© *Academy of Management Discoveries*
2019, Vol. 5, No. 4, 514–529.
Online only
https://doi.org/10.5465/amd.2018.0160

DOES A COMMON MECHANISM ENGENDER COMMON RESULTS? SUSTAINABLE DEVELOPMENT TRADE-OFFS IN THE GLOBAL CARBON OFFSET MARKET

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We investigate whether a common mechanism to achieve global sustainability goals produces uniform results in the world's largest carbon offset market, the UN Clean Development Mechanism. Conventional wisdom suggests that an international regulatory accord designed to stimulate investment in activities to achieve sustainability objectives would yield similar impacts across institutional contexts. But our results illustrate that consideration of various dimensions of sustainability entails inherent trade-offs among local priorities that can contribute to uneven global outcomes. We show that broader country-level sustainability institutions, and the ministerial offices in which sustainability assessments are made, affect preferences for different types of sustainable development. We discuss the implications for the UN Sustainable Development Goals and offer suggestions to regulators and policymakers who design and implement market-based sustainable development systems.

INTRODUCTION

The societal grand challenges facing organizations and policymakers require stakeholders to address multiple dimensions of sustainable development (Hoffman & Jennings, 2018). Yet, prioritizing how to address these issues can be difficult (Ferraro, Etzion, & Gehman, 2015). One arena that manifests the

The authors thank the associate editor Gerald Davis and the anonymous reviewers for their helpful guidance. They also express appreciation to participants from the 2019 Academy of International Business Conference for their comments. The authors gratefully acknowledge funding from the University of Southern California's Lloyd Greif Center for Entrepreneurial Studies.
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trade-offs among various sustainability challenges is the global carbon offset market (Wright & Nyberg, 2017). As part of the Kyoto Protocol, the Clean Development Mechanism (CDM) was designed to provide market-based incentives for investment in emerging markets and developing economies, to achieve two objectives (Drupp, 2011; Nussbaumer, 2009). The first objective was to reduce greenhouse gas emissions. The second objective was to help developing economies achieve sustainable development (Alberton, 2010; Olsen & Fenhann, 2008). Although achieving these objectives seems to have been a largely technical challenge, the practical realities of the CDM involved important institutional and organizational factors (Ansari, Gray, & Wijen, 2011; Veal & Mouzas, 2012).

The CDM follows a market-based approach whereby firms in advanced economies, to offset the amount of carbon they emit, purchase certified emission reductions—or carbon offsets—produced in economically less-developed countries where mitigation efforts are less costly (Wittneben, Okereke, Banerjee, & Levy, 2012). Carbon offsets are created by instituting projects that produce greenhouse gas emissions below the level of emissions that would have occurred if the project had not been developed. If a project is properly designed, executed, monitored, and documented, the relevant UN office issues certified emission reductions, which can be sold to firms in advanced economies seeking to achieve their Kyoto Protocol–mandated reductions (Doh & Guay, 2006). The CDM rules also require that carbon offset project proposals report various sustainable development benefits for host countries. Local host country CDM offices approve projects based on the degree to which a proposed project contributes to the host country's broader sustainable development objectives. Using detailed project-level data abstracted from 8,769 project design documents across 92 countries, we empirically analyze how host country and project characteristics affect new project approvals.

The results illustrate that international policy structures seeking to achieve sustainable development while allowing local countries to prioritize sustainability dimensions (or different Sustainable Development Goals (SDGs)) involve trade-offs among sustainable development priorities. Consequently, creating common mechanisms to augment broader sustainability initiatives will not yield uniform results across institutional contexts but may, instead, vary greatly depending on the mechanism's decentralized nature. Although our findings from the CDM are based on data from policy created before the 2015 adoption of the UN Sustainable Development Goals (SDGs), our study has important implications for future policy mechanisms seeking to simultaneously address multiple SDG dimensions across vastly different institutional contexts. One such policy is the 2015 Paris Agreement, which supersedes the Kyoto Protocol in 2020. Although the Paris Agreement will continue to promote various dimensions of sustainable development, it achieves these goals with a highly decentralized carbon market that is subject to greater local country influence, compared with what the Kyoto Protocol allows. Our findings suggest that the Paris Agreement could lead to even greater variance in the types of sustainability that are globally addressed.

The Kyoto Protocol's CDM

Although the UN Framework Convention on Climate Change (UNFCCC), adopted at the Rio Earth Summit in 1992, was the world's first major international accord to address climate change, a series of subsequent Conference of Parties meetings negotiated global climate policy objectives (Ansari et al., 2011; Ansari, Wijen, & Gray, 2013). The most recognized objective was the 1997 Kyoto Protocol, which developed through a complex compromise between emerging markets and developing countries' desire for sustainable development and advanced economies' desire to reduce greenhouse gas emissions (Bumpus & Cole, 2010; Georgallis, Dowell, & Durand, 2019; Olsen, 2007). One result of this compromise was the development of the CDM, which had two objectives: (1) reduce global greenhouse gas (GHG) emissions in the most cost-effective manner and (2) help developing economies to achieve their own SDGs (Drupp, 2011; Nussbaumer, 2009). The CDM sought to achieve both objectives by undertaking projects in developing economies that could provide sustainable development benefits to those countries while offsetting greenhouse gas emissions in advanced economies. However, when the CDM was designed, the concept of "sustainable development" was less well developed and each country was allowed complete discretion to determine what constituted sustainable development for them. Indeed, the global conversation about CDM implementation helped to inform subsequent discussions and debate that led to the adoption of the SDGs in 2015.

Despite the CDM's lofty aspirations, researchers and practitioners have questioned whether the CDM has achieved either of its objectives (Böhm, Misoczky, & Moog, 2012; Muller, 2007). Regarding the first objective, studies have questioned the extent to which emission reductions associated with CDM projects are actually "additional" (i.e., emission reductions that would not occur if the project were not developed) (Drupp, 2011; Schneider, 2009), and some have argued that other policy alternatives, such as carbon taxes or alternative regulations, would be more effective (Stern, 2008).

