking(Climate Bond Standard (CBS), Green Bond Principles (GBP)). Methodologically, we use qualitative analysis of discourse and content from secondary sources, quantitative analysis of market data, and social network analysis of policy report co-authorship, further triangulated with existing studies on Chinese environmental economic policy and cross-examined with preliminary interviews conducted by the authors in Shanghai in 2017. Based on the evidence, we conclude that the evidence supports the hypotheses, though is ultimately overshadowed by the role of China's endogenous effort to financialize its economy and drive the country towards ecological civilization.

In the following section, the transition management framework is explicated and key concepts in transnational governance and policy are introduced, resulting in a formulation of the 'transnational transition management' framework. Subsequently, the methods and sources of evidence are discussed in further detail. Afterwards, we apply the framework to structure an analysis of the evidence. Finally, we conclude and discuss areas of further research and theory.

Analytical frameworks and key concepts

Considering transition management

Socio-technical innovation encompassing society-spanning, systematic transformation has been extensively studied, providing key insights into the history of technological disruption and the design of prescriptive approaches to sectoral transitions. From energy and water to urban systems, many sectors have come under the microscope, identifying barriers and opportunities to achieving longer-term societal objectives. In the process, a series of analytic tools have been forged in the field of study including the multi-level perspective, strategic niche management, and particularly relevant for the study of

governance and social innovation, the Transition Management framework.

The Transition Management framework (TM) is designed to assess the governance of non-deterministic processes for transitioning complex systems and addressing deep-rooted societal problems (Grin, Rotmans, & Schot 2010). Generally, it encourages a decentralized approach to experimentation and adaptive learning where actors enable transformation through configurations of resources, networks, and capacity-building to meet long-term visions of change (ibid). The framework outlines four non-sequential stages of governance processes and activities for innovation (Loorbach 2010). The first stage is strategic, comprising problem identification, norm setting, and long-term goal formulation by a regime (defined as the dominant decision-making structure, institution, or network). This occurs in 'transition arenas': spaces hosting small groups of frontrunners, visionaries, and experts that frame and identify problems. The second stage is tactical: the long-term vision is articulated into coalitions and agendas moving from problem identification to solution generation. The third is operational: agendas are actualized in 'transition experiments' that mobilize or scale niche innovations. Finally, the fourth stage is reflexive: monitoring and evaluation throughout the transition management process enables continued development and adaptation of strategic, tactical, and operational activities. We use these transition governance phases to bound the activity of transnational transition governance in the case study.

One possible limitation of the TM framework is it's originss in the study of policy experiments in western European contexts. However, a decade of refinement in increasingly diverse applications have shown that where a regime is driving innovation for socio-technical change in complex and uncertain circumstances, the framework supports robust analysis across geography and contexts. Many dozens of applications of the TM framework and parallel socio-technical analyses have been successfully applied in research in India, China, Tanzania, and Thailand and many other global south and non-western European contexts (Wieczorek 2018), providing ample evidence to contest critiques of the framework's

context specific origins..

Articulating a critique of transition management

However, the value of the framework's generalizability creates other challenges. In remaining flexible as a "possible heuristic for operationalizing interactive governance" (Frantzeskaki, Loorbach, & Kooiman 2009, p. 7), it's agnosticregarding questions of legitimacy and authority that bear on cases of global environmental governance and policy. Similar critiques regarding transitions approaches focus on neglecting political reality, power, legitimacy, and democratic content (Avelino & Rotmans 2009; Hendriks 2009). This has driven some theoretical reformulations (Geels, 2014; Loorbach, Frantzeskaki, & Huffenreuter 2015; Voß, Smith, & Grin 2009), as well as context specific re-articulations: some of the principle architects are, as an example, reformulating transition management approaches for the unique attributes of cities and urban change (Frantzeskaki, Holscher, Wittmayer, Avelino, & Bach 2018). This paper makes its own specifications in the realm of transnational governance and policy diffusion. Through engaging more deeply with political science literature and the study of transnational governance processes, the synthesis helps incorporate some of these concerns more centrally in the analysis[1].

Key Concepts in Policy Diffusion and Transnational Governance

One key idea drawn from the transnational governance literature is that there is *an important and defined role for a state actor* (or an actor with equivalent authority and legitimacy) as arbiter, leader, or institutional entrepreneur in governance networks. Governance encapsulates the idea that empowered actors 'steer' broader society via rule making and coalition building, nudging and incentivizing institutional change (Peters & Pierre 1998), which in in contrast to the statist model of command-and-

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[1] Our framework, to be explored in subsequent sections, differentiates from other transnationally-concerned frameworks in the literature: Global Innovations Systems Framework (Binz & Truffer 2017), focuses on transnational technological innovation where the unit of analysis is the firm. Another is 'deep' system transition analysis (Schot & Kanger 2018) that examine long-term, paradigmatic societal changes.

control, emphasize the role of horizontal, decentralized institutions. While that doesn't necessitate state leadership, governance processes on a transnational scale have unique dilemmas that aren't necessarily accounted for in transition management's conception of governance. On a transnational scale, governance as self-organizing networks of actors may create decision-making structures that are unrepresentative, oligarchic, or illegitimate vis-a-vis traditional state institutions (Benner, Reinicke, & Witte 2004). As Jessop (2002) points out, public actors are essential for developing institutions that have the authority and legitimacy to maintain coherence in governance. In complex governance contexts, specific state actors are often positioned to produce rules of meta-governance and deploy an existing monopoly on organizational intelligence to facilitate effective outcomes in the long-term (ibid).

Another important concept is that the *optimal openness of governance networks is a dynamic function of social capital and problem complexity.* That is, participatory and open governance processes, to be effective, require sufficient social capital to motivate a network of actors to agree and coordinate for a policy objective (defined as the measure of trust, common norms, and connectedness of institutions) (IISD 2012). The higher the degree of problem complexity (defined as the heterogeneity of a network), and the lower the social capital of a network, the more an institutional arbiter is needed to steer or control the process (ibid). Transition processes dynamically change in terms of the social capital available and the problem complexity of a policy stage: particularly, as policy innovation scales, it requires significant social capital building, or more centralized processes of governance. This provides some parameters for understanding the incentives and disincentives to increasing or decreasing participation in various stages of policy innovation.

