

## **Comparing Formal and Informal Institutions with the Institutional Grammar Tool**

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## ABSTRACT

While the role of formal and informal institutions has been long recognized among common-pool resources scholars working under the Institutional Analysis and Development Framework (IAD), not much attention has been devoted to disentangling the relative influence of each one on social behavior. We explore this issue through the application of the grammar of institutions, semi-structured interviews, and Q-sort methods. The goal of this paper is two-fold. First, the paper seeks to provide a deeper understanding of the interplay between formal and informal institutions on policy compliance. We do so in the context of aquaculture policies in the State of Colorado, USA. Second, this paper seeks to continue to develop Crawford and Ostrom's grammar of institutions as an analytical tool for systematic institutional analysis. The results from the case study are mixed. We found some respondents reporting strong alignment between informal and the formal institutions but others reporting weak alignment. Additionally, feelings of personal guilt or shame and fear of social disapproval, together, were cited as being more influential in shaping individuals' decision making regarding compliance with formal institutions than was fear of monetary sanctioning. The paper concludes with a discussion of the unexpected relationships among different syntactic elements of the grammar thereby deepening the understanding of how the grammar of institutions can help in the examination of policy documents and explain human behavior.

**KEYWORDS:** institutional analysis and development framework, formal institutions, informal institutions, institutional grammar, q-sort, aquaculture

## I. INTRODUCTION

Understanding when a particular institutional arrangement, that is, sets of rules, norms, and strategies, affect certain outcomes and not others has long been of interest to policy scholars. Scholars have spent significant amounts of time describing and studying the performance of particular institutional arrangements, in the form of markets, hierarchies (Miller 1992), bureaucracies (Moe 1989; Carpenter 2001), polycentrism and federalism (V. Ostrom 1977; Oakerson 1999), multi-organizational systems (Chisholm 1989), decentralization (Andersson and Gibson 2007), co-management, and other forms of collaborative arrangements (Pinkerton 1989; Berkes 2009; Ostrom 1990). Explicitly or implicitly, at the center of these authors' work are questions regarding the relative importance of formal and informal institutions<sup>2</sup> in shaping human behavior and policy outcomes.

Formal institutions are rules, norms, and strategies that have been officially recorded, most often in writing, into policies, codes, laws, statutes, and regulations. Informal institutions are rules, norms, and strategies constituting social habits, customs, and daily practices within a group of people over extended periods of time. Informal institutions may or may not be embodied in the formal institutions.

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<sup>2</sup> We use the terms formal and informal institutions to refer to the formal or informal rules, norms and strategies that make up an action situation.

The influence of both formal and informal institutions can be significant on a community. For example, legally binding water compacts (formal institutions) between states have had an enormous effect on water allocations for much of the western United States (Heikkila, et al, 2011). In contrast, informal institutions can sometimes operate largely independently of formal institutions, as Basurto (2005) found in a small fishing community in Mexico. In other situations, formal and informal institutions can contradict each other, like when nationalized formal institutions in developing countries undermine the ability of local institutional arrangements to maintain a common-pool resource (Ostrom, 1990; pg 23). Moreover, there are also governance and managerial implications from distinguishing between formal and informal institutions. If we know, for example, that formal institutions have little effect in the implementation of a policy to assure reliable water provision to a rural population in a developing country, does it make sense to invest millions of dollars in developing and strengthening formal governance mechanisms and “the rule of law,” or would it be better instead to invest those resources in understanding how monitoring and enforcement of informal institutions can be improved? Alternately, consider the history of civil rights in the United States, where formal institutions were designed and adopted to end racial segregation and constrain informal institutions espousing racism.

While there are certainly situations where formal and informal institutions operate independently, competitively, and symbiotically, it is often challenging to disentangle the relative influence of each on social behavior in a particular action situation. Thus, in this paper we examine the relationship between formal and informal institutions and the effects of this relationship on policy compliance. We explore this issue in the context of aquaculture policies in the State of Colorado, USA.

To conduct our analysis, we rely upon the underlying logic of the institutional analysis and development (IAD) framework to apply the institutional grammar tool developed by Crawford and Ostrom (1995) and later revised by Basurto et al. (2009) and Siddiki et al (forthcoming 2011) in addition to conducting semi-structured Q-Sort interviews. We selected the policy subsystem of aquaculture in Colorado because the formal institutions that govern it are all encompassed in four different legislative documents, making it feasible to code them in their entirety. We also had access for interviews of all main participants who are affected by both formal and informal institutions of aquaculture in the State. Some of these individuals were also involved in the design of the formal institutions for aquaculture governance making it feasible to ask questions about design of the formal institutions. The reporting of this case study in this paper is straightforward. We start by providing an overview of the conceptual language found in IAD framework, including a discussion of formal and informal institutions. We describe the methods for data collection and analysis using the grammar of institutions. The paper ends with a discussion of the findings and their implications for policy analysis and future research agendas.

## **II. DEFINING KEY TERMS WITHIN IAD SCHOLARSHIP**

To develop a stronger theoretical understanding of the relationship between informal and formal institutions, IAD scholars have developed a common vocabulary in reference to institutions, formal institutions, informal institutions, institutional statements, and institutional arrangements or configurations.