Regarding the second objective, scholars have questioned whether a developing country's sustainability goals can be accomplished while also reducing global carbon emissions (Böhm et al., 2012). In particular, three factors indicate friction between the GHG emission-reduction objectives and the CDM's sustainable development objectives for developing economies (Alexeew, Bergset, Meyer, Petersen, Schneider, & Unger, 2010). First, the objectives have different dimensions. Emission reductions are defined as reductions in a specified set of gases with quantifiable greenhouse potential that would not have occurred without the focal CDM project, and can thus be quantified on a common scale. Likewise, the CDM treats achievement of a developing country's various SDGs as a unidimensional construct (Ashraf, Ahmadsimab, & Pinkse, 2017). In truth, this objective is multifaceted (Boyd et al., 2009). As the SDGs reveal, sustainable development encompasses many different types of outcomes (e.g., local employment, improvement in air quality, and energy freedom), which can be extremely costly to measure accurately (Kroeger & Weber, 2014) and are difficult to compare (Rawhouser, Cummings, & Newbert, 2019). CDM rules require each host country to decide what constitutes sustainable development beyond emission reductions, which leads to differences and inconsistencies across countries (Drupp, 2011; Parnphumeesup & Kerr, 2011). The CDM's measuring and accounting of GHG reductions and of local countries' sustainable development benefits are also dramatically different (Veal & Mouzas, 2012). For carbon emissions, the projects' designated processes are precisely measured, and calculations quantify the reductions in common units (tons of CO_2) and are recorded after verification by a third party. The United Nations then issues tradable certified emission reductions (the financial instruments representing these GHG reductions) (Drupp, 2011). By contrast, project design documents do not consistently describe the sustainable development benefits for the host country, and the CDM does not specify rules for assessing, measuring, or prioritizing these benefits (Muller, 2007). Thus, achievement of sustainable development in the CDM is often not measured or monitored and is never traded (Parnphumeesup & Kerr, 2011).

Finally, the CDM's two objectives are subject to different institutional frameworks. A local host country, through the country's designated national authority (DNA), must approve a project before the UNFCCC approves it. The DNA's role is to certify that the project meets the country's sustainable development priorities. Local stakeholders often influence DNA decisions in this regard (Bumpus & Cole, 2010; Halme, Lindeman, & Linna, 2012). The UNFCCC does not exercise any oversight on the degree to which a project achieves host country sustainable development objectives and fully relies on the host country's approval of the project. Without the DNA approval, the UNFCCC cannot approve the project. A host country can impose additional sustainable development requirements, but such additional requirements can deter project developers, who choose among countries in which to develop carbon offset projects, from selecting a country with more stringent requirements (Alexeew et al., 2010). By contrast, determining whether and how much a project contributes to climate change mitigation is at the sole discretion of the global UN office, the UNFCCC.

Given the significant differences in treatment between climate change mitigation and the achievement of other types of sustainable development, it is unclear whether and how a CDM project's achievement of sustainable development matters in the CDM. We aim to understand local factors that influence whether UN regulators ultimately approve projects. One might assume that claims of greater diversity in sustainable development impacts would make a carbon offset project more attractive to CDM regulators and, thus, lead to higher project approval rates. But it is possible that CDM regulators ignore or even negatively perceive some sustainable development benefits. We seek to address the following questions.

How Does the Type of Sustainable Development Claims Influence the Perceived Value of Carbon Offset Projects?

Each CDM project's design document must describe how the project contributes to the host country's sustainable development, and prior research has used these claims to rate CDM projects' potential to offer sustainable development benefits (Alexeew et al., 2010; Drupp, 2011; Olsen & Fenhann, 2008). Following prior carbon offset research, we classify sustainable development benefits as social, environmental, or economic (Lazarus & Erickson, 2012). Social benefits include reduction in health risks, facilitating education and research, increasing awareness, improving local working and living conditions, reducing poverty, and creating direct employment. Environmental benefits include, in addition to the climate change benefits, improvements in air and water quality, reduction in soil pollution, avoidance of waste disposal, and conservation of resources and landscapes. Economic benefits include economic development, enhancement of productivity, improved access to heating and electricity services, and reductions in reliance on foreign exchange to buy fossil fuels (Olsen & Fenhann, 2008).

Author's voice:
What motivated you to undertake this project?

How Do Country-Level Institutions Influence the Approval of Carbon Offset Projects? Do the Institutional Effects Depend on the Projects' Type of Sustainability Claims?

Each host country's DNA determines the criteria for approving a project by defining what counts as sustainable development in the local country. Because CDM projects can bring substantial investment benefits to a host country (e.g., financial flows to local companies from sales of carbon offsets and jobs created from construction and monitoring), DNAs have significant incentives to rubber stamp every project proposed in their country, regardless of the project's sustainable development claims (Stephan & Lane, 2014).

However, despite these incentives, studies suggest that DNAs vary widely in the number of requirements they impose and the degree to which they exert oversight (Michaelowa & Jotzo, 2005). Local sustainability norms, practices, and knowledge needed to fully evaluate projects' sustainable development claims likely vary by country. However, because sustainable development is a multidimensional construct, the effect of local norms, practices, and knowledge is unlikely to be uniform, as projects that vary in their sustainable development impacts also, therefore, vary in their alignment with local preferences and knowledge (Marquis, Toffel, & Zhou, 2016).

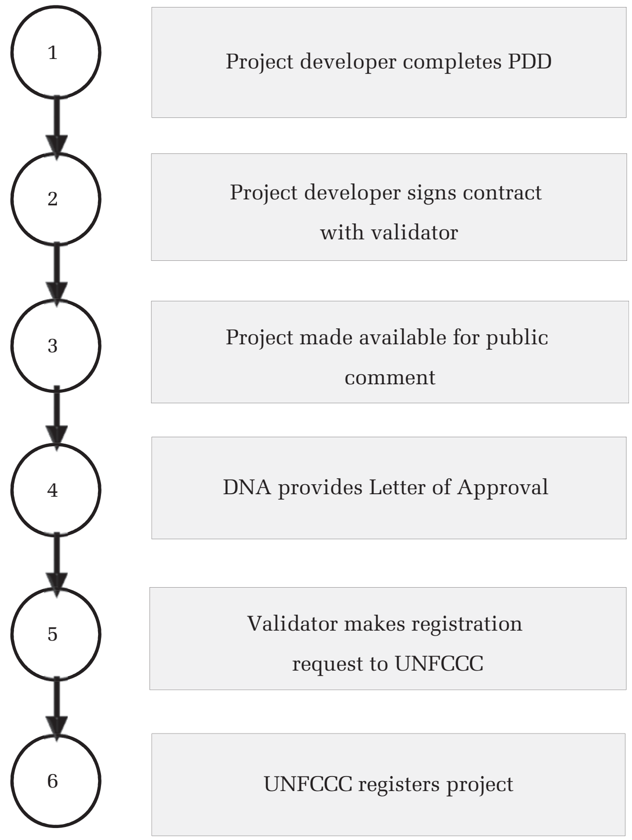
METHODS

Data and Dependent Measure

To assess the factors affecting the likelihood of CDM project approval, we used the CDM Pipeline database compiled by the UNEP DTU Partnership, which has been used in several empirical analyses (Dechezleprêtre, Glachant, & Ménière, 2009; Fenhann, 2013; Olsen & Fenhann, 2008). This data set includes a time line of key dates and outcomes of each proposed carbon offset project, allowing us to chart the development trajectory of all individual projects proposed between 2004 (the beginning of carbon trading under the Kyoto Protocol) and 2013 (carbon prices dropped substantially in 2012, which changed the market incentives and structure). After eliminating projects

Author's voice:
How did you get access to your data?