Lastly, it's important to identify the specific exogenous *mechanisms of policy diffusion:* policies migrate across territories through mechanisms and motivations that include social construction, coercion, competition, and learning to supply content for endogenous reform and innovation (Dobbin et al 2007).

As an example, the diffusion and convergence of policy standards for emissions trading in Europe was enabled by close-knit networks (facilitating learning) and norm similarities (social construction regarding environmental policy) regarding environmental issues in a polycentric governance network (Paterson, Hoffman, Betsill, & Bernstein 2014). These mechanisms occur in the kind of coalitions and arenas identified in the first stages of transition management, where networked participation enables advocacy, exchange, and adaptation of policy ideas. The resulting relationships, norms, and information sharing drives the achievement of policy objectives (Bulkeley et al 2014). Coercion and competition further mediate, through political or economic interests and balances of power, how policy ideas are translated into practice, but also how domestic politics may influence the impact of policies in practice (Jordan & Huitema 2014).

Synthesis: Transnational Transition Management

Considering a defined role for state leadership, the tradeoffs of social capital and problem complexity in network governance, and the specific mechanisms of diffusion, we put forward a re-articulation of the TM framework that enables our analysis. Akin to other attempts to reformulate the framework constructively for transnationally-mediated case studies (Lawhon & Murphy 2011; Tyfield 2014), international or non-sector actors outside the direct influence of the regime can be primary influencers and participants regarding norms, agendas, or politics in sustainability transitions. As such, we draw them into the boundaries of the analysis.

While, like TM, we define regimes (Chinese banking and finance) and niche innovations (green bonds), our revision further borrows conceptually from the governance literature in articulating *a meta-regime* which we are defining as the globalized aggregate of regimes that engage transnationally around an issue area. Whether human rights or green finance, the coherence and authority of the meta-regime influences the degree to which coercive, competitive, socially constructive, or learning driven policy

diffusion can take place in "lower-levels", and thus effects the acceleration or deacceleration of a sustainability transition to the degree that the meta-regime can actualize policy diffusion, capacity building, or resource exchange. This opens several new permutations: not only do niches interact with regimes through empowerment or disempowerment (see Avelino 2017), but the meta-regime and regime interact in contradictory or supportive ways to upscale or slow niche innovation (table 1).

[TABLE 1 NEAR HERE]

These considerations modify the stage-wise structure of the original framework with more specific formulations (Table 2). In the arena phase, problem identification and consensus building is not conducted in isolation, but includes the building of social capital in transnational networks in anticipation of policy diffusion. In the transition agenda, coalitions of policy-making communities are formed that help re-articulate exogenous policy content into domestic forms through social learning and social construction-driven diffusion. Coordinated experimentation arises through both domestic policy projects and through transnational partnerships. Lastly, monitoring and evaluation involves distributed social learning through epistemic communities in which leading policy makers are embedded. We use this framework in the context of the case study to bound and analyze processes of policy development, understanding the regime-specific and meta-regime related dimensions of each stage, and contextualize the challenges of the Chinese green bond market in terms of governance and transitions.

[TABLE 2 NEAR HERE]

Materials and Methods

Using diverse sources of secondary evidence (white papers, green bond databases (CBI and Xinhua), research reports, news releases) we identify key processes and agendas in policy diffusion and innovation and analyze the participation of related coalitions longitudinally. In addition, we examine

organizational co-authorship of research on Chinese green bonds as a representation of epistemic and policy communities through social network analysis (SNA) of 32 English language technical reports principally or significantly concerned with green bond markets in China between August 2014 and November 2017. This involved a snowball sampling process starting with the Climate Bonds Initiative, looking to report collaborators and finding their subsequent or antecedent publications on the topic. This process was repeated until no further results were found. We define collaborators as organizations in which the report's authorship is being attributed, or to sponsorship acknowledged as institutions providing 'financial support' or 'generous support', which are distinguished as "directed" or arrowed links in the SNA. The SNA was rendered in the Gephi software package using the ForceAtlas 2 algorithm (see Jacomy, Venturini, Heymann, & Bastian 2014). 'Gravity' and 'scaling' were adjusted for legibility.

Understanding the limits of research predominantly dependent on secondary sources, this case study is fundamentally exploratory. However, we triangulate the research and validate and test claims based on the significant body of empirical work on the political economy of the Chinese state in transnational and environmental affairs, and more specifically with regards to economic environmental policies going back to experimentation and policy diffusion surrounding instruments including the clean development mechanisms (CDM), renewable energy technology transfer, and emissions trading generally. In addition, claims have been further cross-examined through preliminary interview-driven research conducted in Shanghai in 2017. We expect this project to set the stage for more diverse methods and approaches to validate, contest, and deepen claims put forward with regards to green bonds and green finance.

Results

Introducing the case study: green finance in China

For the biggest producer of CO2 emissions across all countries (and with emissions expecting to rise more than 50% before 2030) (Liu et al. 2015) green finance has offered an upstream entry for addressing climate and sustainability for the People's Republic of China. The degree of extensive environmental degradation is well documented: in 2016, 32.3% of monitored surface water measured unfit for human consumption and 32.9% of counties reported poor or relatively poor ecological environmental quality (MEP-PRC 2017). Most visually evident is the air pollution reaching critical levels for urban residents: a study of 38 cities in China found that the average Pm10 levels were over four times higher than the World Health Organization's critical threshold of 20 ug/m^3 (Yin 2017). However, China was responsible for 40% of renewable energy capacity growth in 2016 and hosts 60% of global solar cell manufacturing capacity (IEA 2017). Tracing back to policy developments in 2007, China's 11th Five Year Plan began inclusion of environmental protection as a key development objective regarding renewable energy and otherwise, defined in the terminology of the 17th National Congress white papers as a pre-requisite concern for continued economic growth (State Council 2006). Facing shortcomings in command-and-control environmental management, the country pivoted towards 'environmental economic' policies with more decentralized, market-driven, and transnational schemes like the Kyoto Protocol's Clean Development Mechanisms and emissions trading pilot programs (He, Yu, Mol, & Beckers 2012).

