 ELR NEWS & ANALYSIS 8-2006

Translating Regulatory Promise Into Environmental Progress: Institutional Capacity and Environmental Regulation in China

by Wanxin Li and Eric Zusman

Editors' Summary: A growing body of research attributes China's environmental problems to weak regulatory enforcement. Few studies, however, have explored the relationship between institutional capacity and regulatory enforcement. In this Article, Wanxin Li and Eric Zusman draw upon the literature on state capacity and institutional analysis to fill this void. The Article reveals that local environmental protection bureaus with greater human capital—though not necessarily greater financial resources—enforce regulations more rigorously. The Article also shows that these efforts do not necessarily lead to cleaner air or water. Regions with industries that have a greater capacity to abate pollution tend to pollute more, offsetting the potentially beneficial effects of stronger regulatory enforcement. The authors therefore conclude that it may take more than just innovative regulations to translate regulatory promise into environmental progress.

I. Introduction

The toll that rapid industrialization has leveled on China's natural environment clearly sets it apart from other countries.[1] Some scholars, for instance, report that China has 16 of the world's 20 most polluted cities,[2] while others estimate that air pollution causes 300,000 premature deaths annually.[3] Figures like these have prompted China's State Environmental Protection Administration (SEPA) (*guojia huanbaoju*) to adopt a series of increasingly innovative environmental regulations that just as clearly promise to set China apart from other countries.[4]

Unfortunately, regulatory promise has often fallen short of environmental progress in China. One needs look no further for causes of this shortfall than to China's environmental protection bureaus (EPBs) (*difang huanbaoju*), the agencies chiefly responsible for regulatory enforcement. EPBs, though nominally affiliated with SEPA, are first and foremost subordinate to local governments. As such, they must compete with other government agencies for funding and influence. But because local government officials typically place stimulating growth before regulating industry, EPBs frequently lack the resources or leverage needed to translate regulatory promise into environmental progress. Regulatory enforcement consequently suffers.

Wanxin Li is an Assistant Professor at the School of Public Policy and Management at Tsinghua University, Beijing, China. For correspondence, she can be reached at wanxin90@tsinghua.edu.cn.

Eric Zusman is a doctoral student in the Department of Political Science at the University of California, Los Angeles. His participation in this project was made possible by funding from the University of California's Pacific Rim Grant Program and Institute for Global Cooperation and Conflict.

This project is partially funded by the Urban China Research Network. The findings, interpretations, and conclusions expressed in this Article are entirely those of the authors. They do not necessarily represent the view of the Urban China Research Network.

1. Responding to the severe environmental pollution and natural resources shortage, the National Environmental Protection Agency (NEPA) and the State Planning Commission (SPC) jointly proposed China's Environmental Action Plan for 1991 to 2000. This plan highlights the environmental issues that national officials consider particularly significant. The top three of the seven problems listed in Table 4 of that plan deal with pollution: water pollution, air pollution, and hazardous waste. The second three involve conservation of natural resources: water, land, and forests and grasslands. The final problem centers on the balance and integrity of China's ecosystems. *See also* Xiaoying Ma & Leonard Ortolano, Environmental Regulation in China: Institutions, Enforcement, and Compliance (Lanham, Rowman & Littlefield 2000).

2. Elizabeth Economy, The River Runs Black: The Environmental Challenge to China's Future (Cornell Univ. Press 2004).

3. Katherine Bolt et al., *Cleaning the Air in Developing Countries*, 16 F. for Applied Res. & Pub. Pol'y (2001). With over 300,000 premature deaths per year, China accounts for over 40% of the total for the developing world—more than twice the number for South Asia, which has a comparable population. This health damage caused an economic loss as big as 4% of gross domestic product annually, which is over twice the estimate for India and much higher than losses for other major industrial economies in the developing world.

4. These include emissions fees, environmental impact statements (and the complementary three simultaneities), total emission control emission standards, emission permits, the two total control zones, clean development legislation, and desertification legislation. For a description of environmental regulation in China, see Wanxin Li, *Environmental Governance: Issues and Challenges*, 36 ELR 10505 (July 2006).