FIGURE 1
The CDM Project Registration Cycle



Note: Adapted from (Magnusson, 2015).

with missing data for key variables, we have a sample of 8,769 projects in 92 countries[2] over 10 years. Our binary dependent measure is *project approval*, which in our context indicates that an individual project has gone through all necessary regulatory stages and has been registered for operation. Of our

[2] Our 92 countries include Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Bhutan, Bolivia, Bosnia, Brazil, Cambodia, Cameroon, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Cuba, Cyprus, Democratic Republic of Congo, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Georgia, Ghana, Guatemala, Guyana, Honduras, India, Indonesia, Iran, Israel, Jamaica, Jordan, Kenya, Kyrgyz Republic, Laos, Lebanon, Lesotho, Libya, Macedonia, Madagascar, Malaysia, Mali, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Nigeria, North Korea, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Saudi Arabia, Senegal, Sierra Leone, Singapore, South Africa, South Korea, Sri Lanka, Sudan, Syria, Tajikistan, Tanzania, Thailand, Togo, Tunisia, United Arab Emirates, Uganda, Uruguay, Uzbekistan, Vietnam, Yemen, Zambia, and Zimbabwe.

8,769 projects, 5,603 (64 percent) received a letter of approval from their DNA, and of those, 5,053 (90 percent) received UN approval to operate, for an overall registration rate of approximately 55 percent. This high correlation between DNA approval and UN approval underscores the importance of focusing on the impact of local institutions in this process (Chaparro, 2006). On average, projects receive approval or rejection approximately 500 days after application. The project registration cycle is shown in Figure 1, above.

Sustainable Development Measures: Project Level

Carbon offset projects also have other sustainable development impacts, aside from the direct reduction in GHG emissions, which may influence their perceived value and, thus, their likelihood of approval. To capture these additional impacts, we use an expert sustainability measure developed by Olsen and Fenhann (2008: 2830) "to assess the sustainability of CDM projects . . . and present findings at aggregated levels." The authors conducted a textual analysis of the design documents of a representative sample of CDM projects, identified sustainable development claims made in the document, mapped these claims to common sustainability indicators, and classified these indicators into four categories: environmental (air, land, water, and conservation), social (employment, health, learning, and welfare), economic (growth, energy, and balance of payments), and others. This time-consuming process, which required technical expertise and manual review of each document (rather than relying on less accurate but more easily scalable word counts), yielded a total number of sustainability indicators among each type of sustainable development (environmental, social, and economic) for each project. These metrics were averaged across project types to create reasonable proxies for total sustainability, environmental sustainability, social sustainability, and economic sustainability that could be applied to the entire sample of CDM projects by other researchers. We rely, in a manner similar to prior research, on Olsen and Fenhann's classifications and extrapolate these representative project sustainability scores to our data set, using 26 project-type classifications (Karakosta, Marinakis, Letsou, & Psarras, 2013). For example, Olsen and Fenhann's textual analysis of design documents for biomass energy projects found an average of 3.2 environmental claims, 2.6 social claims, 3.5 economic claims, and 2.5 other claims, which results in 11.8 total claims per biomass energy project. Using this expert assessment, we assigned these average scores to all biomass energy projects in our data set. We then followed similar procedures for each of the 26 project-type classifications. We call these variables *Project Environmental Sustainability*, *Project Social Sustainability*, *Project Economic Sustainability*, and *Project Total Sustainability*. All of these variables measure diversity in claims of a specific dimension of sustainability, not the magnitude of achieved impact. For ease of comparison, we standardize each of the four variables so that they have a mean of 0 and a standard deviation of 1.[3]

> Author's voice:
> How did the paper evolve and change as you worked on it?

Sustainable Development Measures: Country Level

In addition to project-level variation in sustainable development impacts, institutional contexts may differ in their levels of sustainable development, which can suggest differences in both local needs and capabilities. To address this issue, we rely on a country-level measure of sustainable development called the Sustainable Society Index, which draws on publicly available data to periodically assess more than 150 countries on 21 indicators. These indicators are also categorized into three dimensions of sustainability: environmental, social, and economic dimensions (van de Kerk & Manuel, 2006). Each country receives a numerical score between 1 and 10 for each dimension. For example, on the economic dimension, Mozambique and Sierra Leone, which each have submitted one carbon offset project proposal in our sample, each have a sustainability score of 1.4. At the other end of the spectrum, Mexico, which has 259 projects in our sample, has an economic sustainability score of 6.7. For our purposes, as we did with the project-level scores, we standardize scores within each dimension to ease interpretation of coefficient magnitudes. Variables in our analysis are called *Country Environmental Sustainability*, *Country Social Sustainability*, and *Country Economic Sustainability*.

Control Variables

Before submitting an application, some project owners secured a buyer's commitment to purchase their future potential production of carbon offsets. This resource commitment could signal underlying project quality or attractiveness, and it could affect the level of support from the DNA as well as the UNFCCC's regulatory decisions. To address this

[3] In unreported analyses, we also tested these relationships by using continuous project-level sustainability measures, and our main findings are unchanged.

possibility, we include in our models a 0/1 dummy variable indicating whether the project had secured an offset buyer before submission of the project design document for initial review. We call this variable *Project Offsets Presold*.

