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**Governance by  
Contractual Rules  
- Improving Service  
Relations in Irrigation -**



**Division 45**  
Rural Development

**MAINTAIN – Thematic Paper No. 10**

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# **Governance by Contractual Rules - Improving Service Relations in Irrigation -**

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## Abbreviations and Acronyms

CACG	Compagnie d'Aménagement des Coteaux de Gascogne
ARSP	Asociación de Riego y Servicios Punata
O&M	Operation and maintenance

## Preface

The figures are shocking: According to UNEP, some 1.5 million hectares of irrigated land are lost every year as a result of salinisation and waterlogging<sup>1</sup>. The FAO estimates that world wide, approximately 30 million hectares of irrigated land are severely damaged, and a further 60-80 million hectares partially damaged<sup>2</sup>. Various studies emphasise the fact that the underlying reasons for this are to be found in the **operation and maintenance** of irrigation systems. As the World Bank puts it in its 'Review of World Bank Experience in Irrigation', *"Poor quality of project design and planning are big problems, but poor operation and maintenance is a bigger one"...* *"O&M problems can be seen in the Bank's financing of so many rehabilitation projects. Almost all of them, when scrutinised, turn out to be deferred maintenance projects"*<sup>3</sup>.

Given this problem situation, one can only conclude that the irrigation sector of development cooperation faces a "Maintenance Paradox". On the one hand maintenance is clearly seen at the origin of many of the most serious problems faced by the irrigation sector. On the other hand, maintenance seems to be a sort of "non-issue". In an analysis of its experiences in 614 irrigation projects, the World Bank found that 43% of all project evaluations made no reference at all to operation and maintenance issues. The situation is even worse with regard to maintenance considered in isolation. In the few statistical studies which do exist, operation and maintenance are rarely dealt with separately, and only in exceptional cases do irrigation project evaluations address maintenance issues in any greater depth. The aforementioned World Bank report describes the situation laconically: *"... audits rarely pay much attention to poor maintenance"*<sup>4</sup>.

What are the reasons of this paradox, this striking discrepancy between the well-acknowledged importance of maintenance and the attention it is being given in irrigation practice? One of the reasons, suggested by recent studies<sup>5</sup>, is that there is a **lack of incentives for the stakeholders** to engage in maintenance efforts. **Donors** do not seem to be particularly concerned about the maintenance question, since they do not finance maintenance budgets. They will rather finance new projects than maintenance

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<sup>1</sup> UNEP (1992).

<sup>2</sup> FAO (1993), p. 289.

<sup>3</sup> World Bank (1994), p. 86.

<sup>4</sup> World Bank (1994), p. 86.

<sup>5</sup> See, for example, Skutsch (1999).

activities for existing infrastructures. **Irrigation Departments in partner countries** are faced with extremely high opportunity costs of scarce local financial resources. They are happy to substitute maintenance requirements, which they would have to finance locally, with irrigation system rehabilitation, which foreign donors seem to be eager to fund. **Irrigation agencies** also have little incentives to embark on maintenance activities: as mentioned before, funds for such activities are scarce and engineers do not perceive maintenance to be a “glamorous job”. It is more prestigious to plan new projects. And last but not least, **farmers** very often see maintenance as an obligation of the owner of the infrastructure, i.e. the state, and have no incentive to engage in it.

How can we overcome this “incentive deadlock” in irrigation maintenance? GTZ’s MAINTAIN-project, a research and development project entitled “Institutional Arrangements for Maintenance in Irrigation”, tries to answer this question. The present thematic paper stresses the fact, that **planning** of irrigation maintenance provision – the mainstay of engineering activities – needs to be complemented by **incentive creation** for those who are supposed to make this provision happen. The paper takes a closer look at explicit and implicit contractual arrangements that form the basis of the exchange relations in irrigation service provision, and at the influence of such arrangements on incentive creation.

Angola Russel provided much appreciated comments on an earlier version of this paper.



## Executive Summary

Every type of exchange system or human interaction can be described as an explicit and/or implicit contractual relationship. The provisions of the contract specify the mutual claims and obligations in a relationship that must be, in the end, beneficial to both parties. If the process of fulfilling these claims and obligations is designed in a verifiable and enforceable manner, both parties will contribute and receive whatever it takes to make the joint business a success. This idea can also be applied to service relationships in irrigation. Unfortunately, it is not always possible to write a contract specifying all the details the relationship entails. Not all exchange contracts are complete 'by birth'. Long-term relationships can be incomplete in as far as the future is not completely predictable and there are limits to the amount of information an individual can collect and process. Information asymmetries as well as unilateral specific investments leave room for opportunistic behaviour. If actors involved in irrigation projects have private interests other than pursuing the success of the project, they might have incentives to take advantage of others, who are informationally disadvantaged or locked into the project by specific investments.