Fortunately, in recent years several studies have suggested that strengthening an EPB's institutional capacity—increasing its funding and improving its human capital—can help overcome the aforementioned obstacles to regulatory enforcement.[5] Until now, however, few studies have rigorously explored or systematically tested the merits of this claim. Herein lies the contribution that sets this Article apart.

Results from our study reveal that there is good and bad news for China. On the positive side of the ledger, EPBs with greater human capital—though not necessarily greater financial resources—enforce regulations more rigorously. On the negative side of the ledger, these efforts do not necessarily imply cleaner air or water. Regions with industries that have a greater capacity to abate pollution tend to pollute more, offsetting the potentially beneficial effects of stronger regulatory enforcement. It therefore may take more than innovative regulations and more capable EPBs to narrow the gap between promise and progress.

This Article first delineates between potential and realized institutional capacity. The Article then analyzes the institutional capacity of EPBs. This section uses annual pollution control data to: (1) demonstrate regional disparities in potential and realized capacity; (2) examine the relationship between potential and realized capacity; and (3) estimate the effects of institutional capacity on pollution control. The Article concludes that there is a statistically and substantively significant effect of institutional capacity on pollution reduction that is parried by industrial capacity.

II. Institutional Capacity

Before moving forward, it is important to examine—and delineate between—previous definitions of institutional capacity. Institutional capacity has appeared in literature on state capacity and institutional analysis. In both strands of literature,[6] the distinction between potential and realized capacity has received inadequate attention. Giving it more attention is particularly important in the case of China because it can imply the difference between having impressive regulations on the books and meaningful outcomes on the ground.

Most of the early work on state capacity focused on realized capacity. According to Theda Skocpol, state capacity is "the ability . . . to implement official goals, especially over the opposition of powerful social groups, or in the face of difficult economic circumstances."[7] For Skocpol, exerting a state's will over the objections of dissenting social groups is the essence of capacity; others see the state's role as less adversarial. Illustrative of this more consensual view, Arnold Howitt defines "management capacity" as "[the] ability to identify problems, develop and evaluate policy alternatives for dealing with them, and operate government programs."[8] While disagreeing on how governments relate to society, both Howitt and Skocpol concentrate on what governments do instead of what they may be able to do.

What states may be able to do relates to potential capacity. According to Christopher Lindley, institutional capacity has two dimensions: the ability to choose what ends to pursue and the will to take actions achieving said goals.[9] Others have also pointed out that the potential to act and the resolve to act are conceptually separable.[10] And, on a similar note, the potential and the realization of that potential may not be related. Identifying ends to pursue and reaching those ends are necessarily part and parcel of capacity, but they are not definitively one and the same.

Paralleling literature defining state capacity, another set of studies has identified analytical categories to measure potential and realized capacity that are applicable to China. *The World Development Report 2003*, for example, disaggregated realized capacity into four categories: (1) picking up signals; (2) balancing interests; (3) implementing policies; and (4) policy learning and adaptation.[11] "Picking up signals" refers to identifying what problems to act on and what policy goals are worth pursuing. "Balancing interests" refers to determining whose interest will prevail and the stance that governments will take when interests conflict. "Implementing policies" concerns the actions that are actually taken once interests are reconciled. And "learning and adaptation" refers to bettering performance based on the results from previous decisions.

As for operationalizing potential capacity, some have suggested that the ability to act may be closely related to "administrative stock,"[12] which can be measured by the or-