Each proposed project application incorporates one or more approved methodologies for reducing carbon emissions (Rawhouser, Cummings, & Marcus, 2018). Because the use of multiple methodologies may indicate a more complex project design and a more difficult technical review process, we control for the number of methodologies (ranging from one to four in our sample) by using a count variable we call *Project Complexity*. A carbon offset project's chosen methodology also influences the likelihood of project approval because as particular methodologies for carbon emission reduction become widespread, this may also ease the regulatory review process for projects that incorporate those methodologies. This occurs both because regulators are more familiar with the key components and because the passage of time results in increased potential for firms' vicarious learning *via* knowledge spillovers. Using the CDM Pipeline data set, we gathered data on the number of prior project proposals that have relied on the same primary methodology, to measure *Project Technological Maturity*. Following our practice for other continuous variables, we standardize this variable so that it has a mean of 0 and a standard deviation of 1, to ease interpretation.

Because the quantity of carbon reductions relates directly to financial incentives, we add a measure of *Project Size* as a control, which is the total amount of carbon emission reductions (in tons of CO_2) expected from the time of project approval through the year 2020. This measure also comes from the CDM Pipeline data set and is standardized to ease analytical interpretation.

Project proposals can differ in their attractiveness and potential impact, through the transfer of intellectual property or other technological know-how to developing countries. To capture this effect on approvals, we use a measure developed by Seres, Haites, and Murphy (2009), who analyzed 3,000 project design documents and assessed the average number of technology transfer claims made by each type of carbon offset project (water, solar, etc.). Following our practice for the *Project Sustainability* measures, we match the technology transfer measure to our sample by project type and call this variable *Project Technology Transfer Benefits*. We present our basic descriptive statistics and pairwise correlations in Table 1.

RESULTS

We present in Table 2 our logistic regression results as coefficients with robust (country-clustered) standard errors. In discussing the magnitude and practical impact of our results, we occasionally convert the results to exponentiated coefficients (i.e., $\exp(b)$), which means that their values should be compared with 1, a coefficient value that represents the baseline likelihood of the outcome of interest.

Many of our control variables in Table 2, column 1, are statistically significant and with signs consistent with expectations. For example, a proposed project with a buyer commitment (*Project Offsets Presold*) is approximately four times more likely than a project without such a commitment to receive approval ($b = 1.53$, $\exp(b) = 4.62$, $p < .01$). Similarly, a one–standard deviation increase in *Project Technology Transfer Benefits* is associated with a 17 percent increase in the likelihood of approval ($b = 0.16$, $\exp(b) = 1.17$, $p < .01$), suggesting that stakeholders involved in the project approval process respond positively to technology transfer claims. The exponentiated coefficient for *Project Complexity* suggests that an increase of one methodology in a project proposal decreases the likelihood of regulatory approval by approximately 33 percent ($b = -0.40$, $\exp(b) = 0.67$, $p < .01$). Some nonsignificant results are worth mentioning as well. For example, none of the three country-level sustainability measures are statistically significant at commonly accepted levels, and the overall level of market maturity does not seem to significantly influence the likelihood of project approvals.

Project-Level Sustainability

Moving from our control model to our primary variables of interest, we find that some variables have the expected signs, whereas others are more surprising. The results in Table 2 (column 1) suggest that *Project Total Sustainability* has a small but statistically significant effect on the likelihood of regulatory approval, such that a one–standard deviation increase in the total sustainability is associated with an 11 percent increase in the likelihood of approval ($b = 0.10$, $\exp(b) = 1.11$, $p < .05$).

Yet, our total sustainability measure is an aggregate of three separate dimensions, each of which may have its own effect on the likelihood of regulatory approval. To explore the effect of each project-level sustainability dimension, we disaggregate a project's total sustainability score into components, as shown in Table 2 (column 2). Specifically, results suggest that *Project Environmental Sustainability* is not significantly associated with the likelihood of regulatory approval. By contrast, an increase in a project's purported social and economic impact seems to have a positive effect on the approval likelihood. One–standard

TABLE 1
Descriptive Statistics and Pairwise Correlations

	Variable	Mean	S.D.	−1	−2	−3	−4	−5	−6	−7	−8	−9	−10	−11	−12	−13	−14	−15	−16	−17
−1	*Project Approval*	0.555	0.497	1																
−2	*Project Offsets Presold*	0.648	0.478	0.35	1															
−3	*Project Complexity*	1.089	0.314	−0.03	0.04	1														
−4	*Technological Maturity*	952.725	1,028.557	0.04	−0.04	−0.2	1													
−5	*Project Size*	1270.281	4877.22	0.04	0.05	−0.02	−0.07	1												
−6	*Project Tech Transfer*	37.531	26.069	0.03	−0.04	0.29	−0.2	0.05	1											
−7	*Country Environmental Sustainability*	4.683	0.92	−0.1	−0.21	0.06	−0.23	−0.05	−0.02	1										
−8	*Country Social Sustainability*	6.126	0.456	0	0.02	0.06	0.16	−0.02	0.11	−0.47	1									
−9	*Country Economic Sustainability*	4.783	0.853	0.14	0.32	0.02	0.2	0.03	0.06	−0.66	0.4	1								
−10	*Market Maturity*	28.046	46.29	0.08	0.17	0	0.15	−0.02	0.06	−0.16	0.05	0.2	1							
−11	*Project Total Sustainability*	12.389	2.545	0.05	0.05	−0.03	0.15	−0.12	−0.18	0.02	−0.01	0.09	−0.06	1						
−12	*Project Environmental Sustainability*	3.608	2.341	−0.06	0.04	0.14	−0.29	−0.04	0.15	0.14	−0.07	−0.01	−0.06	0.62	1					
−13	*Project Social Sustainability*	4.656	1.896	0.11	0.04	−0.07	0.28	−0.08	0.01	−0.17	0.11	0.17	−0.03	0.6	0	1				
−14	*Project Economic Sustainability*	3.603	1.512	0.1	0.02	−0.21	0.56	−0.13	−0.48	−0.07	0	0.08	0.05	0.17	−0.41	0.06	1			
−15	*China*	0.421	0.494	0.24	0.5	−0.09	0.25	0.06	−0.19	−0.57	0.02	0.54	0.17	0.04	−0.15	0.14	0.24	1		
−16	*India*	0.248	0.432	−0.17	−0.5	−0.07	−0.09	−0.05	−0.02	0.39	−0.2	−0.66	−0.19	−0.14	−0.1	−0.14	−0.01	−0.49	1	
−17	*Brazil*	0.06	0.237	−0.08	−0.13	0.02	−0.07	−0.01	0.02	0.14	−0.09	−0.13	0.03	0.01	0.04	−0.05	−0.04	−0.21	−0.14	1
−18	*Environmental DNA*	0.504	0.5	−0.19	−0.42	0.08	−0.2	−0.06	0.17	0.52	0.04	−0.44	−0.18	−0.03	0.13	−0.11	−0.19	−0.86	0.57	−0.25