In order to cope with the problems resulting from contractual incompleteness, we can classify different types of contracts. **Classical contracts** are contracts which are complete 'by birth' in a given legal and cultural environment. **Neo-classical contracts** are contracts which can be made more complete by contractual design. Neo-classical contractual provisions can help to make contracts self-enforcing so they are less dependent on external enforcement mechanisms, such as courts of law. **Relational contracts**, however, are incomplete by nature. They depend on the personal relationship and common values of the actors who enter into them.

A more detailed analysis of incomplete contracts is provided, distinguishing adverse selection, moral hazard, and hold-up risks in exchange relationships. Avoiding information asymmetries or unilateral specific investments and co-aligning the actors' incentives are the ideas behind all contractual mechanisms to cope with these behavioural risks. This paper explains examples of such mechanisms and discusses applications in practical irrigation projects.



## 1. Interaction and Exchange Systems: Control by Contract

The major insight of the project “MAINTAIN” concerns the nature of service production and service provision: they can only be understood in terms of *interactive processes* with a variety of contributors. *Multiple actors* have to invest money, time, physical and mental effort, attention, and other suitable resources into a process that eventually generates the desired result, for example the water delivery and the maintenance of an irrigation system<sup>6</sup>. If we look at irrigation maintenance in terms of sustainable, interactive processes of service provision and exchange, it becomes easier to understand why some irrigation systems do not perform well – even though up-to-date technology and lots of money have been applied. According to a World Bank Study from 1991, out of a sample of 21 examined projects, 15 failed to deliver the expected results, most of them due to premature deterioration of civil works and water control structures<sup>7</sup>. Technology and money are important ingredients to irrigation management. Yet, they will always be wasted, unless their use is organised in a way that prevents the actors from ‘abusing’ them. The question is now: what is the secret of efficient organisation in irrigation management? What distinguishes the organisation of successful irrigation systems from the organisation of less successful ones?

The first thing we have to realise when analysing irrigation service provision is that people need to be motivated to use the water delivery infrastructure and other resources available in an effective and efficient way. In economic organisation theory, planning who is supposed to do “what, when, with what kind and amount of resources” is called the *coordination* of a project<sup>8</sup>. Coordination implicitly assumes that everybody is intrinsically motivated to strive for the targeted project goal. However, achieving some abstract service target, e.g. increasing the agricultural production by a certain percentage over a given period, will not be sufficient to motivate each individual to do the best he or she can. Implicitly, or even explicitly, people will ask “What is in it for me?”. It is not some abstract pie they are maximizing but their personal share of it. People will usually prefer a large piece of a small pie, than a smaller piece of a large pie. Therefore, individuals will not work to make a larger pie unless their share of the pie will be larger, too. Thus, the importance of individual *motivation* should not be underestimated when looking at irrigation system performance. Motivation and coordination are two sides of the same organisational coin.

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<sup>6</sup> See Huppert/Urban (1998).

<sup>7</sup> See Carruthers/Morrison (1994), p. 10.

<sup>8</sup> See Wolff (1995).

Maintenance management often suffers from adverse motivational structures inherent in the organisational design of the project: If there is no individual reward for maintaining the infrastructure nobody will do it. This is the bottom line of the arguments put forward by the MAINTAIN-project. The topic of this paper is how service enhancing motivational structures can be created so that people will have incentives to do things that are beneficial to irrigation system performance. It is an exercise in how to **coalign individual goals and system related objectives** in irrigation management.

### 1.1 Levels of Governance in Exchange Relations

The actors involved in irrigation system operation and maintenance contribute their share of effort because they expect to receive some benefits for themselves in return. These benefits might come in the form of wages or salaries, access to water, access to other resources (power) or, in some cases, the opportunity to charge 'side-payments'. What actually motivates the individual actors to contribute to the process depends on their **personal interests**, or preferences. In order to understand the actors' motives and adjust the organisation accordingly, MAINTAIN proposes to analyse the interests of all parties involved. If we understand why exactly the actors do the things they do, it will be easier to control their behaviour in the interactive process of service provision. If a person is supposed to contribute resources to a particular effort, he or she can be motivated by an offer to receive at least the same benefits as he or she would receive from an alternative use of the same resources. If an 'abuse' of resources is possible and more beneficial to the person than his/her desired contribution to the project, 'abuse' is bound to occur. This is what basic economic theory predicts<sup>9</sup>, and what empirical observations of many irrigation systems in developing countries confirm<sup>10</sup>. In our analysis, we do not intend to pass judgement on the motives people might have. Instead, we take their motives as given facts and look, in a non-judgemental and non-moralising way, for means to influence their behavioural decisions so they do not harm but advance the undertaking at stake.

Individual preferences and abilities are the starting point of our analysis. Once we understand the actors' interests in a particular undertaking we can think about adequate governance structures and rules that will coalign their interests with the official, e.g. with those of service provision for irrigation.