5. Geping Qu, Environmental Management in China (United Nations Envt. Programme & China Envtl. Science Press 1991); Barbara J. Sinkule & Leonard Ortolano, Implementing Environmental Policy in China (Praeger 1995); Susmita Dasgupta & David Wheeler, *Citizen Complaints as Environmental Indicators: Evidence From China* (World Bank, Policy Research Working Paper No. 1704, 1997); Kenneth Lieberthal, *China's Governing System and Its Impact on Environmental Policy Implementation*, 1 China Env't Series 3-8 (1997); Ma & Ortolano, *supra* note 1; Christine L. Dobridge et al., Background Paper: Emissions Trading in China: Opportunities and Constraints (Hong Kong Civic Exchange 2001); Judith Shapiro, Mao's War Against Nature: Politics and the Environment in Revolutionary China (Cambridge Univ. Press 2001); Sulan Chen & Juha I. Uitto, *Governing Marine and Coastal Environment in China: Building Local Government Capacity Through International Cooperation*, 6 China Env't Series 67-80 (2002); Lisa Hopkinson & Rachel Stern, *One Country, Two Systems, One Smog Cross-Boundary Air Pollution Policy Challenges for Hong Kong and Guangdong*, 6 China Env't Series 19-36 (2002); Richard Morgenstern et al., *Demonstrating Emissions Trading in Taiyuan*, Resources, Summer 2002, at 8; Hua Wang & Wenhua Di, *The Determinants of Government Environmental Performance: An Empirical Analysis of Chinese Townships* (World Bank, Working Paper No. 2937, 2002); Jonathan Schwartz, *The Impact of State Capacity on Enforcement of Environmental Policies: The Case of China*, 12 J. Env't & Dev. 50 (2003); Economy, *supra* note 2; Richard Morgenstern et al., *Emissions Trading to Improve Air Quality in an Industrial City in the People's Republic of China* (Resources for the Future, Discussion Paper No. 04-16, 2004).

6. Beth W. Honadle, *A Capacity-Building Framework: A Search for Concept and Purpose*, 41 Pub. Admin. Rev. 575-80 (1981).

7. Theda Skocpol, *Bringing the State Back In: Strategies of Analysis in Current Research, in* Bringing the State Back In 9 (Peter B. Evans et al., eds., Cambridge Univ. Press 1990).

8. Arnold Howitt, Improving Public Management in Small Communities 1 (Dep't of City and Reg'l Planning, Harvard Univ., Policy Note No. 77-3, 1977).

9. Christopher Lindley, *Changing Policy Management Responsibilities of Local Legislative Bodies*, 35 Pub. Admin. Rev. 797 (1975).

10. Alvin D. Sokolow, Local Governments in Nonmetropolitan America: Capacity and Will (U.S. Dep't of Agric. 1979).

11. World Bank, World Development Report 2003 (2004).

12. Edward A. Lehan, *The Capability of Local Governments: A Search for the Determinants of Effectiveness*, 28 Connecticut Gov't 1 (1975).

ganization's human and financial resources.[13] Educational attainment, length of employment, and professional training are all proxies for administrative stock. Other elements of potential capacity that have received mention involve the organization itself such as its budget size and level of autonomy. Bigger budgets and greater autonomy should increase "organizational stock" and should help an organization realize its goals.

In sum, the categories identified in the World Development Report study—picking up signals, balancing interests, implementing policies, and policy learning and adaptation—can be used to measure realized institutional capacity. Meanwhile, administrative and organizational stock can be used to measure potential institutional capacity. The next questions are: what data is available to measure capacity in the case of China? What is the relationship between potential and realized institutional capacity? What are the implications of institutional capacity for pollution reduction? The following section answers these questions.

III. Measuring and Ranking the Institutional Capacity of EPBs

A. Measurement and Methodology

In our study, EPB data from 31 regions was ranked by the differences between potential and realized institutional capacity. Several ordinary, least squared regression models were then employed to estimate the relationship between potential and realized capacity, and the relationship between institutional capacity and pollution reduction, controlling for industrial capacity.

As the above review suggested, financial and human resources can measure potential institutional capacity, while activities designed to pick up signals, balance interests, implement policies, and learn and adapt can capture realized capacity. Tables 1 and 2 describe the variables that proxy for potential and realized capacity. A few remarks concerning variable construction and attendant limitations are in order before proceeding to model development and results.

First, in terms of potential capacity, an ideal measure of financial resources would be an EPB's budget, but since budgeting information is inaccessible, gross domestic product (GDP) per capita and fiscal revenue per capita were used as a second best measure. The percentage of professional staff was used to approximate an EPB's human capital. Failing a professional certifying mechanism that standardizes evaluations of staff competency in China, the number of professional staff as reported by the EPBs themselves was used. This figure may reflect different things in different regions, an unavoidable limitation.

