

ENFORCEMENT ECONOMICS AND ENVIRONMENTAL COMPLIANCE: LESSONS FOR THE DEVELOPMENT OF ECE OUTPUT INDICATORS

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1 INTRODUCTION

Effective enforcement of environmental laws and regulations is critical to maintaining the integrity and biodiversity value of protected areas worldwide. When an enforcement regime is weak or ineffective, the disincentive it presents is unlikely to offset the incentives driving illegal resource use, and protected areas remain threatened. In 1999, Conservation International adapted and began field-testing the “enforcement economics”¹ methodology as an analytical framework for identifying key weaknesses in an enforcement regime and developing cost-effective strategies for mitigating them. The results of the enforcement economics analyses,² and the solutions they suggest, shed light on the persistent weaknesses that undermine the efficiency and effectiveness of enforcement systems. But it is the enforcement economics model itself that provides valuable insights that can be used to inform the process of developing ECE output indicators.

The enforcement economics model shows enforcement as a holistic system whose overall effectiveness is dependent on the effectiveness of each of its component parts. To specifically assess the contributions of different agencies to systemic effectiveness, indicators relevant to each step of the enforcement chain must be developed and monitored. The model also reflects the fact that a simple increase in enforcement/compliance actions is not an appropriate indicator of improved performance. Rather, it is the *success rate* of each of the discrete actions comprising the enforcement “chain” that is the true indicator of improved effectiveness of each step of the system, and therefore of the system overall. Furthermore, the model demonstrates that time is an important indicator of the efficiency of enforcement actions, and has a significant effect on the overall effectiveness of an enforcement regime. Finally, the model provides an interesting perspective on the question of effectiveness. By calculating the additional disincentive value generated by increased effectiveness of each step in the enforcement chain, the enforcement economics model can serve as a *predictive* model of how effective a system will be in contributing to environmental goals.

2 THE ENFORCEMENT ECONOMICS MODEL

Economists working on enforcement have found that the frequency and intensity of illegal activities are proportional to the net profits to be earned from those illegal activities. If a breaker of environmental laws believes that his profit will be greater than what he will have to pay for having broken the law, then the net profits of illegal activity are positive, and the crime will be committed. Society relies on an enforcement system to present a disincentive that offsets the incentives driving illegal activity. If the expected value of the enforcement disincentive is high enough to minimize net profits, the illegal act will not be committed.

Using this logic, economists have defined the enforcement disincentive (ED) as:

$$\text{Enforcement Disincentive} = P_d * P_a * P_p * P_c * \text{Penalty} * e^{-rt}$$

Where P_d is the probability of detection, P_a is the probability of arrest given detection, P_p is the probability of prosecution given arrest, P_c is the probability of conviction given prosecution, r is the discount rate (of the illegal actor) and t is the time between initial detection and payment of penalty³.

The value of the enforcement disincentive is the product of the probabilities of each step (or ‘link’) in the enforcement chain happening and the amount of the fine, discounted for the time between detection and paying the fine. The model reflects the fact that enforcement regimes are holistic systems

¹ Originally developed by John Sutinen for application in fisheries enforcement. See *Enforcement of the MFCMA: An Economist's Perspective* by John G. Sutinen, 1987.

² To date, enforcement economics analyses have been successfully piloted in Bahia, Brasil; Selva Maya, Mexico; Papua, Indonesia; and Palawan, Philippines.

³ $P_d = \# \text{ detections} / \# \text{ illegal acts}$; $P_a = \# \text{ arrests} / \# \text{ detections}$; $P_p = \# \text{ prosecutions} / \# \text{ arrests}$; etc.

and must be viewed as such. However, the model also indicates that breaking down and assessing the system in its component parts allows for the identification of specific weaknesses that affect the success rate of each step in the enforcement chain. This leads to a more precise understanding of the factors impacting the effectiveness of the system as a whole.