Recognizing the interconnectedness of finance in influencing environmental degradation, China has undertaken financial reform to help realize sustainable development in a systematic fashion. As of the 13th five-year plan (13[th]FYP), green finance has advanced from a descriptor of market-based tools to its own strategic issue area alongside infrastructure and energy (Ng, Mabey & Gaventa 2016). Remarkably, this transition has been envisioned as a public-private partnership, where 85% of the estimated USD $320 billion in annual investment required for to achieve 'ecological civilization' would be sourced from private capital; domestic and foreign-sourced (Green Finance Task Force 2015). Green

bonds have been an eye-catching novelty to this end. Defined by the Green Bond Principles as "…any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance…eligible green projects…" (ICMA 2016), green bonds have grown to include a large diversity of debt obligations, revenues, and use of proceeds that increase liquidity and create opportunities for green investments, while lowering the cost of capital for green projects (CBI 2015).

Characterized as a tool in which institutional investors can be lured into environmental objective areas, there's enormous room to scale with issuance at the end of 2017 accounting for roughly .2% of the global bond market (Boulle, Dai, & Meng 2017). In December of 2015 and January of 2016, China's central bank, the People's Bank of China (PBoC) and the National Development and Reform Commission (NDRC), the agency for macro-economic management, respectively released green bond guidelines that cleared the ground for market development (CBI & IISD 2016a). In the ensuing year, green bonds were issued across banks and companies onshore and offshore, including on listings and indexes on the Shanghai and Shenzhen stock exchanges (Boulle et al 2017). Issuances from late 2015 to the end of 2016 amounted to USD $36.2 billion, equivalent to 39% of global green bond issuance and 2% of the Chinese bond market with an additional USD $11.52 billion in issuance in the first half of 2017 (CBI 2017a).

Transition Arenas and knowledge networks

2013 saw the first signs of life for Chinese green bonds with calls for bond market reform by the State Council (IISD 2014), and the drafting process of the 13th 5YP, where a broad call for reforming finance for sustainable objectives was outlined (Green Finance Task Force 2015). This signaling of interest from the state council, China's chief administrative authority, opened the doors for the formation of a transition arena: by definition, a network staffed by frontrunners to develop a common language of action for China, and to reach agreement on the challenges and opportunities of green finance. This was

actualized, with some limitations as to the comprehensiveness of participation, in the formation of the Green Finance Task Force (GFTF) in July 2014. Co-steered by the PBoC and UNEP Inquiry, with funding support from the UK's Department for International Development, the GFTF brought together the distributed capacity of academia, NGOs, consultancies, and Chinese policy makers across sectors (table 3).

[TABLE 3 NEAR HERE]

The GFTF published 16 background papers and a final summary report called "Establishing China's Green Financial System", framing problems, generating theoretical frameworks, and identifying niche innovations and transition pathways for transforming structures, institutions, and rules. Green Bonds was one of fourteen novelties for which the GFTF envisioned new roles and regulations (Green Finance Task Force 2015). In the process of producing knowledge products and forming a network to support transition, outputs included strategic orientation and and envisioning of solutions in the domestic and meta-regime. While effectively representing the transition governance function of consensus-building, this process facilitates transnational policy diffusion via collaborative social construction (normative translation of global green finance concepts into the Chinese context) and learning (participants increasing their technical knowledge of green bonds). Overall, attracting investment (competition) is quite an explicitly stated driver of policy diffusion, and frames the overall diffusion process. From 2014 to 2017, this initial transition arena formed the foundation for continued transnational transition management: many of the participants continued to play essential roles in regulatory coalitions (explored subsequently), creating essential social capital for a broader epistemic community to form (figure 1). GFTF members accounted for 51% of technical report authorship as mapped in the SNA, and the key state leader (PBoC) from 2014 to 2017 maintained the highest degree of centrality in the epistemic network across the trajectory of transition. It's important to note that this epistemic network

integrates Chinese policy makers into the broader meta-regime, and as such, knowledge-driven collaboration with meta-regime actors (with funding from interested governments and corporate actors) are vitally providing capacity for policy diffusion and ultimately, as we would suggest, the acceleration of the empowered niche of green bonds.

[FIGURE 1 NEAR HERE]

When evaluating the presence or absence of key actors, it is evident that participation in the transition arena reflects the politics of transition, the limits of professional networks, and the challenges of building productive consensus on problem definitions. While there are many transnational actors involved in the GFTF, there are no foreign corporate actors, indicating typological limits to the professional networks of PBoC's leadership; though not inconsistent with theories of Chinese economic nationalism (see Tung 2016). Additionally, for Chinese non-governmental organizations, there is relative under-representation, and the presence of Eco-Forum Global (an advocate for the concept of 'ecological civilization', discursively proposed by the State Council), the consultancy Syntao (who currently rates green bonds) and the Clean Air Alliance (fighting the most visible and pernicious side of environmental damage) unsurprisingly fits the landscape of how the issue of climate is perceived in official discourse, as well as the nascence of the civil society sector in influencing and accessing environmental policymaking processes (Bernauer, Gampfer, Meng, & Su 2016). There is also an absence of small and Medium Enterprises (SMEs) and green industries with predominantly private ownership structures reflecting less political access than state-owned enterprises (SOEs) (Curran, Neuweg, & Stern 2017). In sum, this suggests selective access domestically, mediated by government actors, to participating in the ideational stages of the transition process.

As well, the absence of the NDRC and the China Securities Regulatory Commission (CSRC) is

noticeable: essential regulators and policy makers in the finance regime. Looking to the conceptualization of the 'shareholder state' and the financialization of state institutions, there is a legacy of market competition between state agencies like the Ministry of Finance and the PBoC via investment and holding vehicles (Wang 2015) that might suggest strong incentives for securing advanced leadership and mediating selective participation in the process of green bond financial innovation.