Second, in terms of realized capacity, actual outcomes of abatement activities would be preferable to the process-driven proxies that are also used to measure picking up signals, balancing interests, implementing policies, and learning and adapting. For instance, EPBs that are better equipped to pick up signals should monitor or inspect polluting firms more frequently. Because source level monitoring and enforcement data was unavailable, the amount of information on the state of environment and environmental behavior of firms and households was adapted for this purpose. Balancing interests may be better observed in the resolution of conflicts, yet absent comprehensive information on resolution mechanisms, such as how many public hearings are held in a given region, the percentage of letters, visits, and proposals from citizens, the National People's Congress, and the People's Political Consultative Committee were used to gauge attention to the public. The ability to learn and adapt, while arguably best measured with new environmental protection programs or projects or processes, was captured with the size of research projects funded by local EPBs.

Third, there are fewer limitations to measuring the implementation of policies. The activities used for this variable such as the three simultaneities (*san tongshi*),[14] environmental impact assessments (EIAs),[15] and investment in limited time treatment[16] are common to all EPBs (some have been in place since the trial Environmental Protection Law[17] was introduced in 1979). However, as is evident from the data presented, while the legal statutes supporting these activities are common to all EPBs, implementation varies across EPBs.

Fourth, data was gathered from *China Environment Yearbook 2003* and *China Statistical Yearbook 2003* to quantify these proxies; the unit of analysis is the province, autonomous region, or provincial level municipality for the year 2002. If data were available at the city and county level, it would be used to produce finer grained and possibly more illuminating findings. Such data is unfortunately unavailable.

Clearly, there are losses associated with the measurement compromises made to construct variables. But there are also significant gains to be made from recognizing these limits and making an effort to quantify measures of institutional capacity, especially in light of the high costs of environmental degradation in China. These gains will become even more evident as we examine the relationship between potential and realized capacity.

Table 1: Potential Institutional Capacity of Local EPBs

Financial resources	Societal: GDP per capita at provincial level Governmental: Fiscal revenue per capita at provincial level
Human capital	Size: Average amount of employees on government payroll of an EPB in a province Quality: Percentage of professional employees on government payroll of EPBs in a province

13. Honadle, *supra* note 6; Jonathan Schwartz, *The Impact of State Capacity on Enforcement of Environmental Policies: The Case of China*, 12 J. Env't & Dev. 50-81 (2003).

14. "Three Simultaneities" finds its statutory basis in Article 6 of the Environmental Protection Law of 1979. It requires facilities to design, install, and use pollution prevention and treatment equipment. For more information, see Li, *supra* note 4.

15. See Li, *supra* note 4, for more information on China's EIA program.

16. Limited time treatment is a command-and-control policy instrument that requires industry to treat pollution within a limited time period. For more information, see *id.*

17. The Environmental Protection Law was first enacted in 1979 for trial implementation, and was amended in 1989. For more information, see *id.*

Table 2: Realized Institutional Capacity of Local EPBs

Category	Operationalization	Measurement
Pick up signals	Percentage of information available on pollutant discharge by media: water, air, and solid waste (total amount and concentration).	Percentage of cells filled in China Environment Yearbook 2003 on criteria pollutant discharge
	Percentage of information available on industrial pollution and treatment	Percentage of cells filled in China Environment Yearbook 2003 on industrial environmental performance
	Percentage of information on city sewerage treatment	Percentage of cells filled in China Environment Yearbook 2003 on city sewerage treatment
Balance interests	Percentage of citizen complaint letters processed	Percentage of citizen complaint letters processed
	Percentage of citizen visits processed	Percentage of citizen visits processed
	Percentage of People's Congress proposals processed	Percentage of People's Congress proposals processed
	Percentage of Political Consultative Committee proposals processed	Percentage of Political Consultative Committee proposals processed
Implement policies	Pollution prevention: EIA enforcement rate	EIA enforcement rate
	Pollution prevention: Three Simultaneities enforcement rate	Three Simultaneities enforcement rate
	Pollution prevention: Percentage of discharge permit applications processed	Percentage of discharge permit applications processed
	Pollution prevention: Percentage of clean energy consumption	Clean energy consumption/Total coal consumption
	Environmental Assistance: Percentage of environmental assistance in total environmental protection investment	Percentage of environmental assistance in total environmental protection investment
	Environmental Assistance: Percentage of levy used for environmental protection	Percentage of levy used for environmental protection
	Environmental Assistance: Average investment in limited time treatment	Average investment in limited time treatment
	Environmental management: Average area of dust control area	Average area of dust control area
	Environmental management: Average area of noise control area	Average area of noise control area
	Environmental management: Average area of high polluting fuel forbidden area	Average area of high polluting fuel forbidden area
Learn and adapt	Funding size of environmental research projects	Funding size of environmental research projects

