A GENERIC FOUR-STEP METHODOLOGY FOR INSTITUTIONAL ANALYSIS OF GOVERNANCE STRUCTURES

PAÚL A. HERRERA[1,2], GUIDO VAN HUYLENBROECK[1] & RAMÓN L. ESPINEL[2,3]

[1]Department of Agriculture Economics, University of Gent, Coupure Links 653, 9000 Gent, Belgium; Tel: +32 92 64 59 26, E-mail: aherrera@espol.edu.ec, Guido.VanHuylenbroeck@UGent.be;
[2]Escuela Superior Politécnica del Litoral (ESPOL), Guayaquil, Ecuador, respinel@espol.edu.ec;
[3]Department of Food and Resource Economics, University of Florida, Gainesville, USA.

Paper prepared for presentation at the 99[th] seminar of the EAAE (European Association of Agricultural Economists), 'The Future of Rural Europe in the Global Agri-Food System', Copenhagen, Denmark: August 24-27, 2005

A GENERIC FOUR-STEP METHODOLOGY FOR INSTITUTIONAL ANALYSIS OF GOVERNANCE STRUCTURES

ABSTRACT

The central hypothesis of this paper is that there may be situations in which the traditional approach to institutional analysis is of limited applicability. Such an approach, which has been called 'comparative institutional analysis', consists of comparing institutional environments and institutional arrangements in terms of specific economic or other efficiency criteria to see which one performs better. However, because of limitations to accurately predict the future performance of alternative institutional settings, comparisons are not always possible. Furthermore, in most cases the only information available is the performance of the current institutional setting. To account for this methodological deficiency, a generic methodology for institutional analysis, which consists of four steps (institutional structure, institutional efficiency, institutional choice, and institutional change), is proposed in this paper. Accordingly, the emphasis switches from evaluating alternative institutional choices to improving current scenarios. To show the validity of this methodology, some results of its application to a case study are presented. Although more research on this four-step methodology is needed, it proved to be robust when applied to the analysis of the governance of irrigated agriculture in the Peninsula of Santa Elena, Ecuador.

Key words: New Institutional Economics, Governance structures, Institutional Change.
JEL classification: B52, D02, Q25

1. Introduction

According to Coase (2000) institutions are the key to explain economic performance. Therefore, it can be argued that the institutions of a country (such as its legal, political, and social systems) determine its economic performance. It is this that gives NIE its importance for economists, political scientists, legal scholars, management specialists, sociologists, and others wishing to learn more about this important subject. Given that institutions provide the basic structure by which human beings throughout history have created a framework to reduce uncertainty in exchange, it is clear that they determine transaction and transformation costs and hence the profitability and feasibility of engaging in economic activity. This implies that institutions are designed to achieve efficient outcomes, which means that they cannot be ignored in economic analysis because they play a key role in economic performance.

This paper tackles an important methodological aspect of NIE, related to situations in which the traditional approach of NIE (comparative institutional analysis), may be of limited applicability (see Herrera, 2005). Since performance is a derivative of the institutional choice (see Schmid, 2004) application of such an approach may not be feasible in some situations. This is true especially when the only available information is the performance of the current institutional setting. Actually, according to Schmid (2004) contrasting the performance of an institutional setting currently in place with another desired structure, says nothing about how to put the alternative in place. To account for this deficiency, a generic methodology for institutional analysis, which consists of four steps, is proposed in this paper. A crucial feature of this methodology is that it requires viewing institutions from a game-theoretic perspective as opposed to the traditional rules-based view of institutions. To show the validity of this methodology, some findings of its application to a case study are shown.

This paper consists of seven sections. After this introduction, section 2 briefly explains the definition of institutions stemming from the game-theoretic approach. Section 3 discusses the limitations of the traditional approach of institutional analysis and provides some theoretical background to the design of the four-step methodology. Section 4 describes the proposed methodology. Section 5 links the institutions as equilibria approach with the methodological proposal. Section 6 presents some of the results obtained from the applications of such a methodology to the assessment of governance of irrigated agriculture in Peninsula of Santa Elena, Ecuador. Finally, section 7 presents conclusions of this research.

2. Defining institutions: a game-theoretic-based approach

A well-accepted definition of institutions says that they are the rules of the game in a society or, more formally, that they are humanly devised constraints that shape human interaction. As a consequence, they structure incentives in human exchange whether political, social, or economic (North, 1990). However, this rules-based view of institutions may be challenged from a game-theoretic perspective, as such a view implies that choice-sets and payoffs are constrained by the institutional setting. In this context players are unable to change the institutional setting while the game is played (Mittenzwei and Bullock, 2004).

In contrast, the definition of institutions stemming from the game theoretic approach, which we share in this paper, is that of 'institutions as equilibria'. Under this view, institutions in an equilibrium situation are established as a result of repeatedly played games. Players can then shape institutions through their strategic interaction. The primary difference between these two concepts of institutions is the causal connection between both, constraints and interactions. According to Mittenzwei and Bullock (2004), advocates of the institutions-as-equilibria view study how equilibrium behavior leads to the establishment of human-made-constraints, while proponents of the institutions-as-rules view seem to focus on the impact of human-made-constraints on the (equilibrium) behavior of individuals. The implications of conforming to this definition of institutions on the design of the four-step methodology, is analyzed later.

3. Limitations of the traditional approach for institutional analysis

Regarding methodologies for undertaking institutional analysis, the vast majority of empirical studies come from the research program on transaction costs developed by Williamson (1975, 1979, 1985, 1996), which is well-reviewed elsewhere[1]. In this research tradition, transaction costs provide the key for understanding alternative forms of economic organization and contractual arrangements. What is important here is the cost of conducting transactions in one organizational or contractual form relative to the others. Therefore, what matters is not the absolute amount of transaction costs, but the relative ranking of transaction costs associated with different organizational or contractual choices.

In trying to follow this tradition, however, it was soon evident that there has been little work undertaken and progress made in applying the theoretical developments to ex-ante analysis of proposals for institutional change. This is exemplified in the work of Ostrom (1990) where prediction of success or failure in common-property arrangements for the use of natural resources was hindered by the lack of appropriate theory for incorporating TC into the analysis of particular institutional structures, and in determining prospects for institutional change[2]. This implies that empirical comparative analysis of two or more institutional settings is not always possible, unless information on how each institutional setting performs is available.

According to Challen (2000) the root of this problem was to think of alternative institutional settings as mutually excludable. That is, as if there were only one feasible institutional setting, thus excluding the possibility of the existence of a whole range of institutional structures all acting at different levels in the allocation of a particular resource. The key for this author is to think on institutional hierarchies were multiple regimes of property rights and their associated institutions can be organized simultaneously. Under this view the emphasis of institutional analysis shifts from assessing the benefits of particular property rights regimes or allocation mechanisms in isolation, to assessing at which level of an institutional hierarchy allocation decisions can best be made. Furthermore, by including the institutions as equilibria approach to the analysis of economic institutions, the emphasis switches from analyzing proposals for alternative institutional settings to improving current scenarios.