TABLE 2
Logistic Regression of Carbon Project Approval on Project and Country Characteristics

Variable	(1) LOGIT	(2) LOGIT	(3) LOGIT	(4) LOGIT	(5) LOGIT	(6) LOGIT	(7) LOGIT
Project Offsets Presold	1.53** (0.15)	1.52** (0.15)	1.51** (0.16)	1.37** (0.19)	1.38** (0.21)	1.46** (0.19)	1.43** (0.21)
Project Complexity	−0.40** (0.15)	−0.35* (0.14)	−0.32* (0.15)	−0.35* (0.14)	−0.24 (0.15)	−0.36* (0.14)	−0.34* (0.15)
Project Technological Maturity	0.05 (0.09)	−0.25** (0.07)	−0.30** (0.06)	−0.29** (0.07)	−0.30** (0.07)	−0.26** (0.06)	−0.28** (0.06)
Project Size	0.06 (0.07)	0.12 (0.08)	0.13 (0.08)	0.09 (0.07)	0.08 (0.07)	0.09 (0.08)	0.09 (0.08)
Project Technology Transfer Benefits	0.16** (0.06)	0.30** (0.11)	0.32** (0.10)	0.33** (0.11)	0.28** (0.11)	0.31** (0.11)	0.30** (0.10)
Country Environmental Sustainability	−0.09 (0.09)	−0.08 (0.08)	−0.10 (0.08)	0.06 (0.10)	0.08 (0.10)	−0.02 (0.10)	−0.02 (0.10)
Country Social Sustainability	−0.11 (0.10)	−0.10 (0.09)	−0.09 (0.08)	−0.02 (0.09)	−0.01 (0.08)	−0.06 (0.09)	−0.04 (0.09)
Country Economic Sustainability	0.03 (0.07)	0.01 (0.06)	0.02 (0.07)	−0.01 (0.09)	0.01 (0.08)	−0.00 (0.06)	−0.02 (0.06)
Market Maturity	0.01 (0.07)	0.02 (0.07)	0.02 (0.02)	0.02 (0.07)	0.00 (0.07)	0.01 (0.07)	0.00 (0.07)
Project Total Sustainability	0.10* (0.04)						
Project Environmental Sustainability		−0.09 (0.08)	−0.19* (0.09)	−0.07 (0.08)	−0.04 (0.06)	−0.08 (0.08)	−0.32* (0.15)
Project Social Sustainability		0.25** (0.06)	0.25** (0.06)	0.25** (0.06)	0.37** (0.08)	0.25** (0.07)	0.25** (0.04)
Project Economic Sustainability		0.46** (0.09)	0.49** (0.08)	0.44** (0.09)	0.26* (0.11)	0.45** (0.09)	0.50** (0.11)
*Project Environmental Sustainability * Country Environmental Sustainability*			0.11* (0.05)				
*Project Social Sustainability * Country Social Sustainability*			0.08** (0.03)				
*Project Economic Sustainability * Country Economic Sustainability*			0.04 (0.06)				
China				0.61** (0.14)	0.59** (0.16)		
India				0.15 (0.21)	0.24 (0.18)		
Brazil				−0.16 (0.14)	−0.15 (0.14)		
*Project Environmental Sustainability * China*					−0.53** (0.11)		
*Project Social Sustainability * China*					−0.11 (0.08)		
*Project Economic Sustainability * China*					0.30** (0.09)		
*Project Environmental Sustainability * India*					0.11^{+} (0.06)		
*Project Social Sustainability * India*					−0.28** (0.09)		
*Project Economic Sustainability * India*					0.32** (0.10)		
*Project Environmental Sustainability * Brazil*					0.24** (0.06)		
*Project Social Sustainability * Brazil*					−0.07 (0.08)		
*Project Economic Sustainability * Brazil*					−0.05 (0.10)		
Environmental Designated Nat'l Authority						−0.26 (0.20)	−0.28 (0.20)
*Project Environmental Sustainability * EnvDNA*							0.33* (0.15)
*Project Social Sustainability * EnvDNA*							0.01 (0.09)
*Project Economic Sustainability * EnvDNA*							−0.09 (0.11)
Constant	−0.22 (0.22)	−0.25 (0.19)	-0.30^{+} (0.17)	-0.42^{+} (0.24)	−0.63** (0.21)	−0.07 (0.27)	−0.07 (0.24)
SEs clustered by country	Y	Y	Y	Y	Y	Y	Y
Observations	8,769	8,769	8,769	8,769	8,769	8,769	8,769

Logistic regression analysis using Stata's *logit* command. All continuous variables standardized (mean 0 and SD 1) to facilitate comparisons of coefficient magnitudes. Coefficients and clustered (country) standard errors reported. Two-tailed *p*-values.

** $p < .01$
* $p < .05$
$^{+}$ $p < .1$

Author's voice:
Was there anything that surprised you about the findings?

deviation increases in *Project Social Sustainability* and *Project Economic Sustainability* are associated with a 28 percent and 61 percent increase in the likelihood of project approval, respectively (b = 0.25, exp(b) = 1.28, $p < .01$ and b = 0.46, exp(b) = 1.61, $p < .01$). These results suggest that the social and economic dimensions are driving the positive sign for *Project Total Sustainability* and that *Project Environmental Sustainability* may partially (but not entirely) dampen these positive effects.

Interactions between Project-Level and Institutional Factors

More fully revealing the possible mechanisms of action, Table 2 (column 2) shows our assessment of the interactive effect of project-level sustainability metrics and country-level institutional factors related to sustainability. The results indicate a positive interaction between *Country Environmental Sustainability* and *Project Environmental Sustainability* (b = 0.11, $p <$ .01).[4] We observe a similar result in the positive interaction between *Country Social Sustainability* and *Project Social Sustainability* (b = 0.08, $p < .01$). On the other hand, we observe a positive but statistically insignificant interaction between *Country Economic Sustainability* (negative main effect) and *Project Economic Sustainability* (positive main effect) (b = 0.04, $p > .10$). These positive interactions suggest that country-level sustainability factors, although they do not have a stand-alone impact on regulatory market approval, do affect the interpretation and impact of project characteristics on market approval; countries with higher sustainability scores prioritize approving project types that are more consistent with their broader sustainability priorities, at least in two of the three dimensions tested (social and environmental).