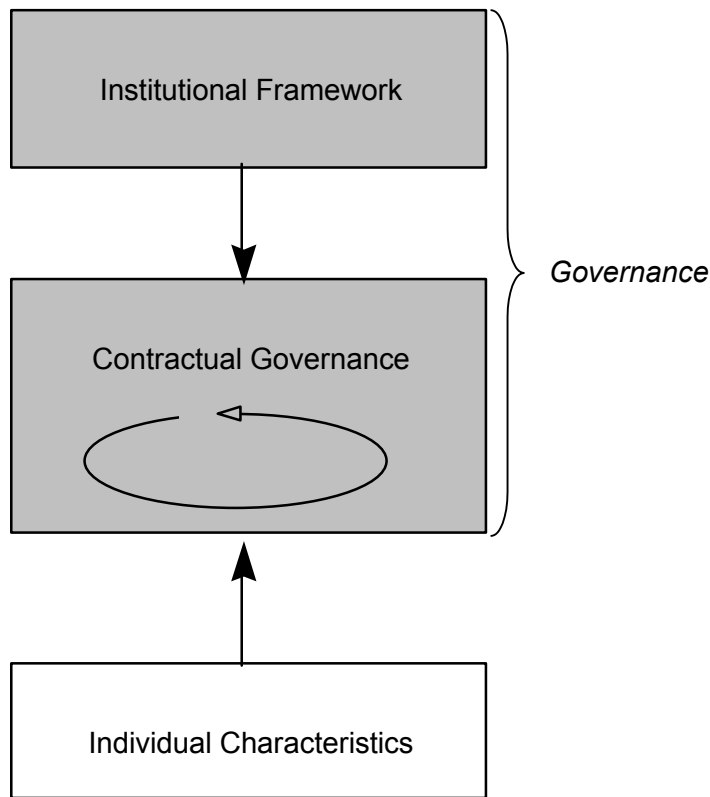
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<sup>9</sup> See, for example, Ostrom/Schroeder/Wynne (1993), Picot/Wolff (1994), and Wolff (2000).

<sup>10</sup> See, for example, Huppert/Urban (1999), Scheumann/Vallentin (1999a and b).

The **governance** of irrigation service provision, however, is determined by two levels. Only one of them, the level of **contractual governance** can be directly influenced through the exchange partners, i. e. the provider and the client of the service in question. Contractual governance includes all the variables that can be determined by the partners in the interaction. These variables can be called 'endogenous' variables because they are endogenous to the decisions of the exchange parties. There are also variables which are determined on the level of the **institutional framework** prevailing in the respective country (see figure 1). These variables are outside the control of the exchange partners. Each country's institutional framework has legal as well as cultural aspects, which might differ substantially across borders. Even different regions within the same state might have different cultures or legal routines. Although the exchange partners in service provision cannot directly control these 'exogenous' variables it is still important to consider them because many contractual provisions require a certain kind of institutional basis in order to function. If there is, for example, no reliable court system and law enforcement, contractual rules which rely on external enforcement will be ineffective. In this kind of environment, one would have to design either self-enforcing contracts or the actors would have to establish their own enforcement mechanism. How to create such mechanisms required to organise a sustainable service relationship will be explained in depth in sections 2 and 3 of the paper.

**Figure 1: Levels of Control in Exchange Relations**



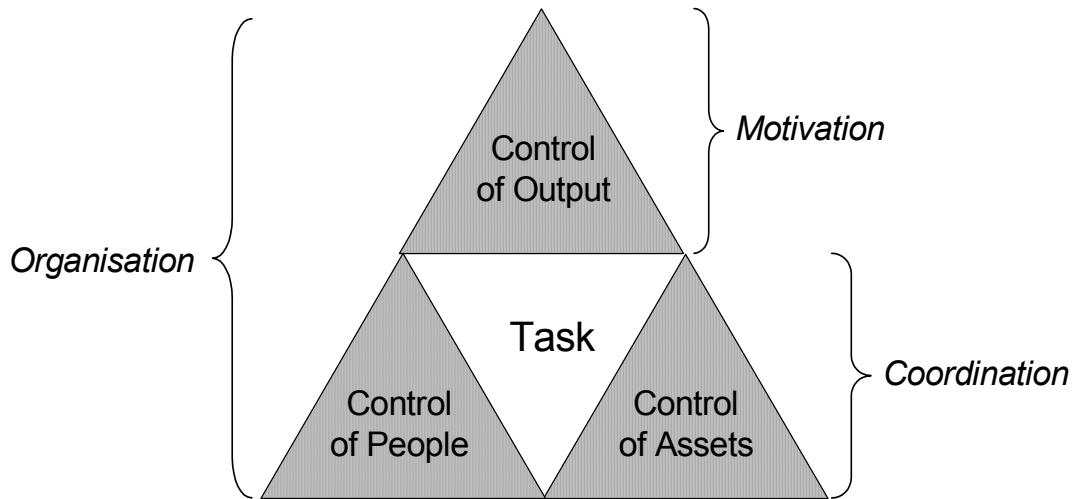
With respect to irrigation systems, however, the distinction between the level of contractual governance and the institutional framework is not always clear. In many cases, one of the partners is a government or a government agency, which can easily influence the institutional framework. This resembles a match of football, where one of the players is also the referee. In this situation the contracting party who does not have influence over the institutional framework tends to be at a disadvantage.