[1] See for example Joskow (1991); Shelanski and Klein (1995); Crocker and Masten (1996); Masten and Saussier (2000); Boerner and Macher (2001); Vannoni (2002).

[2] See Challen (2000) for more details.

4. A generic four-step methodology for institutional analysis

To account for this methodological deficiency, a generic methodology for institutional analysis, which consists of four steps, is proposed in this paper. By generic we mean a method that defines stages of research instead of specific approaches for designing institutional arrangements.

The first step consists of understanding the institutional structure underlying the allocation of a particular resource, that is, the institutional parameters under which allocation decisions are made. The objective is to have a deep idea of the structure, actors, rules (formal or informal), that conform a specific economic system. In Schmid's (2004) words, it consists of describing "the situation". Thus, in order for analysts and researchers to propose improvements to the institutional structure, a first task should be to understand, through a detailed description, the functioning of the social network through which individuals coordinate their economic activities. To perform such a description we propose to consider the description of institutions by levels of Williamson (1996), which correspond to the left part of the scheme presented in figure 1. Actually our proposal of a four-step methodology for institutional analysis consists of adding these four steps as an analytical dimension to the three-level-scheme of institutions of Williamson (1996).

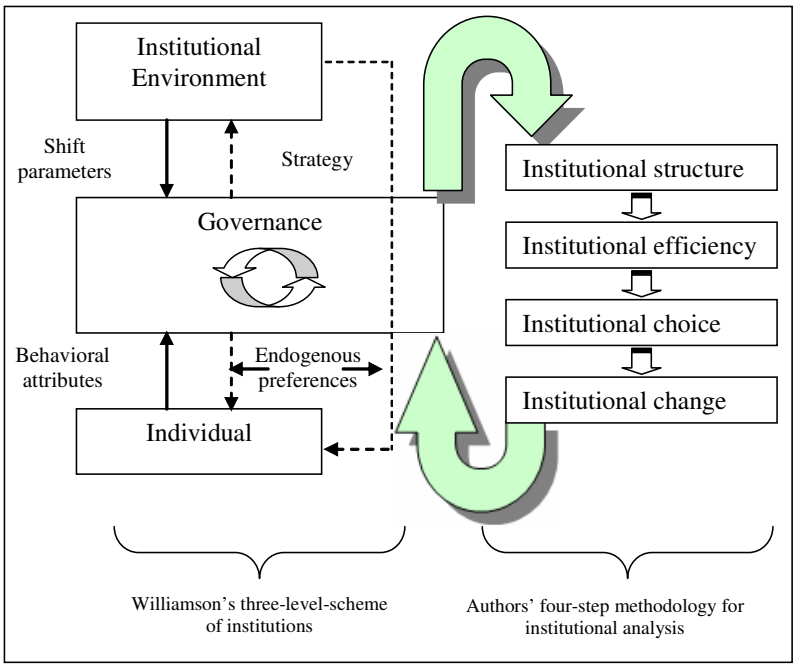

Figure 1: A conceptual model for institutional analysis. Source: based on Williamson (1996) and the author.

Accordingly, the object of analysis of the four-step methodology is governance, which is bracketed by more macrofeatures (the institutional environment) and more microfeatures (the individual actions). Moreover, description of governance should include primary and secondary effects. Primary effects are shown by the solid arrows and secondary effects by dashed arrows. Thus, the solid arrow from the individual to governance carries the behavioral assumptions within which the governance structure operates. The arrow from the institutional environment to governance illustrates the way formal rules at the constitutional level fix governance parameters. Feedbacks effects from governance to the institutional environment can be either instrumental or strategic[3]. Feedback from governance to the level of the individual can be interpreted as 'endogenous preferences' formation, due to advertising or other forms of education. The individual is also influenced by the institutional environment in that endogenous preferences are the product of social conditioning.

[3] An example of instrumental feedback would be an improvement in contract law, brought about at the request of parties who find that extant law is poorly suited to support the integrity of a contract. An example of strategic feedback could be when trading parties request protectionist policies against domestic or foreign competition.

The second step of our methodology consists of assessing the efficiency of the institutional structure. The concept of efficiency used in this paper is that of NIE, which relates efficiency to performance. Given the impossibility of testing which institutional alternative performs better, since performance is a derivative of the institutional choice (see Schmid, 2004), our proposal consists of assessing the current institutional structure to see whether this is producing socially and economically desirable outcomes. If not, this would suggest the need to depict a new institutional setting. Note that in this stage, the institutional structure is taken as given. The key question is how the different institutions involved (formal and informal) would affect the observed outcome in the context of different interests of different people. According to this, the efficiency of a specific institutional setting is the result of a mixture of institutions and a given institutional structure, which is supposed to reflect an equilibrium state (equilibrium behavior). Our approach to institutional efficiency departs from the identification of efficiency criteria, which would allow us to qualify the competence of the prevailing institutional setting.

The third step is institutional choice or the process of designing institutional arrangements. In our methodology the focus is on looking for arrangements that could contribute to improve the current performance of the institutional structure, which previously has been regarded to be a problem. In our view, arrangements are institutional alternatives that people can depict and choose to order their interdependencies. This implies that the actual choice of arrangements may have an impact over the institutional environment or the individual (or both). In this respect, Schmid (2004) suggests that theory can be used to produce knowledge to better inform people of the choice of institutional arrangements so that different people with different interests can work to achieve the institution that provides the performance they want. Our approach to institutional choice implies the design of a set of arrangements which should procure the interaction of individuals, either for improving the performance of the day-to-day use of the resource, or to build a more feasible institutional environment.

The fourth and last step is institutional change. This is defined as the process of moving from a socially and economically undesirable institutional equilibrium towards a new one. This implies that social and economic objectives for the allocation of resources are well defined, in addition to having available information about the potential of the proposed institutional arrangements to move to such new institutional equilibrium. The purpose of this last step is not to predict the future, but to inform people of the choice of a particular institutional setting and how they could use existing political institutions to implement such changes.

Note that describing the structure, determining the efficiency (performance), identifying institutional choices or arrangements and analyzing ways of conducting the implied process of institutional choice, is a dynamic process which involves institutions (formal and informal) that determine the functioning of the governance structure. Therefore, the optimality of an equilibrium state is being analyzed.

One last aspect to consider has to do with the limitations of the traditional TC-based approach for institutional choice, as this ignores the fact that processes of institutional change may be limited by institutional choice. The reasoning is that when processes of change are included in the problem of institutional choice, it can be the case that limitations for undertaking such changes may impose substantial constraints on that choice. That is, institutional choice and institutional change need to be jointly considered.

From an extensive literature review (see Herrera, 2005), it was possible to identify that researchers working on NIE consciously or unconsciously were working on each of the steps proposed here as the four-step methodology for institutional analysis, although separately. In this respect, perhaps the closest attempt to construct a practical framework for analyzing institutions is the work of Challen (2000), although his emphasis was on property rights as institutions. Our contribution basically consists of both, proposing, and testing a research methodology to undertake institutional analysis of resource allocation structures.