To further explore the impact of country-level influences on project approval in the carbon markets, we perform several supplementary analyses. First, a few countries dominate the carbon markets, as a significant percentage of projects are proposed (and approved) in the three most prominent countries: China, India, and Brazil. Given their importance, we explore whether these three countries exhibit differences in how they assess and promote carbon projects. To do so, we report in Table 2 (columns 4–5) regression results of each of the three country dummy variables, along with interactions with *Project Environmental Sustainability*, *Project Social Sustainability*, and *Project Economic Sustainability*. The results in column 4 show an 84 percent higher than the average approval rate in China (b = 0.61, exp(b) = 1.84, $p < .01$) and an approval rate indistinguishable from the baseline in India and Brazil ($p > .10$). Interaction results show that project-level environmental sustainability claims have a greater positive effect on regulatory approval in India (b = 0.11, $p < .10$) and Brazil (b = 0.24, $p < .01$) but a negative effect in China (b = −0.53, $p < .01$). By contrast, economic sustainability claims have a greater positive effect on regulatory approval in China (b = 0.30, $p < .01$) and India (b = 0.32, $p < .01$), and no significant impact in Brazil ($p > .10$). A project's social sustainability claims have a negative effect on project approvals in India (b = −0.28, $p < .01$) but no apparent effect in China or Brazil.

The next country-level factor is the variation in the ministerial location of the DNAs. Each country designates an office to serve as the coordinating authority for project proposals and communication with the United Nations. Some countries located their DNA in environmental agencies, such as Algeria's Ministry of Environment and Renewable Energies or El Salvador's Ministry of Environment and Natural Resources. Other countries situated their DNAs within agencies with less focus on environmental issues, such as China's National Development and Reform Commission or Guyana's Ministry of the Presidency. To address these differences empirically, we generated a binary variable, *Environmental DNA*, which took a value of 1 if the name of the country's DNA included the terms "environment," "ecology," "climate change," "wildlife protection," "sustainable development," "nature protection," or "biodiversity," and 0 otherwise. We report in Table 2 (columns 6–7) regression results of *Environmental DNA* and interactions with *Project Environmental Sustainability*, *Project Social Sustainability*, and *Project Economic Sustainability*. The results in columns 6–7 suggest that environmental agency–housed DNAs do not impact regulatory approval rates on their own, but they positively moderate the effect of project-level environmental sustainability (b = 0.33, $p < .01$). By contrast, environmental agency–housed DNAs do not change

[4] In unreported results, we double-check the sensitivity of these findings to multicollinearity: especially for country-level sustainable development, the dimensions are strongly correlated (economic and environmental sustainability are correlated at −0.73). When we estimate the main effects and interactions of the project and country environmental sustainability measures with our control model (leaving out social and economic), results are consistent with those reported here.

the impact of *Project Social Sustainability* or *Project Economic Sustainability*.

Additional Robustness Analyses

Given the relative prevalence of carbon projects in our data set from three major countries (China, India, and Brazil) that we discuss specifically previosuly, we also wanted to ensure that our findings apply to other countries participating in the CDM. We replicated our main findings, in unreported analyses, but included only projects from the other 89 countries. Results were consistent in sign and largely in significance with those reported here. Although our empirical model and reported results address numerous project-level characteristics that control for alternative explanations for project approval, we also use several alternative specifications to replicate our findings. One potential criticism of our model is that firms might have changed their focus on sustainable development claims because they responded to market growth or decline. Controlling for the number of prior similar types of projects (*Project Technological Maturity*) and the number of prior overall projects (*Market Maturity*) addresses this possibility in part. To further address the possibility that the UN's capacity to review project applications affected project approval rates (rather than project-level characteristics or country-level institutional factors having affected the rates), we added *UN Backlog*, a control variable capturing the number of other projects under consideration by the United Nations at the time the focal project was submitted. Although the coefficient for *UN Backlog* was significant, our main results were consistent in this alternative specification.

Another potential criticism is that our explanation of sustainability assessments does not fully account for the levels of expertise and knowledge in each country's institutional context. Our empirical exploration of the aforementioned DNA characteristics addresses this in part. To further address this possibility, we added *DNA Date*, a control variable capturing the date on which each of our sampled countries established its DNA. Prior research has indicated that countries lacking sustainability capacities were often slow to establish a DNA, whereas countries for which the CDM represented a greater policy priority more quickly designated a national authority for the CDM (Ellis, Winkler, Corfee-Morlot, & Gagnon-Lebrun, 2007; Michaelowa, 2003). Indeed, establishing a DNA requires learning UNFCCC policies, allocating staff, establishing decision-making policies, and aligning coordination between related government offices, such that establishing a DNA has been a key element of building capacity to increase participation in the CDM (Okubo & Michaelowa, 2010). The coefficient for *DNA Date* was positive, suggesting that countries that committed early to the CDM may have higher project standards and lower approval rates, but our main results remained consistent across this alternative specification as well.

Author's voice:
What is the social relevance of your research?

In our logistic regression model, we model the occurrence of regulatory approval as a 0/1 outcome, which assumes that the important question is *whether* the event in question occurs. But because approval time in our setting can vary substantially, we also use our data to explore the question of *how quickly* carbon projects navigate the approval process, using an accelerated failure time (AFT) model (Mitchell, 1989).[5] We used maximum likelihood estimation and robust (country-clustered) standard errors. Results were consistent with those reported here.

DISCUSSION

Our empirical exploration provides important insights about whether claims of various dimensions of sustainable development affect approval of CDM carbon offset projects. Our first question centered on whether the type of sustainable development claims influence new project approvals. We assumed that local countries' DNA officials would more likely approve projects claiming to address multiple sustainable goals. Considering the environmental, social, and economic dimensions as a whole, we find support for this assumption, which is positively associated with higher project approval (about 10 percent). However, when we decomposed the claims into separate economic, environmental, and social dimensions, we found that social and economic sustainability claims had a positive effect on the carbon offset approval, but environmental claims had a null (and sometimes negative) effect. What explains this unexpected result?

[5] The AFT model takes the form: $\log(t_i) = X_i\beta_x + z_i$ where t_i is the firm's observed time to license approval, X_i is a vector of covariates, β_x is a vector of regression coefficients, and z_j is the random error term that has a specific distribution depending on the parametric assumption about the baseline hazard function. Post-estimation diagnostics (AIC and BIC) suggest that the Weibull distribution best fit our model, but results were also consistent when we used the AFT exponential distribution, suggesting that our results are not an artifact of a particular distribution choice.