Transition agendas

Transnational networks followed from problem defining arenas to solution-focused coalitions. One of the key outputs of the GFTF was the creation of the Green Finance Committee (GFC) in April 2015 within the China Society for Finance and Banking, a state-led coalition of key public and private sector actors with the collective capacity to generate market standards and regulations. 48% of the institutions represented in the GFTF took on leadership roles in the GFC, while many of the GFTF's international experts (Trucost, CBI, IISD, UNEP) became 'solution focused' consultants alongside new entries by multi-national organizations (IFC, World Bank, HSBC, ICMA, UNDP) (GFC 2017). Defined as a not-for-profit professional organization dedicated to research, coordination, capacity building, and policy implementation, the members of the GFC collectively oversee 70% of the assets under management in China as of 2017 (EIB & GFC 2017). In some senses participation in the GFC represents a more inclusive transition coalition (and continuing to increase, from 169 as of April 2017 to 222 as of April 2018 (GFC 2018)) however, the GFC remains under the explicit guidance and leadership of the PBoC.

The GFC was instrumental in coordinating policy innovation in green finance: with input from market actors and transnational advocates, the green bonds agenda and subsequent policy instruments was generated by the GFC and put into practice by the PBoC. This included the Green Financial Bond Guidelines: regulations for financial institutions and an endorsed six-category project catalogue released

in December of 2015. As a coalition, the GFC helped develop definitions, rules for the management of proceeds (mandatory earmarking of funds), and reporting guidelines (quarterly disclosure), all aimed at regulations for financial organizations and the interbank bond market (Boulle, Dai, & Meng 2017). It's important to note that project catalogues, definitions, management of proceeds and reporting guidelines are all derivative of preceding standards including the Climate Bonds Standard and the Green Bond Principles– as such, the regulatory agenda is typeset by external policy content, diffused exogenously. Original innovators of standards directly participated in this coalition (CBI, ICMA) and membership including first-movers and issuers of green bonds as well (IFC, World Bank, figure 2).

[FIGURE 2 NEAR HERE]

Yet in the initial year of green bond market development, efforts to generate reform in the sector expanded beyond the GFC. In China, regulation in the bond market is primarily bounded around market type (exchange or interbank), and secondarily by issuer type (SOE, Corporate, financial, municipality, policy bank). As such, other state agencies began their own policy developments: the NDRC issued a twelve-category project catalogue in January 2016 targeting bond issuance by SOEs without restrictions regarding management of proceeds or fund tracking. Across other market segments (table 4), other agendas materialized, that in some ways, created inconsistent standards in how 'green' is defined and evaluated, eligible project categories, whether use of proceeds are tracked, and disclosure processes (CBI & IISD 2016a; Meng et al 2018; IIGF & UNEP, 2017).

[TABLE 4 NEAR HERE]

How can this be reconciled with the model of a PBoC-led transnational transition management process? This fragmentation represents limitations to the coherence of governance, i.e., the degree of problem complexity and social capital led to an un-optimal governance equilibrium, requiring more of a centralized and steered governance process. In the absence of such, the result is less initially effective.

This regulatory fragmentation has been critiqued for creating a burden of additional due diligence, slowing capital flow across different segments of the bond market domestically and internationally; this results in higher transaction costs for environmentally-concerned investors (CBI & IISD 2016; EIB & GFC 2017). It's noticeable that differentiating policy originates from regulators who were not present in the social-capital building transition arenas or coalitions (NDRC, CSRC). However, in learning-by-doing policy innovation, these inconsistencies may be par for the course as complex regulatory mechanisms attempt to adapt exogenous policy content. What is key, is that six months into the launching of fragmented regulatory standards, a PBoC-led report committed to "strengthen inter-departmental coordination and unify the definitions of green bonds" as well as to "expand the scope of international cooperation in green finance, with the co-authorship of the NDRC, the MEP, CSRC, and other key state actors; continuing the process of governance steering to establish a "green financial system" (PBoC et al. 2016).

Transition Experiments

In the subsequent phase of market development commitments, coalitions, and agendas successfully mobilized stakeholders to commence experimentation and demonstration of green bond issuance (figure 3). Policy (state) banks broke ground by leading the market (Boulle, Dai, & Meng 2017), followed closely by commercial banks and corporates – demonstration by state actors provided proof of concept for labeled Chinese green bonds and through the mechanism of the GFC, experimenters had, on paper, access to policy makers to provide guidance in making first movements on green bonds. The first year of Chinese green bonds were emblematic of a learning-by-doing approach with diversity across bond types, issuer types, and market-focusBond types ranged from general obligation, project revenue, covered bonds, and asset- backed securities, representing diverse experiments of bringing new green

financial products and services[2] to market.

[FIGURE 3 NEAR HERE]

A substantial segment of green bond experimentation involved explicit transnational arrangements: these typologies, whether offshore exchange issuance or 'green panda bonds' (Renminbi-denominated bond from a non-Chinese issuer sold in China) made up approximately USD $10 billion or 28% of the Chinese green bond market in 2016, expanding by USD $2.8 billion in offshore issuances by October 2017 (CBI and CCDC 2017; Xinhua News Agency 2017). UK government agencies, who had been funding exploratory research in the GFTF (DFID) and financing policy-focused research with CBI and IISD's work (figure 1) (UK Department for International Trade); contributed to the general inter-regime partnerships, that beyond new coalitions including the UK-China Green Finance Taskforce, yielded several green bonds listed on the London Stock exchange including the Bank of China (policy bank) issuance in November of 2016 raising USD $500 million (Gilbert 2016). Though it would be incorrect to draw a firm correlation between participation in transition governance and opportunities in strategic partnerships for bond issuances, London is certainly a competitor alongside a small cadre of foreign exchanges for Chinese green bonds, and UK-headquartered management consultancies provide 59% of second-party reviews of Chinese green bonds in domestic markets (as of 2017) (CBI 2017a). In sum, even in the most diffuse stages of reform as experimentation is mobilized across a diverse set of actors, transnational governance still plays a sizeable role.