5. The dynamics of institutional analysis

Two questions are crucial in this discussion as the scheme presented in figure 1 suggests a cycled-dynamic of institutional analysis with no end, but more importantly with no beginning. These

questions are: starting from what state of affairs should we begin the analysis of the performance of institutions? and why should we do this? The answer to the second question is naive: simply because there are symptoms of bad performance and actions are required, otherwise sustainability of the institutional structure would be endangered. The answer to the first question, however, is less intuitive. To answer this, we need to bring into the discussion the notion of institutions-as-equilibria discussed previously (see section 2, defining institutions). According to this view, a particular setting of formal and informal institutions is established as a result of a repeatedly played game. This implies that human-made constraints are established as a result of an equilibrium behavior. Therefore, describing the institutional structure and its efficiency indeed implies that the optimality of an equilibrium state is under analysis. Figure 2 shows the dynamics of institutional adjustments as we visualize it.

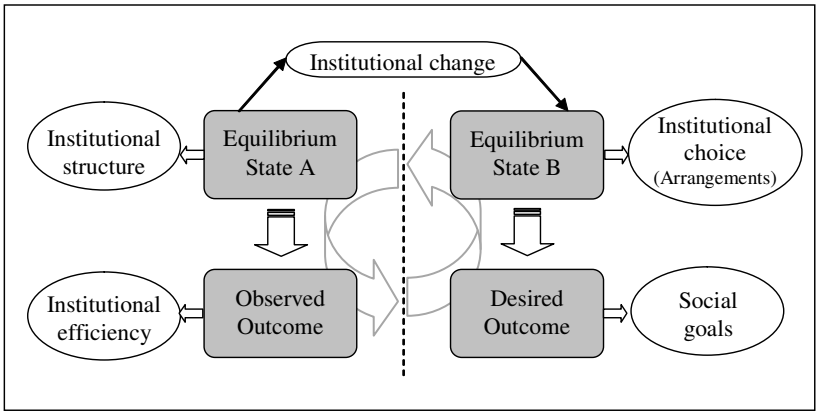

Figure 2: Dynamic of institutional adjustments.

Accordingly, the starting point is the recognition of institutions as behavioral equilibria. Actually, a description of the current institutional structure implies that equilibrium state *A* is being described. Thus, in case the observed outcome of an institutional equilibrium does not correspond to what society in some instance has defined as the desired outcome, a process of institutional change may be required, so that a new equilibrium state *B* may be depicted. Such a process would imply seeking for institutional arrangements which in principle should lead society to this new more desirable equilibrium. The key is to understand the mechanisms by which both formal and informal institutions can be adjusted to reach such a new equilibrium. Note that one element of figure 2 has been absent in the discussion so far. This is the notion of a society defining goals for allocating resources, which we think should be the fundamental driving factor of an institutional change process. Indeed, when social planning has not been well-defined, specific institutional arrangements should also be provided to overcome this void.

Another important aspect to consider in the discussion of the feasibility of this methodological proposal is the notion of path dependence and locked institutions, which corresponds to the traditional view of institutional change of North (1990). Accordingly, institutions are the result of historical processes, which explain why inefficient structure prevails inevitably for a long time, thereby hindering growth. According to Eggertsson (2004b), however, institutions can be unlocked from the pernicious political realities of the past. This is possible as incomplete knowledge and exogenous shocks sometimes create opportunities for reform (Eggertsson, 2004a). Thus, when unexpected external impulses or endogenous development destabilize the social equilibrium, pivotal actors often become uncertain about prevailing social models and show readiness to experiment with new social technologies.

6. Application of the four-step methodology to the analysis of irrigated agriculture: the case of Peninsula of Santa Elena, Ecuador

To test the validity of the four-step methodology for institutional analysis, a case study was selected. This is related to the provision of irrigation in the Peninsula of Santa Elena (PSE), Ecuador. In this area, the government carried out the construction of one of the biggest and more expensive irrigation systems of Ecuador: the Aqueduct-Santa-Elena Hydraulic Project (PHASE). However, so far

results are rather mediocre. The core problem in the PSE is the underutilization of land and water resources, which has direct implications on the Operation and Maintenance (O&M) of the canals, which are starting to deteriorate. In this section we report some of the findings of a research program that was developed to provide solutions to the problem mentioned.

6.1 Some important features of the case study

The PSE is a coastal area of about 6,050 km2 (605,000 ha). Until the end of the 19th century, it was considered an area with high potential for developing agricultural activities (ESPOL et al. 2001). Nevertheless, due to an abrupt deforestation that altered the hydrological cycle, such good conditions changed. According to Da Ros (1994) only 1 percent of the original forest of the PSE survived, which in turn converted this area in one of the driest areas of Ecuador (Larrea and Varea, 1997). The solution offered by the government was the construction of the Aqueduct Santa Elena Hydraulic Project (PHASE), which according to CEDEGE (2001) is the largest and most modern irrigation project in Ecuador. Nonetheless, so far the performance of the system is rather mediocre. In 8 years of functioning, the system has not shown the expected benefits with only about 20 percent of its capacity in use. Furthermore, recovery of the investment is zero as neither operation nor maintenance costs are covered and still remain highly subsidized (Herrera et al. 2004).

The governmental agency in charge of infrastructure development was the Commission for the Development of the Guayas River Basin (CEDEGE). The different stages of the project began in 1986 and consisted of about 120 kilometers of canals, a tunnel of seven kilometers, two pumping stations to elevate water 70 meters, and three dams with a total storage capacity of 352 million cubic meters. The irrigation capacity was calculated to be 42,000 hectares (from which around 40 percent is still unfinished) with an investment of about US$ 550 million, mostly granted by international development organizations by way of external debt or contributions.

The conflicts in PSE started when CEDEGE announced the construction of the irrigation system, which sparked a sudden interest for buying land under the influence of the canals. Not only farmers but particularly speculators took advantage of both the misinformation on the value of those lands and the confusing legal framework regarding the property of land by the communes. The final outcome is that according to non-officials figures from CEDEGE, during the last 2 years (2003-2004) less than 5,000 ha have been cultivated.

There is no accurate information about land tenure under the influence of the irrigation system, although it is estimated that about 90 percent has been sold to non-native individuals, including land speculators attracted by the apparent potential to develop irrigated agriculture. Such attraction can be in part explained by the enormous governmental investment per hectare of about US$ 13,000. This value results from dividing total investment in the irrigation system (USD 550 million) by the projected irrigation capacity (42,000 ha), which has mainly benefited new landholders who, according to table 1, do not number more than 300 people. This figure comes from extracting from total landowners (472), those that have farm plots in the size range of 0 to 5 ha, in which mostly commoners are grouped. Table 1 also shows for different ranges of farm sizes, the corresponding number of water users and the quantity of hectares held by each group. It may be observed that 10 percent of total water users hold approximately 66 percent of the land under the influence of the irrigation canals.