We propose two possible explanations. On the one hand, local attitudes and preferences toward different sustainability dimensions may explain why environmental sustainability claims, in contrast to social and economic claims, either do not matter or have negative effects on project approval. The methodologies that guide a CDM project's greenhouse gas emission-reduction claims explicitly seek to anticipate all potential forms of cheating, concealing, defective action, overstatement, or inaccuracy, so that carbon offsets are issued only for real, additional emission reductions (Geres & Michaelowa, 2002; Schneider, 2009). Because environmental sustainability claims are perceived to be in the same category as that of climate change-reduction claims, the former may face greater scrutiny than do economic and social sustainability claims, which are not in the same comparison group (Lewis & Carlos, 2019).

On the other hand, the null or negative effect of environmental sustainability claims on approval may result from technical interdependencies between climate change reduction and other types of environmental sustainability. Approval requires demonstrating the additionality of a project's emission reductions (reductions would not have occurred if the project were not developed), which is more complicated for some technologies than for others. Technologies that produce environmental benefits beyond those of climate change reduction, such as technologies that improve air quality, reduce water pollution, or reduce environmental waste, could increase the difficulty of measuring the project's climate change additionality because these benefits occur simultaneously with those of emission reductions (Arens, Mersmann, Beuermann, Rudolph, Olsen, & Fenhann, 2015). In other words, augmenting claims of environmental sustainability may introduce added complexity in project design and monitoring, which could reduce the likelihood of successful project design and approval (Phillips & Newell, 2013).

Sorting out the plausibility of these two explanations requires that we address the second question of our study: How do local countries' institutions influence the regulatory approval of carbon offset projects? We find that country-level institutions do not have a direct effect on approval, but the interaction between country-level environmental sustainability and project-level environmental sustainability claims is positive, as is the interaction between country-level social sustainability and project-level social sustainability claims. One explanation, based on differences in attitudes and preferences, is that higher degrees of country-level environmental and social sustainability lead to greater interest and support for CDM projects that provide those benefits, easing the approval process for those types of projects. Another potential explanation is that country-level sustainability capacity for the social and environmental dimensions may represent the country's technical capabilities. Project developers sometimes need help, advice, and assistance to develop projects, and local country-level sustainability attitudes may also bring useful capabilities that facilitate the implementation of projects. These capabilities are likely to help only projects that are aligned with the same dimension of sustainability as that underlying the capabilities.

"Conjecture: The likelihood of project approval increases by matching proposed sustainability efforts to local attitudes and preferences for different dimensions of sustainability."

Another possible reason for the null effect of environmental sustainability claims and the positive effect of social and economic sustainability benefits is the technical interdependencies between assessments of carbon-reduction and other forms of environmental sustainability. Although government agencies contain multiple bureaus addressing specific regulatory issues, the agencies typically hire professionals that have scientific and technical professional training corresponding to the agencies' core mission. For example, government agencies regulating the environment typically hire individuals with environmental and natural-science degrees and backgrounds, whereas agencies overseeing finance and commerce typically hire individuals with economics and finance backgrounds and training. Thus, not only do regulatory professionals within an agency likely share professional norms and values but they also have deeper technical knowledge related to the agency's primary mission.

"Conjecture: Idiosyncratic preferences of major participating country policymakers drive project approval rates."

Given that China, India, and Brazil represent 71 percent of projects, idiosyncratic preferences of policymakers from these countries may drive the varying impacts of sustainability claims on project approval. China has a dramatic positive effect on the overall approval, but projects originating in China that claim higher economic sustainability impacts but lower environmental sustainability impacts are more likely to gain approval. By contrast, India does not have a significant main effect on project approval. But projects originating in India are more likely to gain approval if they propose higher economic and environmental but lower social sustainability impacts. Finally, although Brazil has an insignificant main effect on project approval, Brazilian projects claiming more diverse environmental sustainability impacts are more likely to gain approval. The results are consistent with our prior conjecture regarding the interaction between policymakers' preferences and a project's type of sustainability claims. China has a reputation for favoring economic development and particular environmental technologies, whereas Brazil has a reputation for seeking environmental sustainability benefits from CDM projects (Arens et al., 2015; Ganapati & Liu, 2009).

"Conjecture: The locations of DNAs in government departments/ministries influence attitudes and preferences for types of projects."

Another factor that we suspect could affect approval rates is where host countries decide to house DNA offices. Although scholars have identified qualitative differences between DNAs' organizational structures, they have not developed theoretical explanations for how these factors might affect DNAs' decision-making (Ganapati & Liu, 2009). In empirical terms, most DNA offices are housed in government agencies that oversee the environment, but some countries house them in other departments and ministries, such as those related to economic development and commerce. Research on public administration asserts that bureaucratic decision-making is highly influenced by regulators' incentives and ethos and that these result both from the government agency's public mission and from the training, professional values, and employment self-selection of the bureaucrats into the agency (Evans, Rueschemeyer, & Skocpol, 1985; Skocpol & Finegold, 1982; Weingast, 1984). For instance, agency officials in an agriculture department are generally motivated to advance the economic development of American farmers (Hiatt & Park, 2013), whereas agency officials at an environmental agency likely prioritize the reduction of water, soil, and air pollution (Fineman, 1998).

Our results show that although DNAs housed in environmental agencies do not differ in their likelihood with which they approve projects in general, the interaction between an environmental agency-housed DNA and project-level environmental sustainability claims is positive, whereas interactions with project-level social and economic sustainability claims are not significant. These analyses suggest that DNAs housed in environmental government agencies prefer projects claiming positive ecological benefits and do not demonstrate corresponding preferences for those emphasizing social or economic benefits. This effect is broadly consistent with prior research on bureaucratic ethos and incentives.

Given our limitation in measuring the capabilities of local bureaucracies, future research would benefit from alternative measurements of bureaucratic capabilities, such as individual backgrounds and education (Skocpol, 1985). For instance, scholars could examine how the professional training requirements of local DNA officers, local regulators' independence from elected officials, and even the physical proximity of different government agencies impact carbon offset project approval. Moreover, scholars could examine the interdependencies between scientific capabilities and bureaucratic preferences and attitudes, including the degree to which attitudes and preferences influence the selection of DNA officials and whether formal internal policies support certain dimensions of sustainability.