He or she can, however, still try to lobby for changes in the institutional framework. Sometimes, international donors are well positioned to do so. But what are their incentives to actually use their influence this way? Maybe the incentive structures relevant for them do not encourage such efforts. Furthermore, these interventions are highly political and might not succeed within the time horizon of a particular irrigation improvement program. In this paper, we will be less political, and focusing instead on what can be done within the scope of 'managerial' means.

## 1.2 Creating Incentives by Allocating Property Rights

The approach proposed in this paper follows the insights of New Institutional Economics. The basic idea is that every process of production or service provision can be modelled as an explicit or implicit contract that organises the exchange of resources or services against other benefits. It is important to note that this notion of a contract refers to explicit as well as implicit rights, duties and expectations. It is, thus, completely different from any legalistic notion of contract. It is not necessarily a legal but rather an economic contract. This is why economic contract theory can be applied, as an abstract tool of analysis, regardless of the respective legal framework of a country. The **contract** specifies the contributions and returns for each party involved and how these duties and rights will be enforced. Expressed in terms of **property rights**: The contract specifies which partner has what kind of rights to access and use capital (control of assets), to command human capital (control of people) and to collect benefits from the process (control of output). There must be a 'fit' between the task or service at stake, and the allocation of the relevant control rights. If somebody does not have the means to fulfil a task or service, meaning he is lacking the control over the required input factors, he **cannot** do the job. If somebody does not have the right to collect an appropriate share of the benefits, which his effort creates, he **will not want** to do the job. Both aspects have to be taken care of in order to ensure a coherent organisation of the process. This is depicted by figure 2.

**Figure 2: Incentives through ‘Output Rights’**



The ideal case would be to allocate all the rights and responsibilities connected to a particular task or service to the same person, i.e. create full ownership of the process. This would mean, that the person who performs the service owns all the assets required to do so, provides all labour, and collects all the profits. The complete allocation of all rights to the same individual is the reason why the small entrepreneurship – the one person enterprise – tends to be such a highly efficient organisational mode. If I own the house I am living in, I am likely to dedicate more attention to preventive maintenance than I would if I was renting a house. People do not like to waste their own resources. Unfortunately, this simple organisational form is not always applicable to irrigation management since many of the processes involved are far too complex and require far too expensive assets to be owned by one person. It is also not always easy to determine the profits from each individual sub-process involved in the project. This is particularly true in the so-called non-profit sector – although it is not impossible to generate this kind of information. In many irrigation projects, however, there is just no accounting system that would supply these data.



The secret to efficient organisation lies in designing contractual rules that establish a situation of '**quasi-ownership**'<sup>11</sup>. This can be achieved by creating incentive structures, which establish a sufficient degree of transparency as well as performance related benefits for all actors. Such a contract will render diverting resources either impossible or unattractive. Hence, an alternative term for 'quasi-ownership', is **accountability**. Accountability implies that there is a connection between the result of some person's actions and his personal benefits. Metaphorically speaking: If the actors 'feel' that their contribution to baking the pie is tied to the size of the piece they will receive, they will be motivated to use their resources, human or material, in a pie-enlarging way – instead of stealing the ingredients before the dough even gets to the oven. Holding people accountable for their actions, however, requires a sufficient degree of transparency.

Section 2 will introduce a rather intuitive approach to categorise production- and exchange processes in terms of alternative contractual relations. Section 3 provides more analytical categories to classify typical risks in interactive production processes as well as typical remedies to cope with them. It then shows how typical contractual provisions help to reduce the risks of resource diversion. Throughout the paper, examples from the practice of irrigation systems will illustrate how the approach helps to explain deficits in irrigation maintenance and how contractual reasoning can be applied to solve typical problems in irrigation management. Section 4 summarises the discussion and concludes the paper.

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<sup>11</sup> See Hart (1995), Wolff (1995) and (1999).

## 2. Complete versus Incomplete Contracts

From the point of view of institutional economics, any type of market-based and hierarchical exchange system can be presented as an implicit or explicit contractual relationship<sup>12</sup>. Applying contract theory to service relations makes it possible to systematically analyse the governance problems and possibilities within these relationships.

### 2.1 Classical Contracts: Complete 'by Birth'

Service contracts can either be complete or incomplete<sup>13</sup>. From law, we know this definition of a contract: "A contract is a promise or a set of promises for the breach of which the law gives a remedy, or the performance of which the law in some way recognises as a duty"<sup>14</sup>. The core elements of the legal contract are the promise of performance and the law. This definition is only meaningful where laws governing the relevant state of affairs are already in existence and where the transaction concerned can be described and observed "objectively". Only when the transactions are truly determinable, can classical contracts be concluded and executed. It must be possible ex ante to specify clearly which services and returns (e.g. payment) will be provided. Furthermore, these services have to be objectively verifiable ex post by third parties. This understanding of a contract is termed **classical contract law**. The purchase of a water pump by an irrigation farmer is an example for this kind of contractual relationship: the amount and the quality of the good as well as the price are unambiguously defined. Service and return are delivered (almost) simultaneously, on a kind of 'spot-market'. There are laws and courts to enforce each party's rights and duties in case one party cheats. The contractual exchange will work, no matter who the buyer is. All of the contractual provisions can be specified in advance, monitored, verified, and enforced. Unfortunately, this is not the kind of contractual relationship that we usually find in irrigation management in developing countries. However, there are some examples of classical contracts even there: Some minor provisions, e.g. purchasing irrigation equipment – such as a pump – from a local dealer, might match this description.