Table 1: Registered irrigators in the PSE and hectares per group category

Ranges of farm size (ha)	Landowners	%	Hectares	%
0 - 5	169	36	373	1
5 - 10	59	13	454	1
10 - 20	34	7	539	1
20 - 50	76	16	2,609	6
50 - 100	50	11	4,007	10
100 - 200	39	8	5,986	15
> 200	45	10	26,662	66
TOTAL	472	100%	40,630	100%

Source: survey data gathered by ESPOL et al. 2001

It is important to mention that irrigation water in the PSE is charged volumetrically and that there is no obligation of use. The price is USD 0.03 per cubic meter in open-canals areas and USD 0.04 in pressurized irrigation areas, although it is well-known that such prices are not calculated on a technical basis. The predominant irrigation technologies are drip and microsprinkler with about 3,000 ha together. In turn, the predominant crops are mangoes (2,200 ha approx.), cocoa (730 ha approx.), corn (870 ha approx.) and some citric.

Regarding the communes of the PSE (65 in total spread in 220 towns, PIGSA, 2002), their main characteristic is their communal organization whose predominant feature is the communal ownership of land. They are still considered the largest population group and possessed approximately 85 percent of the land before the construction of the irrigation system. However, after the process of transfer of property of land, they have been pushed to unproductive lands without possibilities for development. Therefore, even though water availability was considered the key limiting factor for the development of the PSE, now it is a resource available only to those who can pay its price in terms of CEDEGE's current policy (Herrera et al. 2004). In either way, asymmetry of information regarding the potential of the PHASE always prevailed in favor of land buyers.

Before the construction of the PHASE, peasant-commoner's agriculture was possible through the exploitation of the 'albarradas'. These are small dams with natural walls built between two hills, generally over the dry bed of a river. Its design is circle-shaped. The accumulation of water is possible through both a slow process of accumulation of rain water and from ephemeral rivers.

One important point to mention here is that albarradas is a very cheap technology. They offer several social and environmental-positive impacts, which were not considered at the design stage of the PHASE. In fact, according to Alvarez (1995) "CEDEGE designed a specific model of development to promote extensive cropping […] ignoring the traditional system of complementarity and diversified exploitation, that even in small scale, still works in communal lands". However, given that commoners cannot easily afford investments in agricultural technology, their main strategy has been either to continue doing economic exchange limited by the institutional structure in place or to sale the land. This may explain why at some point massive sales of communal lands took place in the PSE as short term benefits from selling may have been higher than long term uncertain benefits from the provision of irrigation through the PHASE. This is particularly true if we consider that the PHASE was constructed under a very particular model of development irrelevant to the communal organizations.

6.2 Step 1: description of the governance structure

The more distinctive aspect of the agricultural system in the PSE is the low organization of farmers for key issues like management of the irrigation system. In fact, it has not been possible to complete the transfer of irrigation management (TIM) responsibilities to water users associations (WUAs) in the PSE, among other reasons because of the low performance of agriculture, which has been appointed to be due to incipient farmer's backward-linkages with input supply systems (financing included), as well as to poor forward-linkages with output marketing systems.

Since the PHASE started its operation, irrigation allocation follows an administrative-bureaucratic process run by CEDEGE. This process includes individual registration of irrigators and establishment of a price-fixing agreement. The structure of governance in this case is somewhere between a very thin market because of the price mechanism, but in particular because of the asset-specificity put by CEDEGE in the PHASE. Regarding land allocation, this is done through market mechanisms although limited by the communes' legal framework, which as said before, is subtly interpreted to allow the transfer of rights. The critical point here is the rejection by CEDEGE of the impact of the concentration of property of land in few hands as a key factor determining the performance of agriculture in the PSE.

Table 2 summarizes the institutional structure of allocation of water and land resources in PSE. This table follows the three-level scheme of institutions of Williamson (1996). For each level (Institutional Environment, Governance, Individual), the enforcement, the transaction costs, and the perceptions among private landholders and commoners are assessed respectively. As it can be observed, in the institutional level water in Ecuador is defined as a public good, which in the practice is equated to state good. This definition conflicts with previous private water rights, which were not abolished.

Table 2: Institutional structures of allocation of land and water resources in the PSE*

		Definition	Level of enforcement
Institutional Environment: the rules of the game	Water	Public good – State Good (In conflict with previous rights)	Medium to low
	Canals	State good	High
	Land	Private good – Common good (In conflict / private vs. commoners)	Low
		Structure	Transaction costs
Structure of governance and transaction costs	Water	Administrative – Bureaucratic	Relatively low
	Access to the Canals	Administrative – Bureaucratic	High
	Land	Market (very thin)	High
		Private Farmers	Peasants-Commoners
Perceptions of Individuals	Water	Private property once acquired	Common property
	Canals	State property	State property
	Land	Private property	Common property

* Based on information gathered by the authors.

The implication of this is that individual' perceptions regarding irrigation water is that of a free public good while perceptions regarding the canals is that of a state good, therefore it is the government responsibility to operate and maintain them. The level of enforcement is medium to low because neither conflict resolution mechanisms nor organizations are well-defined in the water law. Regarding the canals, in the case of the PSE, they are considered a property of the State, as no transfer to users has been possible yet.

6.3 Step 2: Institutional efficiency

6.3.1 Property rights and efficiency of the institutional structure of property rights

This section tackles the problem of poorly defined property rights and the effects over the performance of the system[4]. It is argued that Contingent Valuation Method (CVM) can be applied to evaluate the degree of inefficiency of a prevailing institutional structure such as the one that is actually used in the Peninsula of Santa Elena (PSE). Willingness to Pay (WTP) questions can indeed be used to value the outcome of a policy intended to assure the right to have an efficient management of the canals, which implies a more active participation of users in O&M activities. The procedure applied consisted of eliciting among farmers an economic value. The evaluation criterion consists of comparing the resulting economic value with the price currently charged to irrigators. Any deviation is considered an economic rent which is wasted. Thus, CVM is used to investigate the potential benefits of a hypothetical change in the existing property rights structure.

The discussion point raised is therefore whether the economic value of a particular resource is influenced by the institutional structure of property rights involved in the allotment of such a resource. Based on economic principles the answer is `yes'. However, in the application arena, few studies have related their aggregated monetary valuations with the institutional structure of property rights. This becomes particularly cumbersome when the resource has no close substitutes or when there are neither well-defined nor well-enforced property rights as is typically the case in countries such as Ecuador.

Given that in the Peninsula of Santa Elena (PSE) irrigation is already priced under a particular institutional structure, economic values can in this case be calculated and used to assess the efficiency of the institutional structure of property rights by means of comparing the estimated value against the current price of water. The hypothesis is that a sub-optimal definition of property rights limits the value people assign to water. People may in fact be willing to pay higher values for having better defined property rights that assure them a more active participation in the management of the canals

[4] This section briefly summarizes the analysis of property rights and efficiency of the institutional structure. A complete version of this analysis is published in Herrera, et al. 2004.

and an optimal provision of irrigation[5]. If this is the case it means that institutional failures in the PSE do not allow internalizing (through price) what users perceive irrigation should be valued at.