Contributions to Management Research

We believe that this study contributes to management research in several ways. First, institutional studies at the intersection of business and government have generally focused on elected officials' policymaking and the impact of regulations on outcomes for firms (Hiatt, Grandy, & Lee, 2015; Hiatt, Sine, & Tolbert, 2009). Although insightful, these studies have largely neglected the organizational impact of regulatory agencies' policy implementations (Hiatt & Park, 2013). We contribute to recent research on policy implementation by showing that bureaucratic decision-making is structurally influenced by the larger government departments in which an agency is situated. Our findings on the location of DNA offices in the CDM suggest that organizational hierarchies and organizational members' professional affiliations can influence individuals' concerns and values in their attempts to achieve sustainability. Future work would benefit from alternative methodologies such as surveys, ethnographies, and comparative case studies to explore specific mechanisms by which government bureaucrats engage in sense-making behaviors in their regulatory evaluations (Whiteman & Cooper, 2011).

The article also speaks to the business sustainability literature (Carlos & Lewis, 2018; Hiatt & Carlos, 2019; Hoffman & Ventresca, 2002; York, Hargrave, & Pacheco, 2016). Sustainability research has increasingly conceptualized the economic, social, and environmental dimensions of sustainability as an interconnected "umbrella construct" encompassing all three dimensions (Bansal & Song, 2017; Reinhardt & Stavins, 2010). This conceptual convergence has arguably facilitated greater academic and practitioner interest in the business case for sustainability and has led to the development and adoption of various firm initiatives (Hahn, Preuss,

Author's voice:
If you were able to do this study again, what if anything would you do differently?

Pinkse, & Figge, 2014; Lyon et al., 2018). However, the resulting imprecision in conceptual and construct-measurement clarity risks overlooking the potential tensions or trade-offs that individual organizations face in addressing the individual dimensions and in achieving their stated sustainability goals (Aragón-Correa & Sharma, 2003). We find evidence of these tensions in our study. By deconstructing sustainability into its individual component dimensions (which are aligned with various individual SDGs), we find that DNAs have idiosyncratic preferences for carbon offset projects that address specific SDGs and their corresponding sustainability dimensions (environmental, social, or economic). Specifically, a DNA that prefers environmental sustainability goals (driven by its ministerial location) will tend to promote carbon offset projects that emphasize environmental dimensions of sustainability. We believe that future research would benefit from exploring the development of these dimension-specific preferences and whether these different sustainability preferences could also be driven by factors such as regulator identity (Gehman & Grimes, 2017; Wry & York, 2017) and prior experience (Pache & Santos, 2010).

Managerial Implications

Our research clearly suggests the existence of local adaptation, even in a centrally coordinated sustainability regime such as the CDM. Consequently, one implication is that before submitting applications for project approval in the CDM and Paris Agreement, managers of carbon offset firms should observe the ministerial location of the office that approves carbon offset projects as well as pay attention to the types of sustainability outcomes that government leaders prioritize. For instance, if the DNA office were located in an environmental ministry, firms would likely benefit from emphasizing the ecological benefits of their projects. In comparison, in countries where policymakers value economic growth, such as China, entrepreneurs and leaders of carbon offset firms would do well to emphasize, in their regulatory approval submissions, the economic development aspects of their projects.

Policy Implications

Despite the many criticisms of the CDM and questions about whether it has ultimately reduced carbon emissions, we believe that this study provides helpful policy lessons to other cross-country efforts to simultaneously address multiple SDGs, including the Paris Agreement (Gomez-Echeverri, 2018; Schneider & Theuer, 2019). The Paris Agreement was ratified in 2015 by more than 125 countries and seeks to limit global temperature increases to 2 degrees Celsius through the creation of the Sustainable Development Mechanism (SDM), which replaces the CDM in 2020 (UNFCCC, 2019). Although the rules for the Paris Agreement are not fully detailed, Article 6 of the Paris Agreement establishes that the SDM will seek to achieve SDGs along with its climate change-mitigation activities.

However, the Paris Agreement introduces changes from the CDM that underscore the importance of our findings. Unlike the Kyoto Protocol, the SDM will not have a central clearinghouse for carbon offsets (counterpart to the UNFCCC in the CDM). Instead, host country governments will keep their own records of emission-mitigation activities and measure how these activities promote sustainable development.[6] Given the lack of defined structure for measuring different SDGs, each participating country under the Paris Agreement will have greater latitude in choosing activities that couple their preferred SDG with emission-mitigation activities (Greiner, Chagas, Krämer, Michaelowa, Brescia, & Hoch, 2019). These changes coupled with the results from this study suggest that the trade-offs between sustainability dimensions that occurred in the CDM will occur to a greater extent in the future SDM and that the Paris Agreement will likely result in greater global variability in the types of sustainability goals addressed. Consequently, policymakers should consider innovative incentives that motivate private businesses and country regulators to achieve progress on specific SDGs in a more balanced and uniform way.

CONCLUSION

Our examination of the CDM, the world's largest market-based arrangement intended to achieve multiple dimensions of sustainability, illustrates that common mechanisms designed to drive broad sustainable global change will not yield common results across institutional contexts. The CDM focused explicitly on several dimensions of sustainability, many of which are precisely identified as SDGs #1, 3, 6, 7, 8, 9, 13, 15, and 17. Our findings indicate that it is difficult to holistically view sustainable development as a unitary construct, which, instead, should be appraised according to its different dimensions, and that these different perceptions affect the types of activities that countries prioritize and approve. This is important because policymakers seek to implement holistic and integrated activities that address multiple SDGs at the same

[6] As reported in our results, local DNA office decisions largely influenced CDM project approval outcomes, as 90 percent of locally approved projects ultimately gained UN approval.

time. Indeed, the Paris Agreement seeks to reduce climate change (SDG #13) and foster more sustainable development paths for emerging market and developing economies (SDG #17), and do so while achieving goals related to environmental (relating to SDGs #6 and 15), economic (relating to SDGs #7, 8, and 9), and social (relating to SDGs #1 and 3) sustainability. Our findings from the CDM demonstrate that the structure of national-level regulatory agencies (the government agencies that house the DNAs) and national institutional factors (local countries' preferences and regulatory organization) significantly affect perceptions of various sustainability dimensions. We believe that future research would benefit from deconstructing "sustainability" into individual SDGs, to better define and measure the effects of national and multinational policies.

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