In the literature, upscaling 'niche innovations' and coordinating experimentation for reform often requires some protection from market competition (Schot & Geels 2008). In the Chinese state-led context, protecting fledging innovations until mature is a well-established practice. For green bonds this hinges

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[2] Whether labeled green bond issuances were additional to baseline financial flows is a separate, but important, question – though outside of the scope of this paper.

on the relative competitiveness of the risk-return profile vis-à-vis vanilla bonds with provisions like credit guarantees or tax incentives for investors and issuers, or, carbon pricing and environmental laws influencing the relative profitability of green versus non-green assets. Protection, while not an explicit strategy, is an inherent component to the initial but differentiated success of GBM development: policy banks and SOEs have the implied backing of government credit and risk protection, and therefore investment-grade debt. Conversely, it creates differential treatment by organization-type. Touching on the underrepresentation of SMEs and privately-owned corporations in transition arenas or agendas, non-SOEs will have a more difficult time attracting investment and issuing green bonds due to sub-AAA credit ratings, and typically have lower priority in bank lending (IISD 2014). Policy analysis highlights the role of credit enhancement for non-state-owned entities scaling the Chinese GBM further (CBI & IISD 2016b).

With regards to indirect protection, the policy of the 13[th]5YP improves the field of play for green bonds. This includes pricing carbon through the (at the time of writing, soon to launch) national carbon trading scheme, replacing the developmental emphasis on highway infrastructure with rail, as well as increased penalties and credit downgrades for non-compliance with environmental law as part of the "new Economic Norms in China" (Boulle, Dai, & Meng 2017; S. Gilbert & Zhou, 2017; Ng, Mabey, & Gaventa 2016). The 13[th]5YP also strikes directly at coal: setting goals for 2-4% annual decreases in thermally powered electricity, slowing approval processes for coal plants, and planning 4,300 mine closures between 2015-2018 (Ng et al 2016). These parallel efforts serve to increase the associated policy and market risks with fossil fuel investments and balance the cost of capital for green projects, which in turn improve the viability of financial instruments like green bonds. In this sense, policy innovation requires a threshold of coercive capacity domestically to overcome the obstructive interests of fossil fuel-based industries.

Reflexivity, monitoring, and evaluation

Within the domestic regime, China's standards for Green Bonds provide the basis for a robust monitoring and evaluation system. To ensure some baseline additionality, the NDRC, as an example, set limitations on proceeds used for refinancing at 50% (Boulle et al 2017), and though the NDRC doesn't maintain rules for disclosure, the interbank market issuances, which currently constitute most bonds outstanding, are required to provide disclosures on use of proceeds on a quarterly basis as opposed to the annual basis of international standards. With that granularity of data, policy makers can receive feedback on the functional flow of capital, demand and bond subscription, and the effectiveness of various typologies of green bonds, facilitating adaptive responses to experiments.

However, in reflecting on co-authorship networks and the longitudinal view, the evidence supports the role of think tanks, network intermediaries, and international GFC partners in facilitating policy diffusion by learning in more decentralized forms of monitoring and evaluation. As an example, the CBI and IISD "Roadmap for China" reports outline instruments for up-scaling China's GBM through increasing participation of private actors in transition management via investor awareness, project pipelines, securitization and warehousing, PPP vehicles for municipal green bonds, and SME credit enhancement, as well as incongruent standards between international and domestic green bonds (CBI & IISD 2016b, 2016c; EIB & GFC 2017). Both organizations, highly interconnected to the PBoC and the GFC in the epistemic community (see figure 1) defined policy problems that were subsequently responded to: the 'Guidelines for Establishing the Green Financial System' report was released in August of 2016 with the approval of the State Council, took stock regarding outputs, strengths, limitations, and growth areas of green finance and green bonds with the experiences of the PBoC, NDRC, CSRC, and others (The People's Bank of China et al. 2016).

The PBoC is the common denominator in additional connections that are providing policy

refinement to the Chinese case. Outside of broader epistemic communities, one specific example is the European Investment Bank (EIB) and the PBoC, having recently committed to harmonize standards and develop universal taxonomies to further upscale GBMs between China and the EU (EIB & GFC 2017). The PBoC have continued their long-standing collaboration with the UK actors in bilateral collaboration taskforces and policy reporting (UK-China Green Finance Taskforce 2017) and as co-chairs to the G20 Green Finance Study Group. In the reflexive stage, like in the arena stage, diffusion is facilitated through social construction and learning.

And yet little progress has been made in harmonizing standards between the Chinese and global standards: 33% of chinese issuance did not meet international standards (Climate Bonds Standards or Green Bonds Principles) in 2016, and 36% did not meet these standards in 2017 (Meng et al 2018). About half of the dissonance is due to project eligibility: China's inclusion of clean coal, coal plant efficiency retrofits, and large-scale hydro (by CBI standards, over 50 megawatt projects are ecologically disruptive (CBI 2018a). With little coercive authority in the meta-regime, the various financial regulators, through shareholder ownership of SOEs or through patronage have an incentive to de-accelerate transitions to accommodate massive state-owned utilities in energy, with a domestic preference for a more eased transition (He et al 2012). This is not an uncommon consequence in the study of policy diffusion: isometric convergence of policy design is rare: as Kingler-Vidra and Schleifer (2014) outline in a review of the literature, policy content is often contextualized and contested in the process of transfer.

Discussion

The evidence supports the conclusion that transnational networks played an influential role in facilitating policy diffusion and innovation in the development of the Chinese green bond market.

Through the mechanisms of social construction, learning, and driven by the mechanism of competition and investment seeking (though not policy convergence as a result of lacking coercive capacity in the meta-regime and competing domestic interests in 'softening blows' to fossil fuel intensive industries), exogenous parties supplied the policy content with which Chinese state actors made use domestically for policy innovation. We reach similar conclusions as the prevailing literature of environmental economic policies in China: more polycentric governance mechanisms for sustainability s are emerging that incorporate transnational actors and take more decentralized approaches to environmental areas. In the transition process, the PBoC played a key role in steering innovation through governance mechanisms including consensus building, agenda setting, coordinated experimentation, and monitoring and evaluation that were led by the actions of the GFC and informed by transnational actors and the broader meta-regime of green finance. However, this is none the less subject to the prioritization of economic logic and interests and domestic industry protectionism that challenged previous eras of Chinese environment management. In the context of policy diffusion, this helps explains the selective adaptation of policy content, as opposed to convergence with global rules on labeled green bonds. While transnational learning played a role in explaining the rapid expansion of China's GBM, additional empirical research suggests this phenomenon is a moderating variable to the more dominant and long-running force of China's economic financialization and the central directives of pursuing ecological civilization (Zhang 2018).