The foundational stone of the IAD framework are institutions, defined as the “shared concepts used by humans in repetitive situations organized by rules, norms, and strategies” (Ostrom 2007, 23). Institutions provide stability, instill resilience, and reduce uncertainty in action situations by establishing what is permitted, required, and forbidden. The two forms of institutions, formal and informal, exhibit the same general features of institutions in that they too are organized by rules, norms, and strategies that establish what is permitted, required, and forbidden. As mentioned before, the major differences between them are (1) the formal institutions must be written whereas informal institutions may or may not be in written form; and (2) the informal institutions compared to the formal institutions are more immediately proximate to actual behavior and outcomes.

Informal institutions “are the dos and don’ts that one learns on the ground that may not exist in any written document. In some instances, they may actually be contrary to the dos and don’ts written in formal documents” (Ostrom, 2007; page 23). Informal institutions have been coined the “working rules” and “rules-in-use” (Ostrom, 2005; page 19-20) and have been described as the “social habit” among individuals (Ostrom et al, 1994; page 39). As social habits, informal institutions are agreed upon by a collective, often but not necessarily verbally. They also show temporal longevity and adaptability. A theoretical depiction of informal institutions would place classify them with immediate proximity as a causal driver of behavior. Immediate proximity means that, if a process trace were conducted of the causal mechanisms explaining a particular behavior (George and Bennett, 2007), informal institutions would lie closer as a causal mechanism to the actual behavior than any policy, law, or regulation (formal institutions).

Whereas informal institutions are the informal day-to-day institutions that govern behavior, formal institutions are actually written and synonymous with policies, laws, and regulations. Formal institutions have been called “rules-in-form” and “rule of law” (Ostrom, 2005; page 20). Like informal institutions, formal institutions can also affect behavior, particularly if monitoring and enforcement mechanisms are in place. A theoretical depiction of formal institutions would place them at a farther proximity as a causal driver of behavior compared to informal institutions.

Despite the fact that both informal and formal institutions can affect behavior there is no reason to assume that one is necessary or sufficient for the presence or absence of the other. In some cases informal and formal institutions can perfectly align. In other cases, formal and informal institutions diverge with formal institutions possibly constraining or even spoiling the efficacy of informal institutions. Yet in other cases, formal institutions may not matter at all.

Theoretical and methodological headway into studying formal institutions was made by Crawford and Ostrom (1995). They introduced the institutional grammar tool for analyzing formal institutions by studying “institutional statements.” For Crawford and Ostrom (1995; 583), an “institutional statement refers to the shared linguistic constraint or opportunity that prescribes, permits, or advises actions or outcomes for actors (both individual and corporate).” The institutional grammar tool allows researchers the ability to systematically identify and understand institutional statements by compartmentalizing the individual components that comprise them. Specifically, statements are parsed into the following six categories (1) Attributes, or the agent(s) charged with performing a particular action; (2) oBjects, the animate or inanimate part of the statement that is the receiver of an action; (3) Deontics, the prescriptive operator that specifies whether an action is required, allowed, or forbidden; (4) alms, or the action itself; (5) Conditions, which specify the spatial and/or temporal boundaries in which the action in question is to be performed; and (6) Or elses, the punitive sanctions associated with not carrying out an action as prescribed. Not all components must be present within any given institutional statement. At a minimum, institutional statements must contain an Attribute, alm, and Condition. Recent applications of the institutional grammar tool have sought to clarify coding guidelines, clarify the conceptual definitions of individual statement components, and provide insight regarding its practical and theoretical utility (Basurto et al., 2009; Schluter and Theesfeld, forthcoming; Speer, 2008; Siddiki et al., forthcoming 2011). For example, exploring the utility of the institutional grammar in comprehensively identifying the array of opportunities and constraints available to policy actors in various action situations, demonstrating how actors are linked across levels of analysis around shared policy processes, and uncovering how the different components of institutional statements interact to animate the behavior of policy actors. Finally, seeking to demonstrate its versatility, some of these scholars have touted the tool’s methodological applicability under the umbrella of policy process lenses other than the IAD framework to understand the role of policy designs and the actors and processes described within them in communities.

The previous and subsequent discussion is founded upon the assumption that the actions of individuals in action situations are not shaped by a single institution be it formal or informal. Instead, all institutions operate configurationally to shape individual behavior (Kiser and Ostrom, 1982; page 179). By representing sets of interdependent institutions, configurations of formal and informal institutions also depict – to various extents – what individuals may, must, and must not do. Similarly, configurations of formal institutions may perfectly align with actual informal institutions. Other times, there may be imperfect alignment. The degree in that there is congruence between the configurations of formal and informal institutions is an empirical question and the subject of this paper.

### **III. ASSESSING CONGRUENCE BETWEEN FORMAL AND INFORMAL INSTITUTIONS**

A number of factors affect the alignment of formal and informal institutions and the focus of this inquiry is on understanding some of the underlying motivators that

influence this relationship. Presumptively, individuals are embedded in communities that are guided by both formal and informal institutions. Both institutional types can extend explicit and/or implicit pressures on individuals to behave in certain ways. When making decisions, individuals must consider such complementary or contradictory institutional pressures to ascertain a course of action.