Describing the enforcement disincentive in this way provides a few critical insights. First, enforcement systems are only as strong as their weakest link. If the probabilities – or even the *perceived* probabilities – of *any one of these elements is zero, then the value of the entire chain is reduced to zero*, and the enforcement regime presents no disincentive to breaking environmental laws. Focusing investment on raising any single probability to 100% is inefficient, if other probabilities in the enforcement chain tend towards zero. This undermines the commonly held belief that poor enforcement is the result of too few enforcement agents and too few vehicles, and that investing in more agents and equipment alone will strengthen an enforcement system. While investing millions in agents and equipment may raise the probability of *detection* substantially, the impact of this improvement on the overall ED will be negligible if, for instance, prosecution rates continue to be very low. This leads to a second important insight – investing resources so that the success rates of the weakest links in the system are improved, or so that all probabilities are raised in some measure, is a more efficient investment, as it will yield a greater overall deterrent effect.

Finally, the longer the time between detection and imposition of a fine, the lower the value of the fine – at the high discount rates typical of illegal actors a delay of two or more years can effectively diminish the value of a fine as a deterrent to insignificant levels. To the extent that an enforcement process is time-consuming, the system is less effective in deterring illegal acts.

3 APPLICATION TO THE DEVELOPMENT OF ECE OUTPUT INDICATORS

The enforcement economics methodology essentially calculates performance indicators reflecting the success rate of each step of the enforcement chain, which together generate an overall indicator of the system's effectiveness. It focuses on the activities that an enforcement regime engages in, rather than on the resources that enter the system or the environmental changes that result from those activities. As such, the lessons from this model are relevant not to input or outcome indicators, but to output indicators.

The logic of the enforcement economics model generates four lessons that can contribute to the development of output indicators:

- (1) Output indicators that measure the effectiveness of each step of the enforcement chain should be developed and monitored.

The model formulaically represents a holistic view of enforcement that is actually common sense – the success of an enforcement system does not rely on detection alone, but rather, is a product of the performance of agencies charged with detection, arrest, prosecution and conviction.⁴ Monitoring the overall effectiveness of the system without monitoring these component pieces makes it difficult to understand specifically where the weaknesses that contribute to the strength or weakness of the whole system spring from. Without a specific understanding of where (i.e. within which step or agency) weaknesses lie, it becomes impossible to develop precise adaptive management strategies to mitigate those weaknesses.

Therefore, output indicators relevant to each step of the enforcement chain must be developed. These indicators will allow for monitoring the performance of the many agencies whose individual effectiveness directly impacts how effective the system is as a whole.

- (2) Raw numbers that count enforcement actions are not the best indicator of success or improved performance.

⁴ Note that these steps are generalized; the specific steps/agencies that contribute to overall effectiveness of enforcement will vary from country to country as the structure of enforcement systems will vary.

According to the typology of indicators put forth in the Results-based Management and Accountability Framework system, output indicators “are quantitative or qualitative measures of government activities, work products, or actions. In environmental enforcement programs, an example of outputs would be the number of enforcement cases issued or settled in one year. Outputs generally count things produced by the resources of the agency or program.”⁵

One potential shortcoming of this definition is its reliance on ‘counting’ actions like number of patrols or number of prosecutions; the interpretation that an increase in these numbers demonstrates strengthened enforcement. The enforcement economics logic implies that proportion of successful actions, and not number of actions, is the true indicator of performance. For example, the number of detections may double from one year to the next, but if the number of illegal acts committed has also doubled, the percentage of illegal acts detected has not increased – and there is no *de facto* improvement in the performance of the detection agency. While the number of detections has increased, this increase will have no positive effect on the overall enforcement disincentive, and therefore does not contribute to the effectiveness of the enforcement regime. To be meaningful, output indicators should measure the success rates of the agencies that perform each function (detection, arrest, prosecution, conviction), as the probabilities in the enforcement economics model do.