B. Potential and Realized Institutional Capacity

To rank the overall potential and realized institutional capacity of EPBs, we calculated a standardized index of each variable in Table 1 and 2. Assuming a mean score of 60 and a variance of 14, standardized scores were calculated based on the standard index of each region. By averaging standardized indexes of the four variables comprising potential institutional capacity and the 18 variables comprising realized institutional capacity, we created two comprehensive index scores of overall potential and realized institutional capacity. Separate composite index scores were also created for the two components of potential capacity (financial and human resources). In creating these indexes, all variables were weighted equally since existing theoretical and empirical literature does not preference one variable over another.[18]

As demonstrated in Figure 1, an EPB's realized capacity differs, sometimes markedly, from its potential. There were 13 regions, among them Hebei, Jilin, and Shanxi, that performed below their potential in 2002. There were 13 regions, among them Chongqing, Guangdong, and Sichuan, that exceeded their potential in 2002 (a complete listing is provided in Appendix 1). Perhaps most interestingly, Shanghai, China, has the highest potential but its realized capacity ranks only third, 24 slots below its potential.[19] Table 3 lists the five highest-ranked and lowest-ranked regions according to their potential and realized institutional capacity.

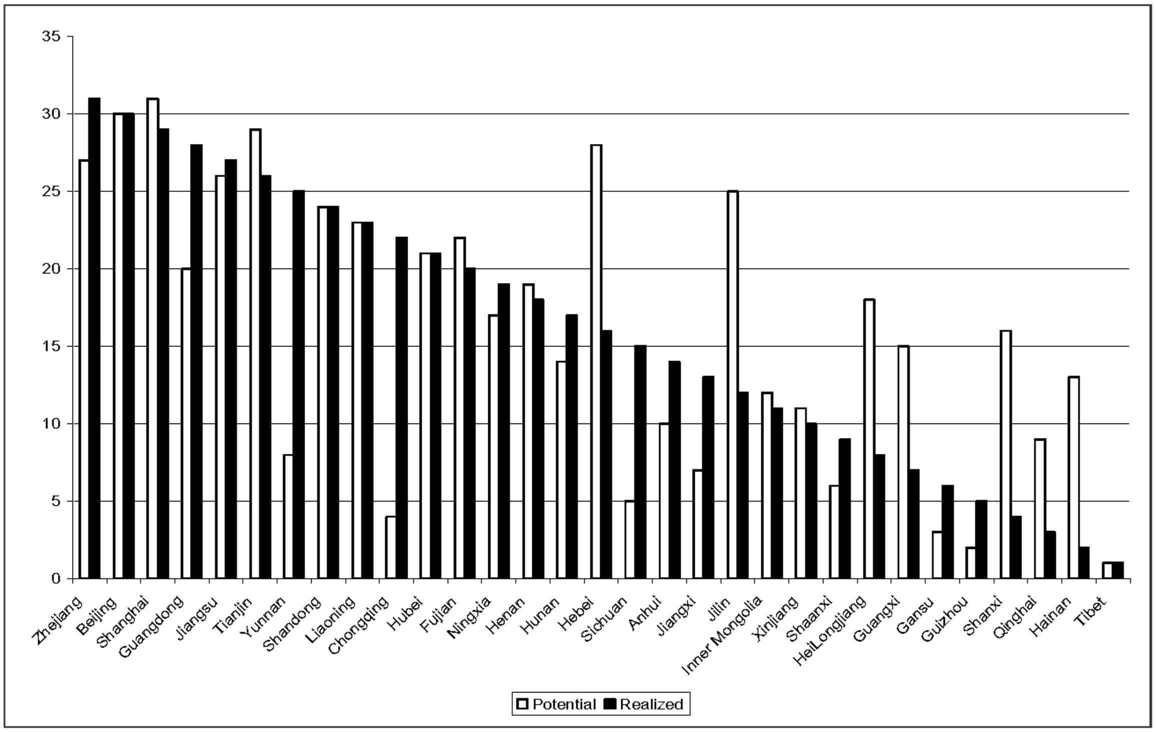
Table 3: The Top and Bottom Five Regions in Potential and Realized Capacity of EPBs (2002, China)