Classical contracts can be described as being 'complete by birth' in a given legal and cultural environment. But most of the exchanges that take place in irrigation management are more complex.

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<sup>12</sup> See Wolff (1995).

<sup>13</sup> See Williamson (1990a and b) and Macneil (1974 and 1978).

<sup>14</sup> Macneil (1974), p. 693.

## **2.2 Neo-classical Contracts: Complete ‘by Design’**

Given the high level of complexity and uncertainty surrounding typical tasks in irrigation management, a different kind of service relationship will have to be established. A lot of the services involved cannot be described in an exhaustive manner in advance. Many of them cover longer periods of time and are susceptible to a great number of external influencing factors. There may also be new participants or participants leaving during ongoing service relationships. There is no spot-market for this kind of service anymore. Instead, the production and delivery of the service requires a contract, which is conditional on a variety of parameters. The exact demand for desilting activities, for instance, cannot be predicted because influencing factors, such as storms or other natural disasters are, at least to a degree, unpredictable. Nevertheless, in spite of these uncertainties, the parties concerned might consider it desirable to enter into an exchange relationship, because the expected benefits outweigh the expected cost. Before two or more parties can enter into an exchange relation, they must come to a consensus on the contractual goal with a verifiable definition. However, when it comes to decisions on the means to be used to achieve this goal, there must be sufficient freedom for all parties to use new information. New technologies, for instance, should be applied to reduce cost or improve the quality of the service if that is in both parties' interests - even if these technologies were not known when the contract was made. Information updates should be exploited to the mutual benefit of the parties involved, to make the achievement of the given objective less costly, and, hence, overall more profitable. It might also be mutually advantageous to terminate the contractual relationship in the interim should the overall purpose of the contract prove obsolete as a result of technical innovations or fundamental changes to the framework conditions. In order to allow the parties to react to such changes in a mutually beneficial way, contracts have to be appropriately flexible but, at the same time, not be open to opportunistic exploitation by either party. **Neo-classical contracting** offers a few potential solutions to this dilemma, attempting to get complete, or at least enforceable, contracts out of ‘incomplete’ contracting situations<sup>15</sup>. Neoclassical contracts can, therefore, be called complete ‘by design’.

Typical neo-classical contractual provisions to cope with uncertain and complex contractual parameters are:

### **2.2.1 A third party as arbiter**

A service provider and a client can agree to use an arbiter in the event of a dispute. The decision of the arbiter has to be honored by both parties. Otherwise, specified sanctions will be applied. These sanctions must also be part of the contract. Establishing or

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<sup>15</sup> See Wolff (1995), pp. 35 f.

appointing an arbiter is particularly useful in environments, where unambiguous laws are non existing, or where neutral law enforcement cannot be taken for granted. This is the case in many developing countries.

*An example of the difference between complete and incomplete contracting and of the deployment of arbiters in maintenance management is reported from Pakistan.<sup>16</sup> Farmers had been expressing concerns about the quality and quantity of the maintenance that had been provided by contractors on behalf of the Provincial Irrigation and Drainage Authority (PIDA). In 1997, the government decided to involve a few reputed consulting firms to monitor the maintenance work. These arbiters discovered that weaknesses in the contracting procedures of PIDA were causing the maintenance deficiencies. PIDA officers had specified the terms of contract fairly rigorously – trying to establish ‘complete’ contractual arrangements – and had left little flexibility for the contractors to adjust to unforeseen circumstances. Given the high negotiation costs for the contractors, the small quantity of work per contract, and the fear of loss of business, the contractors followed instructions closely, even in situations where this proved to be technologically inadequate.*

### **2.2.2 Unilateral decision-making authority**

A typical example of this kind of contract is an option agreement in which the buyer pays a premium to decide at a given point in time whether or not the contract will be executed. The premium is the price for the seller’s readiness to deliver the service anytime the buyer requires it, within the contractually defined period of time.

*Irrigation farmers in Southern France hold a specific unilateral decision-making authority of this kind.<sup>17</sup> The Compagnie d’Aménagement des Coteaux de Gascogne (CACG) is commissioned by the state to generate and operate the so-called ‘franchise perimeters’ for irrigation (‘périmètres en concession’). This franchise includes a 10-year operational mandate. During this period, the franchisee has a high degree of discretionary decision-making power with respect to the details of the service required. However, after this period, the water users have the unilateral decision making authority to extend the contract or to vote for its closure. This provides incentives for the CACG to provide a good and reliable service during the franchise period hoping that the franchise may be extended. The ‘premium’ the farmers pay here is their agreement to a 10-year franchise in the first place which ‘compensates’ CACG in case the contracts are not extended beyond that date. Thus, there is always one party in charge of and accountable for a decision, and there are always clear incentives to perform in a satisfying manner.*

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<sup>16</sup> See Ul Hassan (1999).