Within the purview of the IAD framework, individuals are not atomistic – free to make decisions independent of the institutional, community, and physical/geographic context. They are engulfed by institutional pressures that may be known or even unknown. When making decisions, their information is imperfect as well as their decision-making calculus; that is, they are boundedly rational “individuals who calculate benefits and costs and are fallible learners who vary in terms of the number of other persons whose perceived benefits and costs are important to them and in terms of their personal commitment to keeping promises and honoring forms of reciprocity extended to them” (Ostrom et al., 1993, 45). From an institutional perspective, this view of the individual contrasts with rational choice institutional models that view actors as having static preferences and behavior solely as a product of externally provided constraints, information, and outcome possibilities, while neglecting socially, or community, derived motivations (McCay, 2002; Shepsle, 2006, 24-25).

Within the IAD logic, individuals are stimulated by internal and community derived motivations that are shaped to various extents by informal and formal institutions. In addition to formal and informal institutions, individuals’ decision making processes are jointly affected by contextual bio-physical and community attributes, and a series of individual situational characteristics and endogenous variables such as principles of justice, feelings of responsibility, and a desire to act appropriately.

In this study we focus on three internally and externally derived motivations that shape individuals’ compliance with formal and informal institutions: fear of monetary sanctioning, fear of social disapproval, and feelings of personal guilt and/or shame. These internally and externally derived motivations are characterized as “delta parameters.” The concept of delta parameters refers to the cost-benefit calculus that informs how individuals weight each of the aforementioned motivations in informing their decisions (Crawford and Ostrom, 1995; Ostrom, 2005). As monetary sanctions and social disapproval are externally imposed on individuals, they are characterized as external delta parameters. In contrast, factors emerging internally to the individual, such as feelings of personal guilt and/or shame, are characterized as internal delta parameters (Crawford and Ostrom, 2005, 146-147).

In addition to the three delta motivations, monetary sanctions, social disapproval, and personal guilt or shame, other scholars studying individual decision making behavior in relation to the deltas have found the following factors to be influential: (1) Involvement of community members in labor unions (Offe and Wisenthal, 1980); (2) Change in resource availability with use (Olson, 1991; Hirschman, 1985; Mansbridge, 1994); (3) Involvement of community members in rule development (Frey, 1994); and (4) Perceived legitimacy of rules (Ostrom, 2005). For the purposes of this study, such

variables are characterized as “contingent variables,” meaning that the extent to which internal and external deltas will be expressed in individuals’ decision making is contingent upon a variety of community-based, bio-physical, and political variables, as well as individual situational and endogenous factors in addition to formal and informal institutions.

The specific types of formal institutions used in this study are state level regulations. As such, the extent to which informal institutions and aligned with formal institutions may be considered a proxy measure for regulatory compliance. Considering the former discussion, then, compliance within the setting of the IAD framework as it relates to this study is characterized as conformance with formal institutions and is shaped by both individuals’ normative and material considerations emerging from biophysical, community, and individual contexts (Ostrom, 2005, 167).

We are guided by a general research question about the relationship between formal and informal institutions and their respective effect on compliance. From this general question, we derive three more specific research questions outlined below. The following research questions were posed for our inquiry toward understanding the factors that shape individuals’ decisions to behave in manners consistent or inconsistent with formal institutions. The first of these research questions allows us to understand the degree to which formal institutions are consistent with action situation level behaviors, while the second allows us to explore the causal reasoning informing apparent consistencies and inconsistencies.

RQ<sub>1</sub>: To what extent are the descriptions of situations described in formal institutions reported by interviewees as representing their day-to-day activities, that is, the informal institutions?

RQ<sub>2</sub>: What motivating factors are most influential to individual decision makers regarding compliance with formal institutions: fear of monetary sanctioning, fear of social disapproval, and/or feelings of personal guilt or shame?

RQ<sub>3</sub>: Which contingent factors are most influential in shaping the expression of internal and external delta parameters?

#### **IV. CASE STUDY: COLORADO STATE AQUACULTURE**

Our analysis of these research questions was conducted in the context of Colorado State aquaculture in which we compared aquaculture activities prescribed in formal institutions with those actually being exhibited by members of the community. Aquaculture is defined as, “the farming of organisms that live in water, such as fish, shellfish, and algae (USGS, 1996).” Aquaculture is a relevant national and state-level policy analysis issue given that it is one of the fastest growing food commodities (Naylor et al., 2001), and its governance is embedded in a complex regulatory framework. The decrease of fish stocks in capture fisheries has served as a primary impetus to grow the U.S. aquaculture industry to meet increasing consumer demand (Boyd, 2003).

Regulatory concerns relating to aquaculture include water pollution from farm effluent, competitive feed pricing, and silting issues in federal and state waters (Ackefors et al., 1994). The regulation of aquaculture activities occurs at multiple levels—local, state, regional, and federal—and is conducted by a number of different agencies at each geographic scale (McDaniels et al., 2006, 426). The decentralization of regulatory responsibilities has meant that different stakeholders with varying objectives are involved at each level to decide how and when the aquaculture industry is regulated.