The strategy followed in this section was to undertake an economic valuation exercise that intentionally implies a change (through the wording of the WTP question) in the property rights structure of irrigation in the PSE. The proposed change involves the right of users to have a more active participation in O&M activities. Thus, given that irrigation water is priced, on average, at US$ 0.035 per m3, the WTP-CV question is expected to yield a higher aggregated value. This higher value would demonstrate that marginal improvements in the structure of property rights are valued positively by irrigators in the PSE. This in turn implies that the underlying institutional structure is not efficient, given that it does not allow maximizing welfare because of the rents that are not being internalized and used to finance such improvements. Table 3 shows partly the results obtained. The single-bounded logit analysis uses as dependent variable the acceptance (`yes=1') or rejection (`no=0') to the first bid amount.

Table 3: Single bounded WTP coefficients estimation

Variables	Expected effect	Coefficients	Means of variables
Constant	+	13.636 (2.369) **	--
Bid price (ELI1)	-	-205.381 (43.04)**	0.042
Predominance of permanent crops (PERMCR)	+ / -	-3.681 (0.377)**	1.60
Proportion of use (PROPUSE)	+	7.485 (0.923)**	0.55
Gross annual income (GAI)	+	-1.367 (0.225)**	1.09
Log Likelihood: -11.863; LR Statistic (4df): 49.577; Probability of LR: 0.000			
Info Criterion (minimum values) Akaike: 0.56; Schwarz: 0.736637; Hannan-Q: 0.6303			
Percentage of correct classifications: 88.3%; Percent gain from default (constant probability) specification: 61.11%			
Nagelkerke R square = 0.797; McFadden R-squared = 0.676326			
Goodness of fit: H-L Statistic = 1.0343, prob (Chi-Sq-8df) = 0.9980; Andrews Statistic (grouped by ELI) = 0.0485, prob (Chi-Sq-3df): 0.9972			

* Significance: p< 0.05; ** significance: p<0.1; *** significance p<0,15

Figure 3 shows some interactions in terms of the probability of accepting the bid against the price bid in dollars per cubic metre for different scenarios of land use and income.

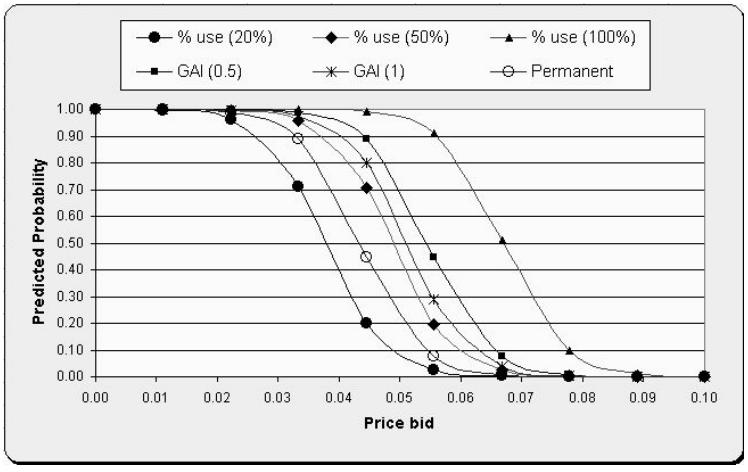

Figure 3: Predicted probabilities of accepting the price bid for different scenarios of land use and income.

As can be observed from figure 3, the higher the percentage of use of land, the higher the probability of accepting an increased price bid is. Thus for example, while the probability that farmers who use about 20 percent of their land would accept a price bid of about two cents per cubic meter is almost 100 percent, farmers who use 100 percent of their land are fully willing to accept a price bid of about 5 cents per cubic meter.

[5] As it was seen in the previous sections, users have almost no participation in the management of the irrigation system and most of the attributions are left to the government.

For the logit probability model, Hanemann (1984) provides formulas to aggregate values of WTP based on the estimated coefficients. Applying these formulas it was possible to estimate an aggregated value of US$ 0.05 per cubic meter of irrigation water. As expected, the resulting aggregated value of WTP is higher than the current water price (US$0.035 per cubic metre in average), which means that the gain in efficiency due to the public provision of irrigation under the conditions of the hypothetical situation are wasted rents. This confirms the hypothesis of an inefficient institutional structure of water allocation for the specific case of the PSE. This introduces an important consideration for future CV studies. The results indicate that it is possible to apply CVM to value marginal WTP for partial changes in the institutional structure of property rights of a specific resource. So, maximizing the value of a resource by introducing the correct incentives in an environment of well-defined property rights can be a more useful approach for CV than just calculating an aggregated monetary value. The challenge, therefore, is to find out what type of institutional structure (regime) of property rights maximizes the economic value people assign to a particular resource.

A favorable point is that the hypothetical programme proposed is valued at US$0.015 per cubic metre over the current price of US$0.035, which means that the programme is considered an improvement and could be considered an objective for future policy design for this specific case. In terms of institutional efficiency, this analysis reveals that the current allocation of property rights does not perform well in defining the attributions and duties of the users and the sole provider, CEDEGE. Furthermore, given that the current structure does not allow a more active participation of users in the management of the irrigation system, WTP of farmers may be limited. Thus, it is possible to conclude that free government assistance through the PHASE has created a sense of speculative dependency among landholders towards the government for the irrigation system. Government investment has served to create the impression that the irrigation structures belong to the government and that it is the responsibility of the government to minimize the cost of irrigation to the farmers. Such assistance has certainly discouraged farmers from taking collective action to maintain the canals and certainly limits their WTP for irrigation water. The fact that property rights are so important for securing farmers involvement implies that the way irrigation management devolution programs are structured, or organized, will determine to what extent farmers are willing to provide collective action for irrigation management.

6.3.2 Asymmetric Information on the Provision of Irrigation through a Public Infrastructure

As mentioned before, due to mismanagement of information and bad definition of goals by the government, a massive interest in acquiring communal lands started in the Peninsula of Santa Elena (PSE) after the government announced the construction plan of a large public irrigation system. During this process, information asymmetries regarding the potential of the irrigation system always prevailed in favor of land buyers. This section starts from the hypothesis that AI has an important impact over the observed pattern of land use and therefore irrigation in the PSE[6]. Under the condition of AI for public goods with costly access, this section shows the results of a test conducted to determine which of the characteristics for an optimal allocation fits in the case of the PSE. Farmer's marginal cost (MC) of access to irrigation in connection with the concentration of the property of land by new landholders is considered the relevant informational variable.

Two characteristics that have been studied by Cremer & Laffont (2003) about this type of goods are that in some cases there is no obligation of use and access may be costly. This last feature is particularly important because it implies that some private goods must be jointly consumed with the public good to have access to the benefits of the provision of the public good. In this case, land is one of the private economic goods that a person must first acquire to have access to the benefits of irrigation. Other costs are those of connecting to the canals through irrigation technologies and the costs of farming itself. This assertion implies that it is not enough to solve the problem of the availability of the public good (water in this case); it is also necessary to make sure that users can afford the costs of acquiring the rest of the associated private goods, including the costs of defending the property of land through communal organizations in the case of the peasants-commoners.