<sup>17</sup> See Huppert/Hagen (1999).

### **2.2.3 Standards**

It might, for example, be necessary to adjust prices in the course of a longer-term contractual relationship. Renegotiations, however, entail the risk that the dependence of one contract partner on another will be exploited in the negotiation process. In order to avoid this, the price of the good or service concerned – or perhaps also the amount of wage earnings – can be linked to an index which cannot be manipulated by either of the parties to the agreement, such as the official government-set inflation rate.

Standards may also be set with respect to the level of service provided. Contracts may specify that full payment will only be made if the agreed upon standard has been achieved. It is important to note that the standard has to be expressed in unambiguous, verifiable terms. This might not always be possible. Proven underachievement will be penalized by certain reductions in the returns for the service in question.

*An example of the latter kind of standard setting are specific services provided by the above mentioned CACG in Southern France.<sup>18</sup> The services are specified in terms of maintaining a minimum flow of water during summer in the 14 streams and rivers that flow into the Garonne river in the north. This recharge takes place by way of a large supply canal in the south ('Canal Neste') that conveys water from reservoirs in the Pyrenees to the upstream ends of these streams and rivers. Minimum flows of this kind are enforced by the state for reasons of hygiene (dilution of sewage water that is released into these rivers) and out of environmental concerns. In return for maintaining minimum flow rates, the state grants the CACG a subsidy known as 'aide à la gestion des étiages' (subsidy for managing minimum water levels). The CACG has considerable incentive to maintain the agreed upon minimum levels, since the subsidies it receives are linked to certain ideal hydrographic standards of water provision in the canal system which are monitored by the state. If CACG fails to keep the defined levels, it will face lower subsidy payments. Consequently, the CACG makes every effort to adhere to the regulations governing water supplies.*

### **2.2.4 Cost-Binding**

In this case, the contracting parties agree to keep the transaction price in line with the costs of the service-supplying party. The recipient party pays these costs – which are verifiable by a third party – with or without an agreed surcharge. It is crucial to make sure that costs cannot be misrepresented. Furthermore, contractual cost-binding can only work if there are no opportunities or incentives for the delivering party to artificially raise the costs.

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<sup>18</sup> See Huppert/Hagen (1999).

*A modified form of cost binding can be seen in the maintenance management of the before mentioned CACG.<sup>19</sup> The necessary annual maintenance activities and costs are difficult to plan in advance. Hence, to be prepared for any unforeseen events, the CACG is obliged to earmark an 'maintenance reserve' in its annual budget (which is financed from water fees and state subsidies). This reserve is designed be high enough to cover the costs of the work likely to be required. The state stipulates an upper and a lower limit each year for all large-scale infrastructure projects in the country, in an effort to rule out any excessive preventive maintenance whilst also ensuring that larger maintenance jobs are not put off for years to come. At the end of year, the actual costs can be verified so that future plans can be adjusted.*

### **2.2.5 "Agreement to Agree"**

This might be a useful contractual provision in cases where decisions can only be taken correctly following submission of outstanding information. The pressure to reach a consensual decision as soon as that information becomes available can be increased by having the respective parties' willingness to arrive at an agreement documented in a contract that incorporates sanctions should they fail to reach an agreement within a given period of time after the new information become available. There are often implicit sanctions to not agreeing resulting from the nature of the issue. These should not be suppressed.

*Looking at irrigation operation and maintenance, 'agreement to agree' contractual arrangements can be found in many farmer managed irrigation systems. In many Andean irrigation systems, for example, there are implicit 'agreement to agree' rules with respect to unforeseen upcoming maintenance and repair needs. Irrigation farmers in the Bolivian Andes, for instance, adhere to the principle of 'ad-hoc working groups'.<sup>20</sup> To cater to changing and unpredictable repair requirements, the irrigation farmers keep advance planning to a minimum but maintain a common understanding (an 'implicit contract') to form ad-hoc working groups, involving several families on a reciprocal basis, whenever need arises. The 'natural' incentive to form these working groups results from the disadvantages they would be facing in case they cannot cope with a problem. Such incentives, however, could also be provided or increased by contractual sanctions if needed.*

### **2.2.6 "Shot-gun clause"**

In its simplest form, this is a contractual mechanism reminiscent of the distribution rule "one person slices the cake, but the other can choose which slice he or she wants first". Such an arrangement provides strong incentives to the party responsible for setting up

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<sup>19</sup> See Huppert/Hagen (1999).

<sup>20</sup> See Huppert/Urban (1998).

the distribution to strive for the most equitable way to do so since otherwise the rule 'backfires' against the decision-maker himself<sup>21</sup>.