In the early 1990's the Colorado aquaculture industry formally requested to be incorporated into the jurisdiction of the Colorado Department of Agriculture, thus conferring the rights and responsibilities associated with other types of agricultural activities in the State upon it. A new set of laws and regulations were created to address this jurisdictional change. The two primary agencies charged with the regulation of aquaculture in Colorado State are the Colorado Department of Agriculture (CDoA) and the Colorado Division of Wildlife (CDoW). The CDoA is responsible for permitting procedures relating to aquaculture and has two complementary legislative documents: the Colorado Aquaculture Act (CAA) Statue and the Rules Pertaining to the Administration and Enforcement of the Colorado Aquaculture Act, that detail the structure and responsibilities of the Aquaculture Board, procedural directives regarding destruction orders and all other permits and regulations present within the legislation, and the fee structure assigned to different permit types. The CDoW deals with matters of fish health and has two legislative documents that deal directly with aquaculture. The first, Article VII of the Chapter 00 – General Provisions, specifies prescribed fish health testing, responsibilities of the State Fish Health Pathologist, and disinfection and quarantine procedures. The second, Section 33-5.5-101 of Title 33 of the Wildlife and Parks and Regulations Rules, outlines the responsibilities of the Fish Health Board as they pertain to aquaculture. Taken together there are four legislative documents governing aquaculture activities in Colorado: the Colorado Aquaculture Act (i.e. CAA Statue), the CAA Administration and Enforcement Rules (i.e. Rules Pertaining to the Administration and Enforcement of the Colorado Aquaculture Act), Article VII of the Chapter 00 Regulations (herein Chapter 0), and the Fish Health Board Statute (Section 33-5.5-101 of Title 33).

## **V. METHODS OF DATA COLLECTION AND ANALYSIS**

To respond to the posited research questions, we applied two distinct but related methodologies. First, we systematically coded a set of formal institutions to analyze the prescribed structure of opportunities and constraints offered to individuals in action situations; that is, the prescribed set of required, allowable, and forbidden actions. Second, we used a dual interview approach applying a semi-structured interview protocol and related Q-Sort technique to assess the degree of congruency between prescribed and actual behavior and to uncover how actors weight internal and external delta parameters when deciding whether or not to comply with formal institutions.

### ***Legislative Coding***



First, to understand the content of formal institutions, we applied the IAD's institutional grammar as described in the institutional grammar tool (IGT) to code four regulatory documents guiding the practice of aquaculture in Colorado State. Before conducting the formal coding exercise, informal, preliminary interviews were first conducted with two members of the aquaculture community to identify the most pertinent legislation in directing the activities of aquaculturists in the State. Across the four policy documents 346 statements were identified. One member of the research team coded each of the four policy documents in their entirety. A second member of the research team coded 35 statements from Colorado Aquaculture Act Administration and Enforcement Rules, comprising approximately ten percent of the total statements across all documents, as a test for inter-coder reliability. Inter-coder reliability results were calculated based on agreement per statement component. The following agreement rates were observed between the two coders on each component: Attributes (86%), oBject (86%), Deontic (97%), alm (94%), Condition (80%), and Or else (100%).

To summarize the data, first, we conducted a basic frequency count for all four policy documents to determine the total number of statements within each document. We also categorized these statements by the components present within them in order of increasing levels of stringency, including Attribute-alm-Condition (AIC), or Attribute-Object-alm-Condition (ABIC) statements, Attribute-Deontic-alm-Condition (ADIC) or Attribute-Object-Deontic-alm-Condition statements (ABDIC) statements, and Attribute-Deontic-alm-Condition-Or else (ADICO) or Attribute-oBject-Deontic-alm-Condition-Or else (ABDICO) statements. In the original grammar tool (Crawford and Ostrom, 1995), this increasingly stringent ordering of categories of institutional statements corresponded with "strategies" (AIC), "norms" (ADIC), and "rules" (ADICO). In this paper, we recognize the underlying logic of ordering the statement categories by stringency from strategies to rules. But we avoid using the conceptual language of strategies, norms, and rules because all statements in formal institutions could be interpreted as rules. More important than the actual label applied is the relative frequency of each categorization and the understanding such categorization provides into the content of the policy documents. Completing the descriptive summary of the policy documents is a frequency count to determine the actual Attributes, oBjects, and Deontics most frequently occurring within each. A summary of institutional statements is provided in Table 1.

**- Insert Table 1 -**

In summarizing the modal Attributes, oBjects, and Deontics within each of policy documents in this manner, we explored if one may begin to discern how individual components from institutional statements cumulatively structure action situations described within policies (Ostrom, 2005, 175), and if within each policy document one may observe who are the primary participants, and various characteristics regarding them, including, for example, the activities associated with them and the control that their respective positions afford.

Second, each of the modal actors from the four regulations was linked with the actions associated with that Attribute in the legislation along with related Deontics. This clustering exercise yielded graphical depictions such as the following Figure 1 for the Fish Health Board.

**- Insert Figure 1-**

Relevant for this study, a mapping of institutional statements that allows one to start to understand the activities associated with particular actors was necessary as it served as the basis for the second round of data collection via formal interviews. For example, the modal attributes formed the sample pool for the interviews. Additionally, individual institutional statements were used as the preselected statements that interviewees would be asked to sort during the Q-Sort exercise.