---

[6]This section briefly summarizes the analysis of asymmetric information and the use of land and water resources in the PSE. A complete version of this analysis is contained in Herrera 2005, chapter 7.

The empirical strategy consisted of testing which characteristics for an optimal utilitarian allocation of the public good (irrigation) with costly access and no obligation of use fit for the case of the PSE. The objective is to understand how under certain conditions the provision and use of irrigation is affected, even when the resource is supposedly so valuable that it should be used by all. To do this, it was necessary to estimate a cost function based on significant cost driving variables, from which marginal cost of access to irrigation can be estimated. The following augmented log linear specification was first investigated for the relevant output variable which is expressed in irrigated hectares.

$$\log(Ki) = \alpha 0 + \alpha 1\log(IRhai) + \alpha 2\log(DISTi) + \alpha 3\log(TOTAi) + \alpha 4TECHi + \alpha 5Wi + \alpha 6FAi + \alpha 7CWUi + \alpha 8PERMi + \alpha 9NPERMi + \alpha 10CRAi + \alpha 11\log(IRRAi)\log(DISTi) + \ldots + \alpha i\log(IRRAi)CRAi + \varepsilon i$$

where: Ki = average total cost per hectare of cropping including connection costs; IRha = irrigated area in hectares; DIST = distance to the source of water in kilometers; TOTA = total farm area in hectares; TECH = technical level of the farm being 1=low; 2=medium; 3=high; W = dummy variable being 1=commoner and 0=non-commoner; FA = number of available facilities as percentage of total facilities (electricity, phone, etc); CWU = percentage of CEDEGE's water use from total water requirement; PERM = ha with permanent crops as a percentage of total cropped area; NPERM = ha with non-permanent crops as a percentage of total cropped area; CRA = cultivated area as a percentage of total farm area. Estimation results are shown in table 4.

Table 7.2: Estimation Results

Variables	Coefficient (t-value)
Constant	5.01 (7.80)*
Log(IRha)	0.99 (2.62)*
W	-0.87 (-4.30)*
FA	0.96 (1.90)**
CWU	1.55 (2.31)*
PERM	-0.01 (-2.87)*
NPERM	-0.45 (-2.07)*
CRA	-0.77 (-2.53)*
Log(IRha)TOTA	-0.09 (-2.93)*
Log(IRha)CWU	-0.37 (-1.15)
R2 (adjusted)	0.65
Akaike	2.66
Standard error	0.872
Marginal Costs (MC)	5.09 (5.32)
MC for v	4.98 (4.79)
MC for 1-v	8.01 (6.02)

* Significance at 5%; ** significance at 10%

According to the results of table 4, the elasticity with respect to irrigated hectares is 0.99 which implies that investment on irrigation technology is an important cost factor. Furthermore, it is possible to conclude that total costs as well as marginal costs increase significantly with (i) the number of available facilities, FA (phone, electricity, etc.); (ii) the proportion of water needs satisfied through CEDEGE's canals which is linked to water charges, CWU; and (iii) the proportion of cultivated land, CRA. A significant influence can also be attributed to being or not being a peasant-commoner, W. Thus, average MC per hectare of accessing to the benefits of irrigation provision for the case of commoners is about US$ 145 while for non-commoners it is about US$ 2,890. This is obtained from calculating the antilog of the resulting marginal cost for v (the new landholders) and (1-v, the commoners) in table 4.

Using these results it was possible to conclude that Asymmetric Information has the following consequences[7]. First, it allows a solution in which only the commoners consume the entire provision of irrigation available to them. This implies that concentration of lands in the hands of the new landholders and the high marginal cost per hectare of farming on such lands induces a scenario in which landholders demand a smaller quantity of irrigation. Thus, it is possible to conclude that the use

[7] A detailed explanation of the model of asymmetric information and how the empirical results led us to determine which of the characteristics for an optimal allocation fits in the case of the PSE, can be found in Herrera, 2005.

of land and water resources in the PSE is economically inefficient. This result is crucial as this would demonstrate that commoners are more efficient users of the irrigation system, although at very low scale. Nonetheless, we think that the observed pattern of land property in the PSE cannot be reversed.

This implies that a new institutional setting will have to consider the participation of these two heterogeneous groups (private landholders and commoners), and find ways to take advantage of the capabilities of each group. According to Cremer and Laffont (2003), in this scenario although the provision of irrigation is the same as with full information, however in order to account for the information rent gained by the new landholders, the demand for irrigation of this group is reduced. In terms of equity, it is possible to conclude that while the availability of irrigation can be considered an apparent Pareto improvement for all, it benefits the new landholders than the commoners. Therefore, the observed outcome is also socially inefficient.

6.4 Steps 3 and 4: Institutional choice and institutional change

The objective of this section is to derive some elements with respect to the final choice of an institutional setting (institutional arrangements) and a path of institutional change for the PSE. To do this, the theoretical framework of institutional choice and institutional change is revisited. The aim is to understand the dynamics of the forces that could produce changes in the institutional structure. According to the approach of institutions as equilibria that we share in this dissertation, a key aspect to have in mind is that the implementation of institutional arrangements, if correctly designed and applied, should in principle enable society to reach a new desired institutional equilibrium, for which a process of institutional change needs to be drawn.

According to North (1990), there are two principal deficiencies in traditional models of institutional change. Firstly, they fail to explain empirical evidences of the persistence of nonefficient institutional structures and the introduction of inefficient institutions; and secondly, the models do not specifically recognize the roles of the actors that produce change. According to him, changes may arise from private economic agents (firms, consumers, associations) which can modify both informal and formal institutions (although the latter not directly), and political organizations, which directly modify formal institutions. An interpretation of North's model of institutional change was schematized by Challen (2000). This is shown in figure 4 although with some modifications to allow for the concept of institutions as equilibria to block the institutional structure.

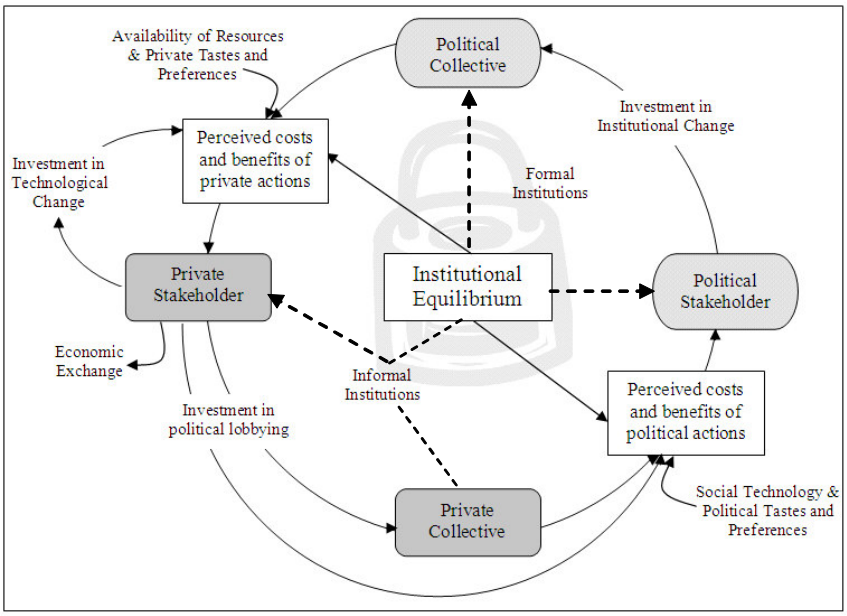

Figure 4: Conceptual model of the Process of Institutional Change. Based on Challen (2000)