We identify green bonds as an accelerated and empowered niche in the TTM framework. In an applied sense, this provides support for the utility of the TTM framework to analyze the interface of transnational and domestic forces in sustainability transitions. Beyond finance, most sectors of the society are engaged substantially with globalization and forces of transnationalism. If a particular eco-innovation has a supportive meta-regime of participating transnational actors, planners and policy makers would be

wise to consider the costs and benefits of building linkages with transnational actors to help accelerate their planned sustainability transitions. Examples of sub-national governments in the United States, for example, illustrate the effectiveness of this strategy where climate change action is being stymied by national level government actors: states and cities develop peer networks to facilitate social learning and innovation (C40 Cities, America's Pledge, etc.) to develop accelerated niches if not empowered niches (in the terminology of TTM). Additionally, the application of the framework illustrates the validity and importance of applying sustainability transitions approaches to the analysis and planning of the rapid 'greening' of finance, adding to the modest but increasing number of these applications in academia (e.g. Falcone Morone & Sica 2018) as well as in policy making (e.g. EEA 2017).

Like all theory and frameworks, transition management sustainability transitions approaches have limitations and strengths. In our approach, we attempted to correct for some of the insensitivities to issues of power and politics from an analytical point of view, however, moving to policy planning must carefully consider contextual political realities including legitimacy, accountability, and representation. The frameworks also often presume that limitations to progress are normative as opposed to capacity-based. To be prescriptive in the context of finance, sustainability transitions planning must be supported with economic analysis to understand the full suite of obstacles and opportunities at play. In the context of finance, it's vital that this additionally involve a socio-environmental analysis of impacts and benefits. Close study will be necessary to ensure that, despite the risk of obscurity and complexity of international finance mechanisms, added-value is being contributed by programs and policies that are consistent with goals established for countries under the Paris Agreement's Nationally Determined Contributions, or for double/triple bottom lines determined for institutional investors. Some of the research available far has shown uncertain results about the tangible and additional environmental benefits of green finance (Bracking 2015; Clapp, Alfsen, Knut, Torvanger, & Lund 2015; Ehlers & Packer 2016). Logical next

steps beyond this exploratory research would involve testing the explanation and framework through direct interviews with individuals who played prominent roles in the various stages of transition. While we've made attributions of mechanisms of policy diffusion based on the available evidence, the relative importance of a given mechanism in each context is often re-cast by the inside perspective, and might reflect positionality that contains some important socio-cultural or organizational patterns. Similarly, participating actors may differently attribute boundaries for stages of transition governance – validating the model of TTM in this case would strengthen it's future application As well, comparative analyses in additionalcase studies, particularly in the EU, where green finance has been experimented with can assist the development of robust, policy-grade recommendations for upscaling green finance generally.

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Table 1: Meta-Regime/Regime/Niche interactions

Meta-Regime	Supportive	Indifferent/hostile	Supportive	Indifferent/hostile
Regime	Supportive	Supportive	Indifferent/hostile	Indifferent/hostile
Result	Accelerated, empowered niche	Empowered niche	Accelerated, unempowered niche	unempowered niche

TABLE 2 Processes of (Transnational) Transition Management (Adapted from Loorbach 2010)

Phase	Governance Processes (TM)	Governance Processes (TTM)
Transition Arena	Problem identification, consensus building	Building social capital in transnational networks, development of leadership in regime, social construction diffusion
Transition Agenda	Agendas and coalitions	Social learning/construction diffusion in policy-generating networks
Transition Experiment	projects and programs	Coordinated experimentation through domestic policy innovation and transnational partnerships
Monitoring and Evaluation	Monitoring and Evaluation	Reflexive learning in transnational epistemic communities

TABLE 3: Participants in the Green Finance Task Force

	Regime Actors (China)	Regime Actors (Other)	Meta-Regime Actors
State/Public Actors	PBoC, China Banking Regulatory Commission, China Development Bank, Shenzen Stock Exchange Group, Ministry of Finance, Industrial and Commercial Bank of China, Ministry of Environmental Protection	(UK) Department for International Development	UNEP Inquiry UNEP Finance Initiative
Academia	Chinese Academy of Social Sciences, Remnin University of China, Central University of Finance and Economics	(Brazil) Getulio Vargas Foundation School of Law	
Corporates	Beijing Orient Landscape Industry Group,		

China Securities,

 People's Insurance Group of China,

Zhong De Securities,

Noah Private Wealth Management,

China Industrial Bank,

Zhong Lun Law Firm,

China Minsheng Bank

| **Think tanks/NGOs** | Syntao, Clean Air Alliance China, Eco-Forum Global | (US) Energy Foundation (UK) Trucost | International Institute for Sustainable Development, Global Footprint Network, Climate Bonds Initiative, 2 Degree Investing Initiative, World Resources Institute |

TABLE 4: Market Segments and regulation

Bond Type	Typical Issuer	Market Segment	Regulatory Authority	Related policy
Sovereign Bonds	Policy Banks	offshore exchanges, interbank bond	Ministry of Finance	[If onshore – Green Financial

		market		Bonds Guidelines]
Municipal Bonds	Municipalities	Interbank bond market	Ministry of Finance	Pending
Financial Bonds, credit asset-backed securities	State and corporate banks	Interbank bond market	PBoC, CBRC	Green Financial Bonds Guidelines
Non-financial corporate debt financing	Non-SOE corporates	Interbank bond market	PBoC, NAFMII	NAFMII Guidance on Debt Financing Instruments Issuance from Non-Financial Corporates (In accordance with 2008 PBoC Decree No. 1)
Enterprise bonds	SOE	Interbank bond market	NRDC	NRDC Green Bonds Guidelines

Corporate bonds,	SOEs +	Stock Exchanges	CSRC	CSRC
corporate asset-	corporates			guidelines
backed securities				