*Examples for 'shot-gun like' contractual arrangements are found in many traditional tank irrigation systems in South India and Sri Lanka.<sup>22</sup> Water bailifs, who are supposed to organize water distribution, are given land at the very downstream end of the canal system. This way, incentives are strong for the holders of the water distribution function to strive for properly maintained water delivery systems. Any waste of water on the way to their own properties will 'backfire' against the 'bailifs' themselves, leaving smaller amounts of water for their own use than would be available otherwise. (The water bailifs will also have to make sure that the upstream users cannot simply reduce the amount of water delivered to downstream users.)*

The examples given above illustrate how contractual rules can make an exchange-relationship more 'complete'. Using specific contractual mechanisms, the parties can ensure that the correct decisions are made and the most advantageous actions are taken, even in an uncertain environment. The examples also show that it is possible to find contractual mechanisms which are independent of legal enforcement. Thus, such mechanisms are likely to work even in countries without a 'functioning' (in a western sense) jurisdiction.

### **2.3 Relational Contracting: Relying on Personal Relations**

Classical and neo-classical contracting is primarily based on formal regulations and agreements which, in principle, can always be formulated explicitly and verified by a third party. Classical and neo-classical contracts contain specified measures designed to ensure the completion of the project, taking into account all foreseeable future developments. That is why we can call these contracts 'complete'. In contrast, **relational contracting** also includes implicit arrangements and tacit agreements without any formal regulations. Arrangements of this kind are not verifiable by third parties, which is why courts of law cannot pass judgement on them or can but only with great difficulty. The formal definition of the term contract no longer applies here. In classical and neo-classical contracts, the parties can be exchanged at will, provided of course they offer the specified service on the agreed upon conditions. In relational contracts, however, mutually shared, implicit values determine whether a given business venture will succeed. Indeed, in view of the highly complex and uncertain developmental potential of long-term exchange relationships, certainty as to the other party's behaviour cannot be ensured at a reasonable cost merely by explicitly stipulating

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<sup>21</sup> We assume that the name 'shot-gun clause' originates from the times when men used to duell. One man challenged the other, but the other had the right to determine the weapon to be used by both.

<sup>22</sup> See Meinzen Dick (1999).

payment regulations for all possible scenarios. Instead, the contracting parties are assured that their counterparts will act in a given way, as a result of shared underlying values. Having both parties reliably uphold specific implicit rules and standards known to each other is a much less expensive way of ensuring that they will act in a certain manner than trying to work out ex ante explicit rules for all possible situations. However, trusting the other party to observe such implicit rules, rules that cannot be sanctioned by a court of law, is an act of faith that is particularly open to the risk of opportunism. Therefore, business relationships of this kind can only be envisaged, if the contracting parties know each other sufficiently well and can be certain of the other's reliability. Thus, the identity of the contracting party becomes decisively important. Examples of relational contracts include marriage contracts, state constitutions and cultures as well as long-term cooperations between networked companies.

*The advantages of relational contracting over formal, 'classical' contracting under specific circumstances became obvious in the 'Upper Cochabamba Valley' irrigation project when the newly founded water user association of Punata ('Asociación de Riego y Servicios Punata', ARSP) tried to collect water charges from the water users of different communities for the operation and maintenance of the main conveyance system.<sup>23</sup> The level of the charges was agreed upon between ARSP and the different communities. Initially, the monetary contributions themselves were to be collected by ARSP, which established an extensive fee collection and accounting system for this purpose. It kept lists of all water users, the area irrigated by them, the water allocation demanded and the resulting fee to be paid. ARSP was also responsible for the collection of the fees. With over 3000 water users, such a system naturally tended to be very susceptible to free-riding. Similarly, the ways and means effectively open to ARSP for imposing sanctions on non-payers were too small to overcome free-riding by coercion. The consequences were foreseeable: an increasing percentage of water users did not pay any water charges or were in arrears and the discussions on whether and how to persuade defaulters to pay their contributions began to erode morale and community spirit within the ARSP.*

*The solution to this problem, chosen by the water users, was that in future the charges for O&M of the main system would no longer be paid by the individual water users, but by the communities themselves. And this payment would be made in a lump sum before the start of a new irrigation cycle. It was agreed that any community that had not paid the full fee for all its water users to ARSP by one day before the start of the cycle, was to be excluded from water delivery. The effect was that the communities did everything in their power to ensure that fees were paid on time. Here they could rely on implicit relational contracts between the community and individual users. This meant that delays*

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<sup>23</sup> See Huppert/Urban (1998).



*in payment by individual users were dealt with by the relevant community, which would advance the money and subsequently reclaim the missing contributions from its non-paying members. The relational contracts within the community and the social pressure exerted to satisfy all contractual obligations resulted in a fee collection rate of 100% with the new system.*

The example illustrates how already existing relational ties between participants in an irrigation system can be used in obtaining the envisaged goals. Local or corporate cultures can be considered as relational contracts unifying all members of a specified organisational entity. To shape these cultures or create new relational ties, however, is a rather long-term undertaking.