### ***Interviews***

Data collection to capture action situation level behaviors was done through the formal collection of interview responses. The sample of interview participants included modal actors from the four legislative documents coded for the exercise, including, four facility owners and operators, the Colorado State Fish Health Pathologist, one representative from the Colorado Department of Agriculture, one member of the Colorado Aquaculture Board, and one member of the Fish Health Board. A total of seven formal, semi-structured interviews were conducted. Some of the interviewees have multiple roles in the aquaculture community (ex. Fish Health Board member and facility owner) and this is reflected in their responses to interview questions in which they provided answers from the perspective of each of the positions held. The interviews consisted of two parts. In the first part, we asked interviewees a series of questions based on a formal, structured interview protocol.

#### ***Interview Part 1: Protocol-Based Interview***

In order to link the interview responses with the data collected through the legislative coding, questions asked during interviews were directly related to the interviewee's role and responsibilities as presented in legislative documents. Questions were structured around statement components from the Grammar (Attributes, oBjects, Deontics, etc.) and were catered for the particular position/role of the interviewee in the aquaculture community as prescribed in the coded legislation. A sample of Grammar related questions used in the interview protocol can be found in the Appendix.

The formal interview protocol also included a number of questions relating to the history and context of regulations, regulatory compliance, and regulatory effectiveness. However, analysis of interview data focused primarily on the grammar component related questions in an effort to understand the utility and theoretical relevance of parsing institutional statements by Attributes, Deontics, alms, etc. We were particularly interested in assessing whether such a compartmentalization is practically and

theoretically justified; for example if interviewees would reveal practically and theoretically useful insights when asked questions pertaining to each grammar component independent and dependent of others.

With respect to Attributes (actor categories frequently mentioned in the policies), five out of the seven interviewees that responded to this question indicated that they represented the appropriate target audience for the respective regulations, including, four facility owners, one of whom was also a member of the Fish Health Board, and the State Fish Health Pathologist. Those who felt that they are not the appropriate Attributes were the representative from the Colorado State Department of Agriculture and member of the Colorado Aquaculture Board. In most cases those who felt that the regulation appropriately targeted them stated that they were a primary Attribute because they were intended to be regulated under the legislation. Additionally, level of influence within the aquaculture community was also cited as being a reason as to why certain actors were modal within the regulations. This was the case, for example, with the member of the Fish Health Board, the entity charged with approving most mandates within aquaculture regulations in the State, who stated that the Board was a primary policy actor as it is very influential in shaping the aquaculture industry in the State.

Those who stated that they were not the appropriate target audience of the regulation stated that their presence as a frequently mentioned Attribute in the policies overstated their influence in the management of the aquaculture industry. With respect to the Colorado Aquaculture Board, the member stated that the Board is only called upon under certain circumstances to perform the activities described in the regulations, while the regulations make it appear that the Board is performing these activities on a regular basis. The Colorado Department of Agriculture representative stated that many of regulatory activities associated with it are performed jointly by the Department and the Colorado Division of Wildlife, while the regulations make it appear that it is the sole actor involved with such.

For the object questions, we were interested in knowing if the number of activities prescribed to a particular actor provided an indication regarding the scope of his/her activities in aquaculture, in addition, to level of influence. For example, if an individual is associated with a larger number of activities, does this mean that his/her scope of activities and/or influence is commensurately greater? Of the six interviewees that responded to this question, three responded that the regulations accurately portrayed the scope of their activities relating to aquaculture, while three said they do not. Of those who responded positively, two remarked that the nature of their work in aquaculture is highly specialized and, thus, they are related to relatively few activities that are fairly substantively narrow. One interviewee commented that regulations define the scope of activities as they relate to particular actors and thus consistency is observed between prescribed and actual activities. Of those who responded negatively, one interviewee, a member of the Colorado Aquaculture Board, stated that regulations do not provide an accurate representation regarding the role of the Attribute in the aquaculture community which has weaned in recent years. Another, the member of the Fish Health Board stated the regulations relay just a few of the Board's activities out of

many, which devalues its influence and the scope of activities performed regarding the development of aquaculture policies. This interviewee further noted that while the Board may not be associated with many activities, the content of these activities better reflects the broad-reaching influence that it has. In other words, one must not only consider the number of activities associated with an Attribute, but also the types of activities and the implications of them. The third interviewee, a facility owner, indicated that Conditions dictate whether or not a particular activity within the regulation is relevant to a particular person. In other words, there are a wide variety of activities described in the regulations in relation to facility owners, not all of which are applicable to everyone. Applicability is anchored on Conditions that specify to whom certain activities apply and under which circumstances.

Regarding the Deontic/alm question, of the five interviewees that responded to this question, three stated that they interpret prescriptive operators very literally, with two interviewees stating that they interpret the different prescriptive operators with some degree of leniency. One of the latter interviewees, who is charged with enforcing regulations, elaborated that his interpretation of these is based largely on a case-by-case base determination of the perceived appropriateness of a prescription in relation to a farmer's activities. He went on to state that often times non-compliance with regulations has minor or negligible implications. However, results from the Q-Sort exercise indicate that while the majority of interviewees stated that they adhere to a strict interpretation of prescribed Deontics, their actual practices indicate otherwise. That is, in many cases interviewees understand activities to be associated with one prescriptive operator when in fact they are associated with another. Further discussion regarding the role of Deontics is provided in the Q-Sort exercise results section of the paper.