(Adapted from Meng, Lau, & Boulle 2018*).*

FIGURE 1: Collaborations in report outputs on Chinese green bond market development
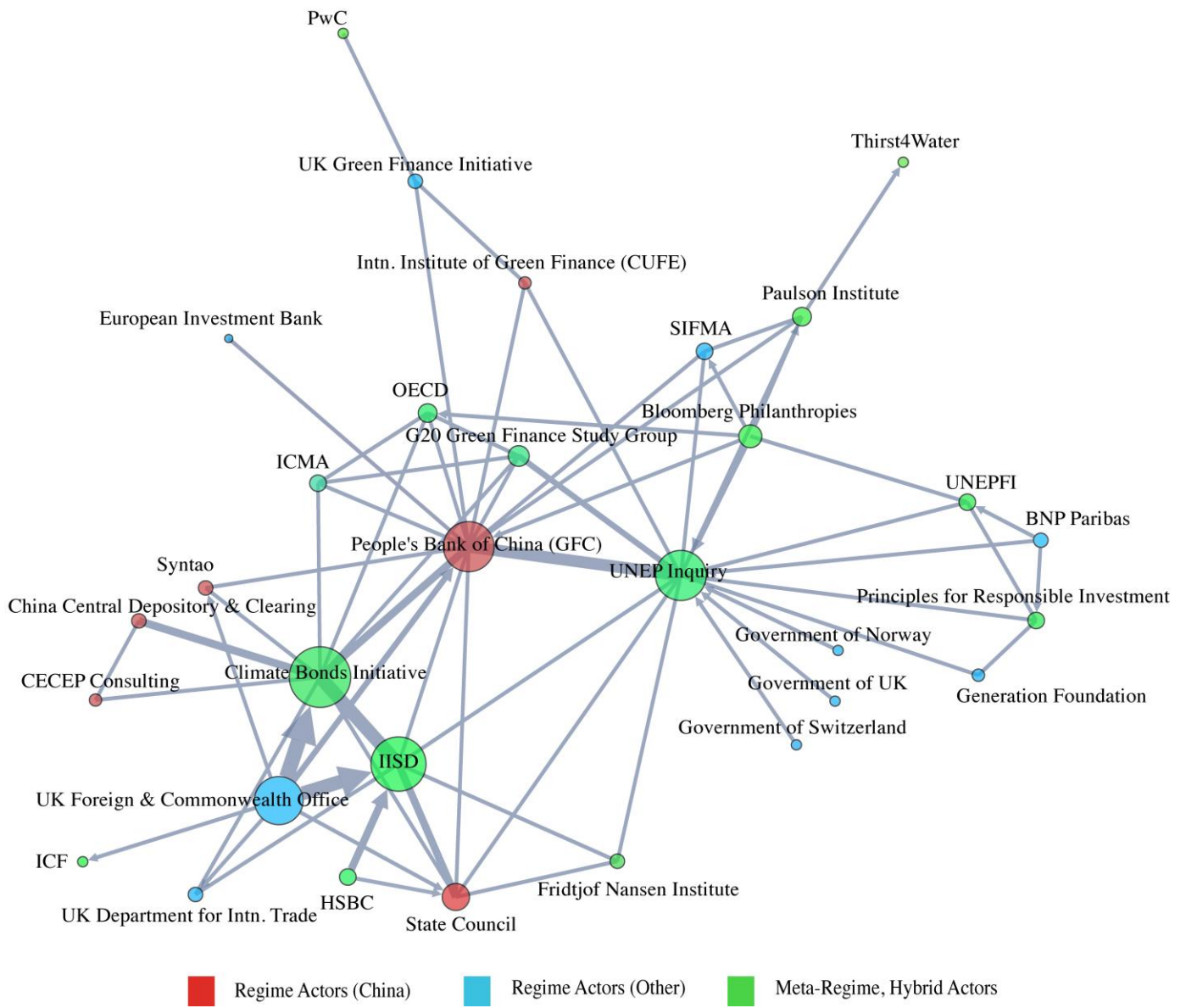
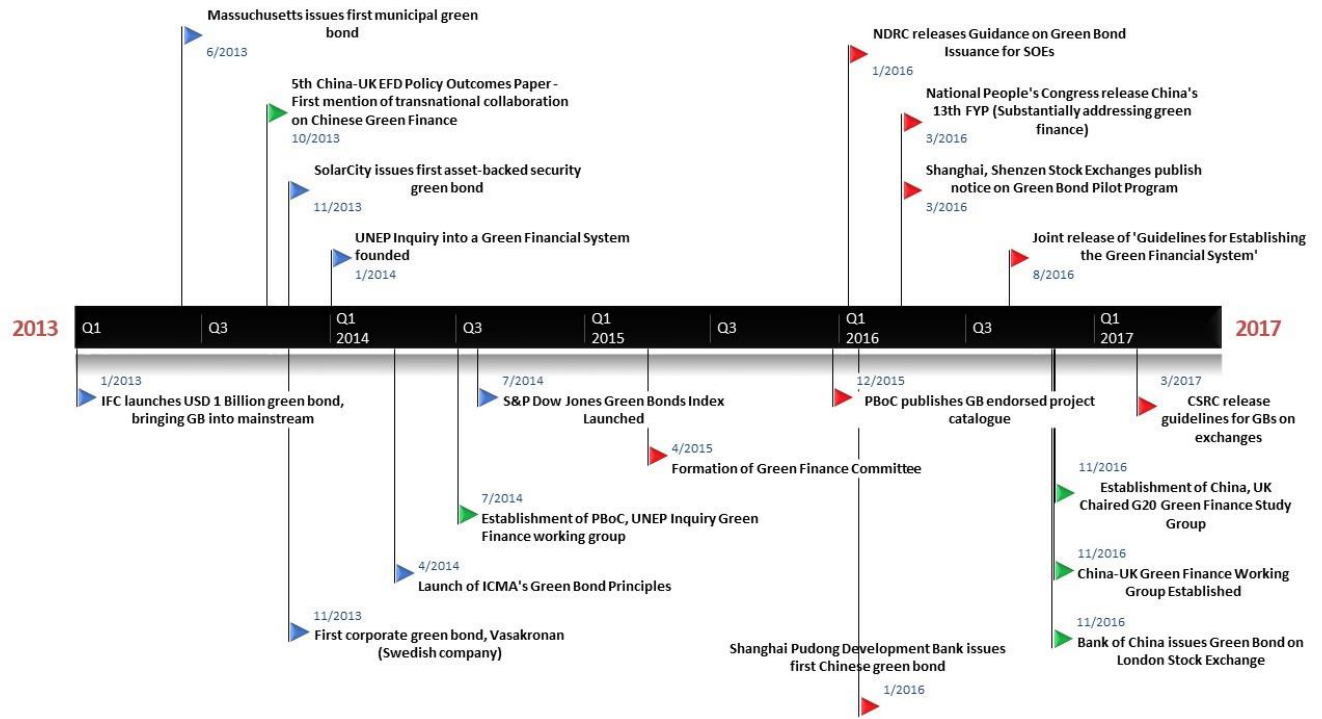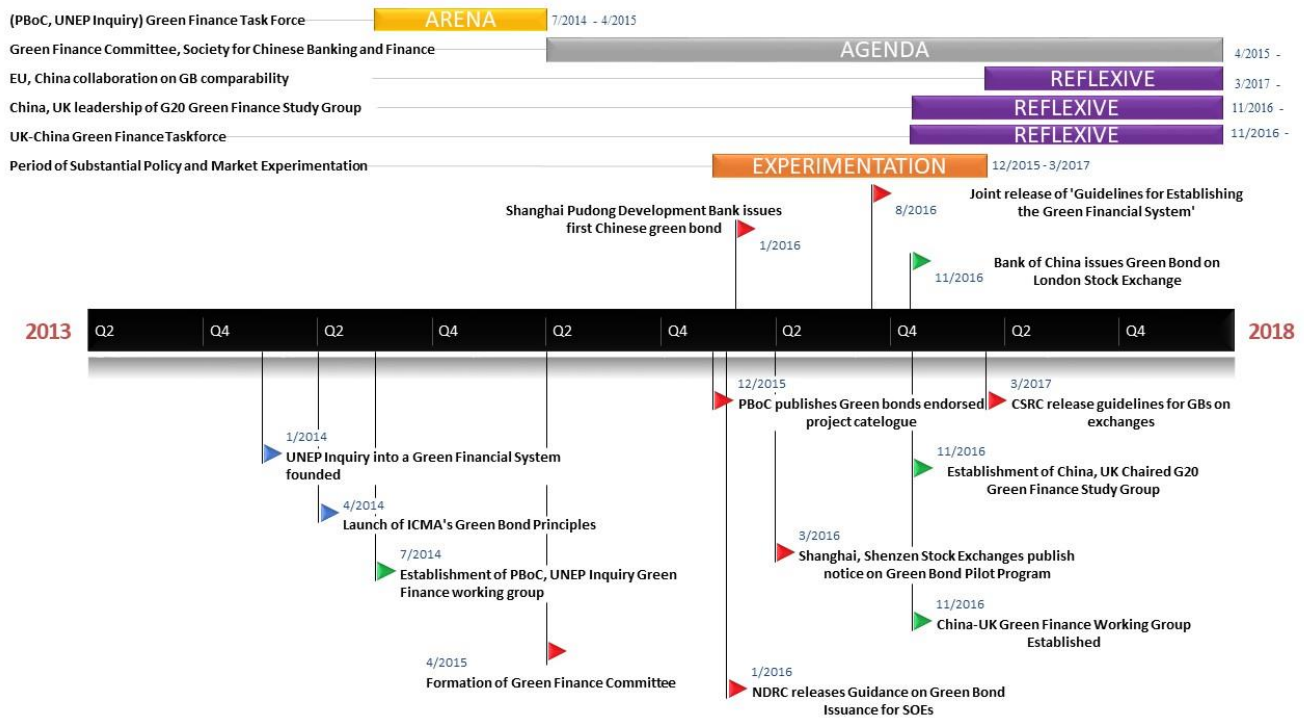Figure 2: Timeline of Green Bond Market Development in China

