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A gilded trap in Dominican rice farming

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ABSTRACT

The Dominican rice sector is highly industrialized, with substantial levels of inputs and mechanization used to maximize the production of a rice monocultures. These practices have negative environmental effects and leave the sector ecologically and economically vulnerable. In this paper we identify barriers to and opportunities for pro-environmental change in the Dominican rice sector by applying the lens of path dependence to several of data sources. These include roughly two hundred in-person, structured interviews that our team conducted with rice farmers in the northwestern Dominican province of Montecristi, as well as key informant interviews with government officials involved in the agricultural sector there.

The analysis proceeded in three steps. First, we descriptively analyzed the farmer interview data. Second, we developed a conceptual model of the rice commodity chain to identify other relevant actors in the system and the implications that these actors' roles and interests have for the future path of the system. Finally, we constructed a path dependence model and tested the applicability of the "gilded traps" scenario to explain the characteristics this model contains. We find that the Dominican rice sector can be characterized as a gilded trap, with the highly profitable industrial model driving farmer debt and vulnerability, and leaving them without substantial access to alternative technical assistance that departs from the goals and underlying assumptions of this model. We conclude by identifying the primary change factors that could disrupt the system, including local-level collective-action among farmers to join a group sustainable rice certification scheme, as well as the DR-CAFTA agreement that will lower tariffs and quotas on rice imports.

1. Introduction and background

In this paper we apply the perspectives of resilience, path dependence, collective action, and social traps to the rice farming and processing sector in the Dominican province of Montecristi. The research question that we sought to answer in this analysis was, what are the barriers to, and opportunities for, pro-environmental change in the Dominican rice sector? An additional goal of this analysis was to explore the integrated application of these perspectives to a social-ecological system.

These ideas have been applied to agricultural systems before. Hodbod and Eakin (2015) argue that the two primary goals of agricultural policy historically have been (1) growth and (2) stability in support of "production for profit and capital accumulation.", and that the pursuit of these goals has come at the expense of the resilience of agricultural systems. A primary component of this argument is the dominance of monocultures in industrialized systems. Holling and Meffe (1996), in one of the seminal works that expanded the resilience perspective to social-ecological systems, include agriculture as an example of what they call "the pathology of command and control." Here they criticize the decline in variation represented by monocultures and the loss of resilience, or increased vulnerability, that this farming strategy introduces. These arguments are similar to those made by Scott (1998), who criticizes the myopic focus on one or several system attributes, that are then maximized to the detriment of the integrity of the larger system. In the face of this loss of resilience, as well as other costs such as excessive pollution linked to runoff from farms, we must ask: how do such fragile systems persist, and how could they be productively altered? To help us answer these questions, we can turn to the literatures on path dependence, lock-in, and social traps.

1.1. Path dependence and capital

Path dependence is the idea that history matters because of positive feedbacks or increasing returns that increase the costs of exiting from a path (Pierson, 2000, 252). Drawing inspiration from several seminal works on path dependence (North, 1990; Arthur, 1994), we view path dependence as resulting from important attributes of the capital that

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decision-makers own, the interests they have, and the decisions they make as a result. For a taxonomy of the types of capital that actors possess, we rely on the "five factor" model (Parkin, 2010). This taxonomy consists of human capital, social capital, manufactured capital, natural capital, and financial capital.

There are three interrelated attributes of capital that encourage path dependence. First, capital is owned by strategic actors with interests tied to this capital. Owning a resource both has the potential to confer (1) benefits and (2) power on the owner. As a result, the distribution of capital ownership within a system affects who is in a position to plan to change or maintain the current path, and what decisions those actors will make based on how this will affect their net benefits. A capital-oriented analysis of path dependence must therefore examine the power, interests and incentives of the actors involved.

We can better understand the decisions of capital owners through a second attribute of capital, what we call capital interdependence, wherein the value of capital to its owner is largely a function of how well it complements the capital owned by other actors, a situation that is most frequently referred to as a coordination effect or a network effect. A network effect refers either to the situation where a single resource or technology becomes more useful as it is increasingly adopted by additional actors (direct network effects), or a situation in which the value of a resource depends on its interaction with other resources and types of capital (indirect network effects).

Because of this attribute, when deciding how to develop their capital resources, actors will be incentivized to obtain capital that is complementary to existing types of capital, thus leading the overall system down a path with increasing interdependence among the resources that are employed. Various terms have been developed to describe a suite of resources and their complementary functions, including "technological regimes", "techno-institutional complexes", and "socio-technical systems" (Unruh, 2000; Berkhout, 2002; Geels, 2004). This interdependence (also referred to as complementarity or compatibility) acts as a strong barrier to change from a "dominant design" (Unruh, 2000) such as those associated with industrialized farming. In a complex system that employs multiple interdependent types of capital, a given component cannot be easily altered without a loss of value in the larger system; this makes incremental change difficult when many components must be replaced at once to avoid substantial loss in value.