- (3) Time has a significant impact on efficiency and enforcement effectiveness, and must therefore be incorporated as an output indicator.

As described, time plays an important role in determining enforcement effectiveness. When an enforcement system is inefficient and processing times are lengthy, discounting erodes the value of the disincentive generated by the system. Even a system that enjoys high success rates in each step of the enforcement chain can present a very weak deterrent if the time between initial detection and collection of penalty is very long.

This suggests that output indicators that only reflect success rates of enforcement actions are not adequate measures of the efficiency or effectiveness of an enforcement system. To be thorough, a suite of output indicators must also incorporate an indicator of enforcement processing time.

- (4) Appropriately designed output indicators can also be used to predict the likely effectiveness of enforcement-strengthening investments.

Because of the lag times required to observe tangible changes in environmental quality, measuring the effectiveness of ‘output’ (enforcement actions) in contributing to environmental goals can be difficult. According to the INECE Expert Working Group on ECE Indicators, “practitioners have little reliable information by which to gauge the effectiveness of policies and regulatory activities in terms of delivering real and measurable environmental outcomes....developing meaningful indicators that link compliance and enforcement efforts with environmental improvements remains a challenge.”⁶

While the enforcement economics model does not establish the causal relationships directly linking enforcement actions to environmental outcomes, it can serve as a predictor of whether a given set of investments is likely to result in fewer environmental crimes (directly), and improved environmental quality (indirectly). According to the enforcement economics model, the ‘effectiveness’ of an enforcement system is determined by the extent to which it generates an ED that offsets the incentives driving illegal activity. If the system presents a disincentive that is equal to or larger than profit, the net profit of the illegal act is zero or negative, and there is no incentive for the crime.

Once the success rates resulting from given investments are known or modeled, the enforcement economics function can be used to predict the resultant change in ED. One can predict whether or not the system will be successful in deterring environmental crime by comparing this ED to the incentives driving illegal resource use. If so, it is reasonable to assume that positive environmental outcomes will

⁵ From “INECE-OECD Workshop on Environmental Compliance and Enforcement Indicators: Measuring What Matters,” Discussion Paper produced by INECE Expert Working Group on ECE Indicators, October 2003.

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result. In this way, it is possible to 'know' what the direction of environmental change resulting from investments in enforcement will be, even if the magnitude of those changes cannot be known in advance.

An interesting corollary of this logic is that investments can be optimally allocated to generate the efficiency gains that will maximize the effectiveness of the system. The EE model can be used to identify this optimal allocation of enforcement-strengthening investment.

4 CONCLUSION

Output indicators should ideally serve two objectives. First, they should provide an indication of quality and effectiveness of performance. Indicators should also, however, be designed in a way that makes them useful in precisely identifying sources of weakness while simultaneously suggesting the reasons underlying those weaknesses. If output indicators meet both of these objectives, the process of developing adaptive management strategies to mitigate these weaknesses is greatly facilitated.

The enforcement economics model is a very simple yet logical and elegant representation of the factors that determine how effective an enforcement system is in deterring environmental crime. While the model itself may be too simple to serve as a direct source of ECE output indicators, the insights into appropriate indicators that the model yields are critical. Given the holistic nature of the enforcement system, proper monitoring depends on monitoring output indicators that measure the effectiveness of each element of the system, not just some elements of the system or the system overall. The importance of success rates and time to enforcement performance and effective deterrence must be reflected in output indicators. Output indicators should also be designed in such a way that they provide an insight into what the likely environmental outcomes of enforcement actions will be.

Monitoring indicators is just the first step in a process that should ultimately lead to development of strategies for making an enforcement system stronger. Incorporating the lessons of the enforcement economics model into the design of output indicators will make them more informative, precise, and instructive. The better the design of these indicators is, the more useful they will be in not only identifying systemic weaknesses, but in suggesting targeted strategies for strengthening enforcement performance and effectiveness.