Figure 3: Imposing the TTM Stages onto key milestones in the case study

(PBoC, UNEP Inquiry) Green Finance Task Force

ARENA

7/2014 - 4/2015

Green Finance Committee, Society for Chinese Banking and Finance

AGENDA

4/2015 -

EU, China collaboration on GB comparability

REFLEXIVE

3/2017 -

China, UK leadership of G20 Green Finance Study Group

REFLEXIVE

11/2016 -

UK-China Green Finance Taskforce

REFLEXIVE

11/2016 -

Period of Substantial Policy and Market Experimentation

EXPERIMENTATION

12/2015 - 3/2017

8/2016
Joint release of 'Guidelines for Establishing the Green Financial System'

Shanghai Pudong Development Bank issues first Chinese green bond

1/2016

11/2016
Bank of China issues Green Bond on London Stock Exchange

2013 | Q2 | Q4 | Q2 | Q4 | Q2 | Q4 | Q2 | Q4 | Q2 | Q4 | 2018

12/2015
PBoC publishes Green bonds endorsed project catelogue

3/2017
CSRC release guidelines for GBs on exchanges

1/2014
UNEP Inquiry into a Green Financial System founded

11/2016
Establishment of China, UK Chaired G20 Green Finance Study Group

4/2014
Launch of ICMA's Green Bond Principles

7/2014
Establishment of PBoC, UNEP Inquiry Green Finance working group

3/2016
Shanghai, Shenzen Stock Exchanges publish notice on Green Bond Pilot Program

11/2016
China-UK Green Finance Working Group Established

4/2015
Formation of Green Finance Committee

1/2016
NDRC releases Guidance on Green Bond Issuance for SOEs

- Figure 1 Caption: Undirected edges represent report collaboration, direct edges represent

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financial sponsorship or support, and the size/strength of edges are a function of the number of

collaborations between actors. Node size is a function of the weighted degree, or the number and

strength of its connecting edges. Note that GFC authorships were included as the same node as

the PBoC due to lead authorship by PBoC-staff on GFC report collaborations.

- Figure 2 Caption: Blue flags indicate non-Chinese regime milestones, red indicates Chinese

  regime milestones, green indicates Chinese collaborative milestones.