For the Condition question, of the five interviewees that responded to this question, each expressed that these aspects of the regulations are extremely important. The State Fish Health Pathologist, for example, mentioned that detailed conditions are written as they are to provide clarity regarding what he is required, allowed, and forbidden to do when conducting fish health testing and inspections. The consequences of such procedures can have significant implications. The Fish Health Board member stated that conditions are extremely important as they are a major consideration when the Board is hearing cases of non-compliance to determine a violator's sanction. He further stated that Conditions largely shape how the interviewee interprets regulatory Deontics and associated phrases. For example, a "must" is really only a "must" under certain conditions, and the same goes for "mays." Regarding the prevalence of informal institutions, one administrative representative commented that many times the conditions upon which decisions are made are not formally written in legislation but are rather informally considered based on particular circumstances. He stated that this is particularly true for cases that are viewed as less serious. Where cases of non-compliance are more serious, a stricter adherence to formally stated conditions is used.

Across the four policy documents, very few statements contained Or else components. Interviewees were asked to describe why they feel this is the case. Of the

seven individuals that responded to this question, three stated that this was due to a lack of enforcement capacity by regulating agencies. Two interviewees stated that, as those individuals responsible for enforcing rules, they preferred to deal with non-compliance issues on a case-by-case basis rather than imposing blanket penalties within regulations. Both individuals stated that the observed leniency has in large part to do with maintaining harmonious relations between regulating agencies and members of the industry.

### ***Interview Part 2: Q-Sort***

For the second part of the interviews, we conducted a Q-Sort exercise with interviewee participants. A total of six Q-Sort exercises were conducted, with one interviewee who holds dual positions in the aquaculture community conducting two sorts and the remaining participants conducting one sort each. The Q-Sort is a methodological technique that allows study participants to subjectively sort a pre-selected set of statements into a set of categories designated by the researcher. Sample statements can be chosen following an unstructured or structured approach. In the latter, the researcher chooses the statements that will be sorted based upon prior collected information, such as through preliminary interviews or from the examination of existing documents.

For our analysis, we used a modified, structured Q-Sort in which each study participant was given a set of cards containing statements that describe activities that relate to his/her position in relation to aquaculture as prescribed in one of the four regulatory documents analyzed in this study. The participant was asked if s/he “must,” “must not,” “may,” or “may not” perform the activity described on the card based on adopted practices. We chose to use the Q-Sort technique in our interviews as we felt it would allow us to capture action situation level behaviors exhibited by interviewees which we could then formally and systematically compare to the formal institutions. Once the sorting exercise was completed, the researcher asked the participant to explain the placement of statements. Follow-up questions were structured around pro-factual and counter-factual prompts as well as probes relating to the interviewees’ motivations in performing/not performing prescribed activities. Additionally, interviewees were also asked to articulate how they interpreted and weighted different prescriptive operators.

Q-Sort data were first analyzed by calculating the percent congruence between the content of actual regulatory statements and interviewees’ description of their activities. The results from this exercise are provided in Tables 2 through 7. For each attribute, the tables display the total number of “must,” “must not,” “may,” and “may not” statements in respective regulations, the number of statements placed in each of the Deontic categories by the participant, the number of statements correctly identified, and the percent agreement between the two. The average percentage agreement across the Deontic categories differed markedly across the different Attributes, ranging from 27.5% to 95.5%. Agreement tended to be higher for “must” Deontics implying that interviewees are most knowledgeable about activities they are required to perform and

this is reflected in their actual aquaculture practices. This is an indication that in some cases while the average agreement across Deontic categories was relatively low, instances of non-compliance are not likely characteristic of gross negligence. The data also show that average agreement across all Deontic categories was higher where interviewees felt that the regulations accurately portray their scope of activity and/or responsibility within aquaculture in the State. For example, average agreement was lower for the Colorado Department of Agriculture representative and member of the Colorado Aquaculture Board, both of whom expressed that the regulations do not accurately reflect their daily activities and/or role in aquaculture. The former interviewee also indicated in the interviews that he has purposefully relaxed interpretation of Deontics.

**- Insert Tables 2-7 -**

Next, interviewees' responses regarding the motivations that influence their choices relating to regulatory compliance were analyzed. Of the seven interviewees who participated in study, five responded to this set of questions. The responses given by interviewees reveal interesting nuances regarding both the calculus of internal and external delta parameters in addition to the contingent factors that influence their affectation. In the majority of the cases, endogenous norms were the most prevalent contingent factor emerging from community derived norms of reciprocity and/or responsibility. To remind, the counter factual and pro factual questions posed to interviewees in relation to compliance motivations were anchored on interpretation of Deontics associated with the prescribed activities.