Potential Capacity 1st - 5th	Realized Capacity 1st - 5th	Potential Capacity 31st - 27th	Realized Capacity 31st - 27th
Shanghai	Zhejiang	Tibet	Tibet
Beijing	Beijing	Guizhou	Hainan
Tianjin	Shanghai	Gansu	Qinghai
Hebei	Guangdong	Chongqing	Shanxi
Zhejiang	Jiangsu	Sichuan	Guizhou

18. Daniel Esty & Peter K. Cornelius, Environmental Performance Measurement: The Global Report 2001-2002 (Oxford Univ. Press 2002).

19. Although it appears that Shanghai, China, only performed three slots below its potential, Figure 1 only shows the rankings of the regions. So the vertical axis does not reflect the actual standardized scores of the regions.

Figure 1: Ranking of Potential and Realized Capacity of Local EPBs of the 31 Regions (2002, China)



To explore the relationship between potential and realized capacity, we constructed six regression models (results reported in Table 4). Regression is a statistical technique that enables one to estimate whether and how much an independent variable (in our case, potential capacity) affects a dependent variable (in our case, realized capacity).[20]

But before running our data, it is important to report our expectations about relationships between our independent and dependent variables. We anticipated that potential capacity would have a positive effect on realized capacity. The higher an EPB's potential capacity, the better equipped it will be, on average, to pick up signals, balance interests, implement policies, and learn and adapt. We have a similar albeit less certain expectation about the effect of industrial capacity. The greater a region's industrial capacity to abate pollution, the more resources will possibly become available for pollution abatement. And the greater the level of environmental stress, the more likely EPBs will be actively engaged in implementing regulations (though higher levels of environmental stress may overwhelm an EPB to pursue programmatic goals).

20. Of particular interest are the coefficient estimates, the figures reported in the cells below their corresponding model numbers. These estimates predict how much a change in a single unit of an independent variable affects the value of the dependent variable. Thus, to take Model 1 as an example, our coefficient estimate suggests that, on average, a one-point increase in potential capacity lead to a 0.48 increase in realized capacity. Or, stated differently, moving across the potential capacity scale from the least (Tibet = 43) to the most (Shanghai = 95) potentially capable case in our sample translates into nearly a 25-point increase in predicted realized capacity ([95-43] x 0.48 = 24.96). This is an appreciable jump given that the difference in the high and low point on the actual realized capacity scale is 41.

Also of interest is how confident one can be that the estimated relationship between potential and realized capacity is not simply due to random chance. Coefficient estimates are indeed estimates, but our regression results can tell us how sure we should be that the predicted effect is not actually equal to zero. This is indicated by the significance level. In the regression results table, coefficient estimates that are statistically significant—that is, those we can be reasonably sure are not equal to zero—have asterisks next to them.

Another relevant point relates to the multivariate regressions in Models 2 through 6, as opposed to the bivariate regression in Model 1. Multivariate regression allows one to control for factors, besides potential capacity, that we believe have an impact on realized capacity. Once again referring to our results table, these control variables include industrial capacity to protect the environment (measured with the gross industrial output and number of industrial employees responsible for environmental protection) and initial level of environmental stress (measured with the amount of criteria pollutant discharge). It is possible that the predicted effect in the bivariate model is actually due to another factor that would not be noticeable without including additional variables that also have their own coefficient estimates. (This would be evident if the sign of the original coefficient estimate changed or became insignificant when additional variables are included in the model). A related reason for employing multivariate regression is it enabled us to decompose potential capacity into financial resources and human capital and estimate how much each of the two elements that make up potential capacity individually impact realized capacity (as is done in Models 4 through 6 where we break down the potential capacity variable into separate components).