From the perspective that institutional change arises from the actions of individuals, there are two generic types of individuals within the model: the private stakeholders and the political stakeholders. Private stakeholders can be firms, households, producers and even consumers that comprise the typical

set of actors in traditional economic models. Political stakeholders on the other hand comprise members of the polities that develop and implement formal institutions for social or economic exchange. According to the original model, the process of institutional change is a continuous one. However, it is clear that there must be a starting point, which according to our view consists of the institutional setting in place and the underlying institutional equilibrium. Thus, the institutional setting comprises a component of both, the economic environment of private stakeholders and the political environment of political stakeholders. These environments present the respective stakeholders with benefits and costs of prospective actions which include options for maintaining the status quo, as well as for altering the existing institutions.

According to this model, private stakeholders maximize an intertemporal utility function, for which they take into account the existing institutional environment, the availability of 'scarce' resources, their tastes and preferences, and a given state of production technology. These components combine to determine prices and to create perceptions of costs and benefits to the private stakeholder for all possible actions. The same occurs with the political stakeholders, except that they maximizes some other form of utility function, and combines social technology (instead of a production technology) and their political tastes and preferences in order to form their perceptions of costs and benefits for all possible actions. Note that if both, political and private stakeholders perceive that their respective costs of actions are higher than their respective benefits, no actions (no institutional change) can be foreseen to occur, which in turn implies the path of institutional development is locked in a unfavorable environment of underdevelopment .

The question now is: given the institutional equilibrium in the PSE, which is mainly characterized by a low performance of irrigated agriculture, what kind of institutional arrangements (institutional choices) should be provided in order to activate a process of institutional change to allow society to reach a new and more efficient institutional equilibrium. Following the logic of the four-step methodology for institutional analysis, this implies that we need to know perfectly where we are (institutional structure in equilibrium) and where we want to be (improved institutional efficiency); what are the arrangements to make this happen (institutional choice) and finally how they could be implemented (institutional change).

6.4.1 Determinant factors for the provision of institutional arrangements

A critical factor for institutional change in the PSE is how to cope with the constant decrease over the years of O&M budget made available by the government, which after the dollarization of the economy in 2000, became particularly critical as it increased the price of several inputs required for the operation of the irrigation system. The solution to this problem is not new and has been broadly discussed in irrigation literature[8]. It basically consists of procuring a more active participation of users in irrigation development in order to make the systems more sustainable.

In this respect, the literature on WUAs is conclusive in confirming the advantages of such an approach to ensure a "good" management of the water resources and infrastructure[9]. This confronts us with two crucial questions for the subsequent discussion: whether revitalized WUAs could be a vehicle of change in the PSE and under what conditions these organizations could be viable. This is important given that there are no reasons to think that O&M budgets made available by the State will be increased or even available in the near future, and that the State will become all of a sudden an efficient provider of irrigation services. Thus, it is possible to conclude that the participation of users through private collectives (for which collective actions are required) is the more crucial factor to consider in the definition of the new institutional equilibrium.

According to different authors[10], for irrigation systems to be productive and sustainable, water users must play a larger role in their governance, financing, and management. This view is based on several studies that have documented improvements in performance of government funded systems through the creation of WUAs, although the sustainability of this arrangement is often problematic, primarily due to problems of accountability. Even so, the advantages of a bottom-up approach for

[8] See Vermillion (1999), Höynck (2003), Jones (1995), Merrey (1996), Ostrom (1992)
[9] For more details see Herrera, 2005.
[10] See mainly Ostrom (1992), Vermillion (1999) and Merrey (1996)

organizing irrigation management are widely recognized in irrigation literature. Based on IWMI, SIC-ICWC (2003), for example, WUAs that are established using a top-down approach are weak and have a high risk of failure, while WUAs that are based on a bottom-up consultative approach and work with ordinary grassroots level water users are robust organizations that generate benefits to their members.

Hence, it seems that procuring a more active participation of users in the governance of irrigation is a sound institutional arrangement that has proved to be partially successful even in Ecuador if some conditions are met. These conditions are basically related to establishing better farmer's backward-linkages with input supply systems (financing included), as well as forward-linkages with output marketing systems. Note that these linkages are outside the boundaries of irrigation institutions, which implies that a broader view of institutional change is necessary. This implies that it is not enough to have a supportive formal institutional environment for water issues, secure water rights, local management capacity building, and an enabling process to facilitate management transfer, which has been the approach proposed by donors agencies and development organizations that promote TIM processes.

This suggests that institutional alternatives to be successful in the context of PSE must deal with the entire complex of constraints facing PSE' landholders and help them move to a substantially higher trajectory of productivity and income, from where they can absorb the additional cost and responsibility of managing the irrigation systems. In developing such institutional alternatives, rather than focusing only on direct transfer of irrigation management, we propose to design an institutional setting that simultaneously procures to enhance the wealth-creating potential of landholders irrigated farming by strengthening market access, promoting high-value crops, and improving systems for providing extension and technical support to irrigators.

In terms of the model of institutional change depicted in figure 4, we need arrangements that allow farmers to unlock the institutional setting by creating the conditions for private and/or political stakeholders to invest in institutional change as means of improving their cost-benefit ratios of doing so. Based on this model, there are several ways of unlocking the institutional equilibrium. Regarding improvements in the institutional structure brought about by private stakeholders, there are various options. They can for example select to invest in technology as long as they perceive that the benefits of doing so are higher than the costs. Another possibility is, of course, to invest in institutional change, which as has been demonstrated previously, may improve the cost-benefit ratio of private stakeholders as long as a redefinition of property rights allows them to participate in the O&M of the system. Furthermore, if arrangements that improve the linkages with input and output supply systems are also provided, it is likely that private stakeholders perceive the need of securing the provision of irrigation as this will then become a critical production factor, making more likely investments in institutional change to improve the provision of irrigation water.

Summarizing, it is possible to conclude that the PSE requires arrangements for: improving the management of the irrigation system; improving the linkages with input supply systems; improving the linkages with output supply systems; and improving the linkages with political collectives through political stakeholders in order to induce institutional change.

Regarding the necessary conditions to make WUAs be a viable vehicle of change in the PSE, we think they are related to: agreement on the path of development wanted for the PSE, so that speculation of land is avoided; incentives for farmers to undertake actions through private collectives as well as arrangements to shield from the problems derived from collective actions; a sound organizational structure and viable sources of financing; and finally more flexible land access institutions[11].