Two of the interviewees stated that feelings of guilt or shame are the primary motivators influencing their decisions regarding compliance with formal institutions and one interviewee stated such feelings are the second most influential factor. One of the interviewees was the member of the Fish Health Board, the entity charged with reviewing any rule that is to be incorporated into the aquaculture regulations, and also a facility owner. According to this interviewee, feelings of guilt or shame are the primary motivator for his literal interpretation of Deontics and this is grounded in his desire to promote a fair and equitable regulatory process, both as someone involved in the development of the regulations as well as someone whose activities are governed by them. Another of these interviewees was the State Fish Health Pathologist. In this interviewee's case, feelings of guilt or shame emerge from implementing a prescriptive required by regulation that is not grounded in sound scientific evidence. That is, implementing a prescriptive that he feels could be of detriment to industry. In such cases, the interviewee stated that he would contact the authorities to pursue amendment to the statute.

One of the interviewees, responsible for the administrative aspects of aquaculture development in the State, indicated that social disapproval is the strongest factor in his decision making relating to formal institutions, followed shortly by feelings of guilt or shame, and that fear of monetary sanctions is the least significant factor in shaping his decisions. He further indicated that his fear of social disapproval from

industry members in particular, for whom has a lot of respect, leads him to have a more relaxed interpretation of “must” Deontics. He stated that he has little desire to hurt aquaculture farmers who have good intentions but fail to meet requirements occasionally; this goes for cases when the non-compliance has harmless implications. He stated that this was the position adopted by the regulating agency of which he is an employee and thus the culture of the agency toward industry is marked by a desire to maintain harmonious relations.

Two of the interviewees that responded to these questions did not explicitly state which internal and /or external delta motivations are most influential in guiding their decisions. Instead, however, they elaborated on the contingent factors upon which their decisions are based. For example, one interviewee who expressed a strong internal norm to follow regulations as closely as possible indicated that he felt accountable to government agencies and fellow industry members to set a good example as a person of authority in the aquaculture community. He further elaborated that while the duty to serve as a role model in the community is not a requisite of his professional position, it is part of his own personality that he should take this responsibility upon himself. Another interviewee stated that facility owners in general have expressed a norm to adhere to regulatory mandates as a part of their duty to the law.

## **VI. DISCUSSION**

Our study was guided by the need to better understand how the relationship between formal and informal institutions affects policy compliance. In order to do so, we posed three specific research questions:

***To what extent are the descriptions of situations described in formal institutions reported by interviewees as representing their day-to-day activities, that is, the informal institutions?***

The results are mixed. We found some respondents reporting strong alignment between their daily behaviors and the formal institutions and with others weak alignment. Most disagreement between prescribed and actual behaviors was observed when interviewees stated that regulations do not accurately represent their role in the aquaculture community or where the interviewee stated that prescriptive operators are purposefully interpreted with a degree of leniency.

Underscored by our empirical results is that the extent of alignment of formal and informal institutions is fundamentally an empirical question and subsystem wide claims should not be made without a systematic investigation representing the breadth and depth of actors. What is needed is breadth in capturing the views of the different actors in the subsystem as well as depth in numbers of particular actor categories.

Our empirical approach and data collection also indicate that partitioning institutional statements along grammar components has theoretical and practical relevancy when seeking to understand the relationship between prescribed and actual

activities of community members. For example, in most cases modal Attributes are the primary actors involved with the regulated activity and oBjects tend to accurately reflect their scope of activities and/or influence.

***What factors are most influential to individual decision makers regarding compliance with formal institutions: fear of monetary sanctioning, fear of social disapproval, and or feelings of personal guilt or shame?***

Feelings of personal guilt or shame and fear of social disapproval, together, were cited as being more influential in shaping individuals' decision making regarding compliance with formal institutions than was fear of monetary sanctioning. From this one can conclude that, as expected, informal institutions play a significant role in shaping individuals' decision making behavior alongside formal institutions. The extent to which they do will be particular to varying contexts based on a variety of other community, biophysical, political/regulatory, and endogenous characteristics. In other words, the expression of these is contingent upon a variety of actors, as demonstrated by interview responses. Such contingent factors must be explored to more fully understand how internal and external delta parameters shape decision making.

***Which contingent factors are most influential in shaping the expression of internal and external delta parameters?***

The data collected from the interviewees demonstrate that internal and external delta parameters are always anchored on contingent factors. The responses given by interviewees reveal interesting nuances regarding both the calculus of internal and external delta parameters in addition to the contingent factors that influence their affectation. In the majority of the cases, endogenous norms were the most prevalent contingent factor, emerging from community derived norms of reciprocity and/or responsibility. For example, when explaining their motivations to comply with regulations, individual interviewees stated that their desire to do so stemmed from personal feelings of responsibility to the industry, a desire to maintain harmonious relations with other industry members, the desire to maintain a fair and equitable regulatory process, and a commitment to regulations that promote scientifically sound practices within the aquaculture industry. Such responses indicate that interviewees' motivations are rooted in endogenous norms to promote reciprocity and cohesion among members of the aquaculture community.

Beyond the three research questions, this study also discovered nuances in the application of the IGT. For example, it was clear in the interviews the interdependencies of the components within a particular institutional statement. There is a strong link between Deontics and Conditions. Several interviewees indicated that their interpretation of Deontics is anchored on Conditions. For example, by only observing Deontics in the regulations, it appears that certain types of fish health testing are required of all aquaculturists. However, associated Conditions indicate that several fish health tests are only for facilities that have tested positive for a particular disease within a given time period. Furthermore, the results indicate that even where interviewees



expressed that they maintain a strict interpretation of Deontics in relation to prescribed activities, their descriptions of their actual behaviors demonstrate notable discrepancies. However, in most cases this does not pertain to gross negligence, but rather minor infractions.