Table 4: Potential Capacity's Impact on Realized Capacity of Local EPBs (2002)

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Overall Potential Institutional Capacity: Index Score	0.48***	0.35***	0.34***			
Financial Resources: Index Score				0.20**	0.11	0.08
Human Capital: Index Score				0.29***	0.26**	0.27**
Capacity of Industry		0.24***	0.27***		0.25***	0.3***
Pollutant Discharge			-0.05			-0.08
R-Squared[21]	0.46	0.62	0.62	0.47	0.63	0.63

*** Significant at a 1% confidence level.
** Significant at a 5% confidence level.

Table 4 indicates that our expectations were, for the most part, borne out in the regression results. There is a statistically significant relationship between overall potential and realized institutional capacity. In particular, the coefficient estimates in Model 3 show that a one-point increase in overall potential capacity leads to a 0.34 point increase in realized capacity. If the overall potential institutional capacity is decomposed into financial and human capital, as in Model 6, an increase in the human capital component makes a 0.27 point contribution, while financial capital contributes a 0.08 point to realized capacity. Interestingly, an EPB's human capital seems to have a stronger effect on realized capacity than financial capacity. When potential capacity is broken down into its constitutive components and industrial capacity is controlled, the coefficient estimates on financial resources are not statistically different from zero, while the estimates for human capital clearly are.

Another interesting result is that the effect of capacity of industry to protect environment is positive and statistically significant. A one-point increase in industry capacity leads to a 0.29-point increase in realized capacity (Model 3 and 6). This result suggests that industry could facilitate EPBs to carry out environmental protection activities, which is reasonable because most of the efforts by EPBs need the cooperation from industry.

Finally, the level of pollutant discharge, the proxy for environmental stress, has a slightly negative but statistically insignificant effect on realized capacity of local EPBs. This may suggest that the task of pollution reduction is very challenging and sometimes overwhelming for local EPBs; however, it is difficult to put too much faith in this interpretation, since the coefficients are small and not significantly different from zero.

The above analysis suggests that criteria pollutant discharges (ambient environmental quality) do not have a statistically significant impact on either the potential or the realized institutional capacity of local EPBs. It does, however, give rise to a question pertaining to the reverse relationship: what effect does institutional capacity of local EPBs have on criteria pollutant discharges?

C. Institutional Capacity and Pollution Reduction

The ultimate purpose of increasing the capacity of EPBs is to reduce pollution. Does an EPB's institutional capacity help abate pollution? We developed a second set of regression models to examine this question, using the previous environmental stress variable as the variable to be explained. We anticipated that both potential and realized capacity would reduce pollution. We also expected, although with more uncertainty, that increased industrial capacity would result in less pollution. Higher industrial capacity implies greater industrial production, and possibly, higher concentrations of emissions and effluent. However, technology advances and greater investment in pollution control, known as process effects, may offset greater industrial production.

Table 5: EPB Institutional Capacity's Impact on Pollutant Discharges (2002)

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Overall Potential Institutional Capacity: Index Score	-0.02	-0.28	-0.26**			
Financial Resources: Index Score				-0.15	-0.26	-0.32**
Human Capital: Index Score				0.18	0.03	0.16
Overall Realized Institutional Capacity: Index Score		0.53	-0.14		0.52	-0.21
Industry Capacity			0.57***			0.6***
R-Squared	0.00	0.09	0.42	0.03	0.1	0.47

*** Significant at a 1% confidence level.
** Significant at a 5% confidence level.

As expected, Table 5 shows that both the potential and realized capacity of local EPBs help reduce pollutant discharge, although the effect of realized capacity is statistically insignificant (Model 3 and 6). A one-point increase in the potential capacity of local EPBs leads to a 0.26-point decrease in pollutant discharge. And a one-point increase in realized capacity leads to an average of 0.17-point decrease in pollutant discharge.

Yet the capacity of industry to protect the environment does not help reduce pollutant discharges. Rather, a one-point increase in the capacity of industry to protect the environment increases pollutant discharges by an average of 0.59 points. This result implies that economic development is a double-edged sword. On the one hand, it can increase industrial capacity to protect the environment and complement EPB-supported regulatory activities. On the other hand, economic development can increase production. Thus, increased capacity to protect the environment might not be able to overcome countervailing impacts of increasing industrial production and the resultant increases in pollution.

21. The R^2 statistic, also known as the coefficient of determination, indicates how much better than the mean of the dependent variable that the model estimates the dependent variable. The statistic ranges from 0 to 1 and is often used to gauge how well the model fits the actual data. Caution should be used before reading too much into the R^2 statistic because it can easily be inflated by including more independent variables in the model.