The decisions that actors make in many settings display coordination effects, with similar consequences for path dependence. In a collective-action setting, the net benefits that an actor receives are a function of their own decision (say to cooperate or defect) but also of the decisions that others make, as has been noted by scholars studying collective-action and the commons (Ostrom et al., 1994).[1] Here we see the "first-mover problem", where each actor in a strategic situation, say at the Nash equilibrium of a social dilemma, has an incentive to wait until others have changed their strategies first. A key part of this dynamic is the formation of expectations, which has been emphasized in the literature on institutional path dependence (David, 1994). Actors in a social dilemma can become stuck in a maladaptive equilibrium based on self-reinforcing expectations of continued non-cooperation by their co-participants. This first-mover problem in a social dilemma is analogous to the problem of motivating incremental capital change just described above: if actors expect that the current mix of capital will pursuit, then they won't have an incentive to wildly depart from this mix in their own capital development decisions.

The final attribute is the inertia of capital, or the costliness of capital development and removal. Capital development includes the formation of human capital through social learning, social capital through the establishing of trusting relationships, or infrastructure construction in the design and manufacture of technologies. The costliness of capital removal has more often been referred to as capital durability. With physical infrastructure this is an obvious feature, but it has also been noted to characterize social and human capital in the form of "sticky" institutions. Such stickiness arises from the transaction costs inherent in developing new institutions, which requires bargaining and overcoming vested interests.

Capital interdependence and inertia are closely related. First, as David (1994) describes, institutional inertia also results in part from mutually reinforcing expectations of complementary patterns of behavior. Additionally, when an actor decides that they need a new resource, they can often decide to develop it on their own or obtain it through someone else who currently possesses it. Because capital is costly to develop, frequently it is most beneficial to obtain capita through trading: this is arguably the primary motivation behind task specialization and market exchange. Finally, combining interdependence and inertia makes it difficult to develop a new path because of the costliness of developing massive amounts of new capital when incremental innovative change is stymied as described above. "This is because of the heavy initial costs of switching to more sustainable systems and the need for all to act simultaneously in the switching process if economic losses are to be avoided" (Wilson and Tisdell, 2001, 458).

1.2. Path dependence, social dilemmas and traps

Typologies of problematic scenarios involving path dependence have been developed, largely based on the language of traps and social dilemmas, which are interrelated (Platt, 1973; Boonstra and de Boer, 2014; Cumming, 2018). Building on Platt's (1973) work, Cumming (2018, 3) defines social dilemmas as "situations in which there is opposition between a highly motivating short-term reward (or punishment) for an action and its long-term consequences. Social dilemmas also include situations in which individual and group benefits are in conflict." Social dilemmas are analogous to collective-action problems as used in the commons literature (Poteete et al., 2010). When enough participants in a social dilemma act as conditional cooperators, which is often the case (Chaudhuri, 2011), initial cooperative or non-cooperative dynamics can lock participants into self-reinforcing cooperative or non-cooperative patterns.

Social-ecological traps can involve social dilemmas, and are situations with "persistent, self-reinforcing dynamics…with negative outcomes for people and/or ecosystems" (Cumming, 2018, 3). Much of the utility of the literature on traps is the typology that has been developed to describe context-specific dynamics that lead to maladaptive, self-reinforcing patterns. Several of the more popular types of traps that have been developed are poverty and rigidity traps (Allison and Hobbs, 2004; Carpenter and Brock, 2008; Haider et al., 2018). Allison and Hobbs (2004) also describe a lock-in trap in western Australian agriculture. The concept of lock-in has been widely used to describe problematic self-reinforcing dynamics, particularly in agricultural and technological systems (Cowan and Gunby, 1996; Unruh, 2000; Hammond Wagner et al., 2016). A focus of this work is on understanding the dominance of a set of technologies in the face of desirable alternatives, due to the historical antecedence of the dominant design.

In the analysis below we explore the applicability the "gilded trap", to the Dominican rice sector. The elements of this trap provide us a set of theoretical expectations and thus a structure for addressing our principle research question regarding the opportunities and barriers for positive change in this sector. Steneck et al. (2011) introduced the idea of a gilded trap to describe the famous Maine lobster fishery. Gilded traps occur when there is a highly productive but ecologically simplified ecosystem and a set of highly dependent resource users who incur debt and leverage themselves to capitalize and increase their ability to extract products from this ecosystem for which there is a high level of market demand. Cumming (2018) argues that gilded traps also involve social dilemmas, insofar as they involve "group actions resulting from

[1] Pierson (2000) provides a more in-depth discussion of the role of path dependence in collective-action dynamics.