## **VII. CONCLUSIONS**

Advances in social science usually comprise the discovery of the nuances of a phenomenon as well as the theoretical and empirical approach to inquiry. The phenomenon we were interested in is the relationship between formal and informal institutions in a given policy subsystem as investigated by the institutional grammar tool (IGT). Through our methods, we found (1) variance in alignment of formal and informal institutions; (2) shame and guilt were more often than not important factors for alignment; and (3) contingent factors condition the relationship between formal and informal institutions as well as the effect of internal and external delta parameters. Further, that contingent factors based on endogenous norms to maintain reciprocity and cohesion among the aquaculture community are the most influential factors in influencing this relationship.

The fact that members of the aquaculture community across professional positions exhibit a strong desire to maintain a fair and sympathetic process toward one another has notable implications for the management of the aquaculture industry in Colorado more broadly. First, it is evident that this has shaped how individuals interpret regulations, particularly Deontics. For facility owners, this has often resulted in a more strict interpretation of Deontics, while for those enforcing regulations, this has led to a more relaxed interpretation. Second, it is evident that this desire has influenced the design of formal institutions that govern the industry. Interviewees reported that regulations were and are purposefully non-stringent to allow for a higher degree of leniency in the ways in which they are interpreted and enforced. This second point affirms that a reciprocal relationship exists between formal and informal institutions.

This study marks one of the first applications of the grammar tool to the coding of actual policies and the first application that relates the output of the institutional grammar tool (the micro-level dissection of policies) with informal institutions – the perceived social habits of actors in the policy subsystem. We found that one of the most important unrecognized dimensions of the grammar output is scope of institutional statements/activities. Scope is the extent that the formal institutions encompasses the range of activities in the informal institutions, independently of congruence. For example, a policy with ten institutional statements for actor A may encompass 90% of actor A's actual, daily activities making these ten formal institutional statements both a congruent and complete matching of the informal institutions. Whereas ten institutional statements for actor B may encompass only 10% of actor B's actual activities making these ten formal institutional statements a congruent yet incomplete representation of actual activities. Thus, researchers should consider both scope and alignment.

The interviews made very clear that the relationships among components of the institutional statements are interdependent. For example, Conditions and Deontic interrelate in a more complex way than previously thought. Our prior expectation, perhaps naïve, was that a “must” Deontic represented required behavior independent of the Condition components of the statement. Instead, we found that the influence of the Deontic is interdependent on the Conditions. We postulate, for example, that strict temporal and process Conditions strengthen the “must” Deontic whereas lenient temporal and process Conditions weaken the “must” Deontic.

Part of the underlying logic of the IAD framework is the notion of self-governance; that people can self-organize from the operational level to the collective choice level to design and modify formal and informal institutions. In situations with large, heterogeneous populations that are geographically dispersed not everyone can participate in this self-organization. Instead, they rely upon their representatives or decisions are simply made without their direct consent. Our study finds that participation in policy design affects their knowledge of formal institutions as well as their willingness to comply. Limitations to our study prohibit us from drawing strong inferences on this point but there is also a strong possibility that informal institutions written into the formal institutions may not have represented the entire scope and content of the informal institutions found in the population. We posit that in large heterogeneous populations, informal institutions are not homogenous but may manifest in homogenous clusters based on biophysical and community characteristics.

Finally, keep in mind that this study constitutes an exploratory first step. We are still exploring what are the most appropriate ways by which to operationalize the grammar, how to operationalize its concepts and what can the grammar be useful for. While the lessons of this study are necessarily bounded to the policy subsystem we studied, the results of this work have provided useful insights about the relationship between formal and informal institutions, and thus we remain optimistic of its potential as a policy analysis tool.

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## IX. APPENDICES, TABLES, AND FIGURES

### ***Appendix A: Sample Interview Questions***

These are sample interview questions based on the coding of policies using the Institutional Grammar Tool.

#### **Attribute Interview Question**

You are one of the people [in terms of position] most often referred to in this legislation. Does this accurately reflect your level of involvement in the aquaculture industry? Probe: Given your knowledge of the aquaculture community, do you think [modal attribute] is the appropriate target audience? Probe: Please describe why or why not. Probe: If not, please describe who you think should be. Probe: Who are the other people [in terms of position] that you think are most involved in aquaculture in the State?

#### **Object Interview Question**

You are/are not listed in relation to many “items.” For example [object 1, object 2, etc.]. How do you think this reflects the scope of activities that you are involved in on a daily basis?

#### **Deontic and Aim Interview Question**

Some of the prescribed processes assigned to you in the legislation include [X]. How do you interpret different prescriptive operators in relation to these [may/may not/must/must not]? Probe: When you see a “may” and “may not” in the legislation, vs. a “must” or “must not,” what factors influence your decision to perform the directive or not?

#### **Condition Interview Question**

How do prescribed conditions influence how you interpret these?

#### **Or Else Interview Question**

I noticed there are not a lot of sanctions described in the legislation for instances in which compliance is not achieved. Why do you think this is the case?