IV. Conclusion

Overall, this Article suggests that the higher an EPB's potential institutional capacity the greater its realized institutional capacity, and the greater an EPB's institutional capacity the greater the level of pollution reduction in China. Specifically, the following conclusions can be drawn:

- Regions with higher potential capacity tend to have greater realized capacity (with some important above and below trend deviations). A one-point increase in potential leads to a 0.34 point increase in realized capacity (Model 3 in Table 4). If the overall potential institutional capacity is decomposed into financial resources and human capital, human capital contributes to a 0.27-point increase while financial capital contributes to a 0.08--point increase. The relatively greater positive effect of an EPB's human capital is worth emphasizing for policymakers and scholars interested in increasing the frequency and effectiveness of abatement activities outlined in regulatory provisions.
- An EPB's potential capacity has substantially positive effects on pollution reduction, though the effect of realized capacity is statistically insignificant. A one-point increase in potential capacity of local EPBs leads to a 0.26-point decrease in pollutant discharge, and a one-point increase in realized capacity of local EPBs leads to a 0.17-point decrease in pollutant discharge (Table 5).
- The effect of the capacity of industry to protect the environment on an EPB's institutional capacity is interestingly paradoxical. As a complement to government actions, increasing the industry capacity for environmental protection helps improve the realized capacity of local EPBs. However, better industry capacity implies greater industrial production and greater pollutant discharge. This is perhaps the most intriguing result from our study. The positive effect of industrial capacity on realized capacity and the negative effect on environmental quality indicates that even as of 2002, industrial development seems to outweigh industrial contribution to pollution control. Leveraging the economic power of industry remains the preeminent challenge facing EPBs.

China is a country with limited resources but severe environmental problems. Environmental protection and natural resource preservation are critical to achieving sustainable development. This Article has made a small step toward this end, and the authors anticipate more in-depth research along these lines. Harnessing industrial capacity, so that it does not offset the virtuous effects of institutional capacity, is just one of several areas that this Article suggests is ripe for future research. Yet other research questions and puzzles remain unanswered and unresolved. For example, how should resources be allocated across the 31 regions in China given the differences in institutional capacity of local EPBs? Better indicators and measurements of institutional capacity, as well as more rigorous evaluations of environmental protection efforts by both environmental protection agencies and industry, would be an important first step in translating environmental regulations into progress in China.

Appendix 1: Ranking of the 31 Regions by Potential and Realized Institutional Capacity (2002, China)

Province	Potential: Standardized Score	Realized: Standardized Score	Ranking Potential	Ranking Realized	Differences between Realized and Potential
Zhejiang	67.35	77.51	5	1	10.16
Beijing	88.64	71.51	2	2	-17.12
Shanghai	95.34	71.45	1	3	-23.90
Guangdong	59.70	71.45	12	4	11.75
Jiangsu	66.24	66.53	6	5	0.29
Tianjin	72.36	66.01	3	6	-6.34
Yunnan	53.58	64.04	24	7	10.46
Shandong	64.55	62.69	8	8	-1.86
Liaoning	64.07	62.50	9	9	-1.58
Chongqing	51.59	61.89	28	10	10.30
Hubei	60.40	60.26	11	11	-0.14
Fujian	61.29	60.15	10	12	-1.14
Ningxia	58.47	59.93	15	13	1.46
Henan	59.57	59.77	13	14	0.20
Hunan	55.15	59.08	18	15	3.93
Hebei	68.64	59.02	4	16	-9.62
Sichuan	52.46	58.77	27	17	6.31
Anhui	54.29	58.65	22	18	4.36
Jiangxi	53.45	58.55	25	19	5.11
Jilin	64.63	58.06	7	20	-6.56
Inner Mongolia	55.07	57.97	20	21	2.90
Xinjiang	55.04	57.77	21	22	2.73
Shaanxi	52.70	57.51	26	23	4.81
Heilongjiang	58.66	56.63	14	24	-2.03
Guangxi	57.99	55.89	17	25	-2.09
Gansu	49.15	55.37	29	26	6.22
Guizhou	48.65	54.20	30	27	5.55
Shanxi	58.39	54.18	16	28	-4.22
Qinghai	54.09	50.57	23	29	-3.52
Hainan	55.13	49.16	19	30	-5.97
Tibet	43.41	36.30	31	31	-7.12