7. Conclusions

With these theoretical aspects in mind, and given the institutional equilibrium in place in the PSE, the aim of the previous sections was to answer the question of what institutional arrangements (institutional choices) could activate a process of institutional change to allow society to reach a new institutional equilibrium. In this respect, it is stressed the central role of collective actions for implementing the required changes, which is the overall superior arrangement landholders need to

[11] A very detailed explanation of each institutional arrangement can be found in Herrera, 2005.

agree in order to reach a superior level of development. Furthermore, the need of tackling simultaneously other related topics, which were found to be crucial for securing investments in institutional change, was revealed.

Note that the fundamental aspect to make this new institutional equilibrium functioning is the design and provision of new rules on payment, which can be said, is the real driver of change. This introduces incentives to landholders, and makes possible the sustenance of the institutional setting by financing WUAs. If landlords are obliged to pay a fixed amount of water rights because they have land in the area of influence of the canals, then this could reduce abandonment of agricultural land, enhance farming and thus also participation in irrigation and in other institutions. It would also be an incentive for making land market functioning more efficient.

Thus, based on the findings of these last sections as well as the theoretical sections at the beginning of this paper, it is possible to conclude that both theoretically and in the application arena, the proposed methodology for conducting institutional economic analysis is consistent and robust. As final recommendation, we suggest more research on suitable methodologies for undertaking institutional analysis of governance structures. This should consider the interdependencies of all the different institutional structures that affect the allocation of a particular resource. Concerning the four-step methodology for institutional analysis proposed, although it seems to be very consistent both theoretically and empirically, further elaboration may be necessary, as well as further applications to other situations were institutional analysis is critical.

References

Alvarez, S., 1995, From huancavilcas to commoners: inter-ethnic relations in the PSE, Ecuador. Ph.D. dissertation, Department of social anthropology and history, Autonomous University of Barcelona, Spain.

Boerner, C., and Macher, J., 2001. Transaction cost economics: an assessment of empirical research in the social sciences". Unpublished manuscript.

CEDEGE, 2001. Basic information about the capacity of the canals and irrigation infrastructure in the Peninsula of Santa Elena. Internal reports.

Challen, R., 2000. Institutions, transaction costs and environmental policy: institutional reform for water resources, New horizons in environmental economics, Edward Elgar.

Coase, R., 2000. The new institutional economics. Chapter 1 in C. Menard (ed.) Institutions, contracts and organizations: perspectives from new institutional economics. Edward Elgar.

Cremer, H., and Laffont, J.J., 2003, Public goods with costly access, Journal of Public Economics, Sept., 2003. Ed. Elsevier, pp. 1985-2012.

Crocker, K., and Masten, S., 1996. Regulation and administered contracts revisited: lessons from transaction cost economics, Journal of Regulatory Economics, 9(1), pp., 5-39.

Da Ros, G., 1994. Tools for environmental policy. Journal of Economic Topics. Central Bank of Ecuador.

Eggertsson, T., 2004a. Imperfect institutions: possibilities and limits of reform, Ann Arbor: University of Michigan Press.

Eggertsson, T., 2004b. The subtle art of major institutional reform: introducing property rights in the Iceland fisheries, in role of institutions in rural policies and agricultural markets, edited by Van Huylenbroeck, G., Verbeke, W., and Lauwers, L. Elsevier.

ESPOL, CEDEGE, University of Florida, and PROMSA, 2001. Study of the potential for developing agro-industry in the Peninsula of Santa Elena and the required resources for its implementation, Final Report, published by ESPOL, Guayaquil, Ecuador.

Hanemann, W., 1984. Welfare evaluations in contingent valuation experiments with discrete responses, American Journal of Agricultural Economics, 66, pp. 332-341.

Herrera, P., 2005. Institutional economic assessment of the governance of irrigated agriculture: the case of the Peninsula of Santa Elena, Ecuador. Doctoral Dissertation. Department of Agricultural Economics, Ghent University, Ghent, Belgium.

Herrera, P., Van Huylenbroeck G., and Espinel, R., 2004. An application of the contingent valuation method to assess the efficiency of the institutional structure of irrigation property rights: the case

of the Peninsula of Santa Elena, International Journal of Water Resource Development, Vol. 20, No. 4, pp. 537-551.
Höynck, S., and Rieser, A., 2003. Dynamics of water user associations in a large-scale irrigation system in Thailand. Technology Resource Management & Development - Scientific Contributions for Sustainable Development, Vol. 2
IWMI & SIC-ICWC, 2003. How to establish a water user association. Practical Steps for Social Mobilizers. Integrated Water Resource Management in Ferghana Valley.
Jones, W., 1995. The World Bank and irrigation. Washington, D.C.: World Bank.
Joskow, P., 1991. The role of transaction cost economics in antitrust and public utility regulatory policies. Journal of Law, Economics, and Organization 7, pp., 121-55.
Larrea, F., and Varea, A., 1997. Ecology and sustainable development. Abya Yala, Quito.
Masten, S., and Saussier, S., 2000. Econometrics of contracts: an assessment of developments in the empirical literature on contracting. Revue d'Economie Industrielle v0, n92 (2nd-3rd Trimesters 2000), pp: 215-36
Merrey, D., 1996. Institutional design principles for accountability in large irrigation systems, Research Report No. 8, International Irrigation Management Institute.
Mittenzwei, K., and Bullock. D., 2004. Rules and equilibria: a formal Conceptualization of institutions with an application to Norwegian agricultural policy making, in Role of institutions in rural policies and agricultural markets, edited by Van Huylenbroeck, G., et al., Elsevier.
North, D., 1990. Institutions, institutional change and economic performance, Cambridge University Press.
Ostrom, E., 1990. Governing the commons, the evolution of institutions for collective action. Cambridge University Press.
Ostrom, E., 1992. Crafting institutions for self-governing irrigation systems, ICS Press, Institute for Contemporary Studies, San Francisco–California, A publication for the International Center for Self-Governance.
PIGSA, 2002. Integral plan for social and environmental management of the Guayas river basin and the Peninsula of Santa Elena, CEDEGE.
Schmid, A., 2004. Conflict and cooperation, institutional and behavioral economics. Blackwell Publishing.
Shelanski, H.A. and Klein, P.G. 1995. Empirical research in transaction cost economics: A review and assessment. Journal of Law, Economics, and Organization, 11, pp.: 335-361.
Vannoni, D., 2002. “Empirical studies of vertical integration: the transaction cost orthodoxy.” International Review of Economics and Business 49 (1): 113-41.
Vermillion D., 1999. Property rights and collective action in the devolution of irrigation system management, in: Proceedings of the International Conference, Collective Action, Property Rights and Devolution of Natural Resource Management, Philippines, 21-25 June 1999
Williamson, O., 1975. Markets and hierarchies: analysis and antitrust implications, New York, NY, Free Press.
Williamson, O., 1979. Transaction costs economics: the governance of contractual relations, Journal of Law and Economics, Vol. 22 October, pp. 233-261.
Williamson, O., 1985. The economic institutions of capitalism, New York, NY, Free Press.
Williamson, O., 1996. The mechanisms of governance, New York, NY, Oxford University Press.