It is important to note that when crossing borders, we should not expect the same implicit understanding of contractual rights and duties from our partners. Culture has a major stake in shaping these implicit expectations. Thus, implicit expectations cannot always be transferred from one cultural sphere to another. For instance, 'side payments' might be considered to be an unethical business practise in one country, while somewhere else, they might be entirely normal.

### 3. Solving Contract Specific Problems in Service Provision

We have already gained a first insight into the craft of designing balanced contracts. Yet, a more detailed description of the reasons for contractual incompleteness might be useful, in order to be able to address the roots of contractual incompleteness. A particular set of contract specific risks is highlighted by Principal-Agent Theory. The starting point for agency analysis is the asymmetrical information status of the actors entering into a service relationship<sup>24</sup>. This asymmetry is, on the one hand, both necessary and desirable since it reflects the division of labour and specialisation and raises the general level of prosperity. On the other hand, though, the actor who is not as well informed (*principal*) – in our case the client of the service delivery – runs the risk of being exploited by the better informed party (*agent*), the service provider.

#### 3.1 Contracting against Adverse Selection

An asymmetrical information status can already exist before a contract is concluded or might arise in the course of the transaction relationship. In the case of **pre-contractual asymmetry**, the client or principal does not have sufficient information about the provider's (the agent's) true characteristics or the real quality of the service the agent is offering.

A good example of such a situation is a used-car dealer. A certain dealer may be able to praise the qualities of his car in a more convincing manner than his competitors. This may induce the buyer to purchase a used car from this person. She faces the risk that the dealer may be aware of some technical defects, which he does not mention (**'hidden characteristics'** of the car). These may be defects that cause problems only after the buyer has signed the contract. It will then be difficult to hold the dealer accountable. In this case, the buyer will face a loss because she has chosen a bad deal as a result of an information deficit on her side. Concluding unfavourable deals is one typical result of a pre-contractual information asymmetry. Another typical outcome is that the buyer anticipates that the seller could take advantage of her relative ignorance and decides not to consent to any deal at all. This might result in potentially efficient deals foregone, for the sole reason that there was no way to communicate credibly about the quality of the car. Thus, missing out on potentially favourable deals is another typical result of a pre-contractual information asymmetry. These risks, arising from pre-contractual information asymmetry, are known as **adverse-selection risks**. Contractual provisions are now being sought to ward off these efficiency losses and to help to pair up suitable partners after all, via either **signalling** or **screening** mechanisms. With signalling, the provider/agent bears the costs, for example, by providing certificates,

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<sup>24</sup> See Picot (1990), p. 150.

quality seals or by maintaining a good reputation. With screening, the client/principal bears the cost, e.g. by buying-in information from third parties or carrying out specific tests. It is, however, important to **distinguish between a signal and 'cheap talk'**. Mere promises or advertisements are not automatically signals in the economic sense. A signal requires that there is something at stake for the individual who sends it. Only if the agent incurs a risk of personal loss if the signal turns out to be wrong at a later stage, can the information he conveys be supposed to be credible. For instance, if a car dealer backs a quality claim with a 10-year warranty that puts the risk of failure on him, the promise of quality is credible. If he merely states, "This car will last forever!", he is engaging in cheap talk.

### **Box 1: The Adverse Selection Problem**

An Adverse Selection Risk exists whenever two actors are planning to join in a client-supplier constellation. The client (principal) intends to buy a service or a good from the supplier (agent). There might, however, be characteristics of the service or good which are unobservable to the client but known to the supplier. The supplier might not have an interest in revealing any information about these characteristics. As a result, the buyer might find himself trapped in an unfavourable exchange relation after signing a contract, or he might not enter the relationship at all because he anticipates being taken advantage of. Both of these outcomes can result in missed benefits for all partners. Better selection mechanisms (signalling and/or screening) offer solutions to these problems.

*Adverse Selection in irrigation management occurs whenever, after a contract has been signed, it turns out that the quality of the service or product at stake does not comply with the buyer's expectations. In these cases, there might have been some pre-contractual information asymmetry. For example, water meters sold to a water user group may not correspond to the quality of the water used in irrigation. Often, the water meters installed are suitable for clean drinking water but give wrong readings when used to measure less pure water. Drinking water meters can, in many cases, not cope with the sediments contained in irrigation water. The agent selling the meters is likely to know this. It probably was not in his interest to reveal this information to the buyer because then he might not have got the business.*

*There are two possible solution to this problem.*

- *There should either be a better training (or advice) for the buyers so they know what they are buying.*

- *Or the seller should be asked to offer a guarantee, credibly promising that the products he delivered will do the required job for a certain minimum period of time. Otherwise, he will fix them on his own account. Such a contractual provision is likely to deter him from selling unsuitable meters.*

*There are probably also examples of profitable deals which were not concluded because one party did not trust the service or good offered by another party – although this trust might have been justified. But this is hard to find out, even ex post. One example might be the fact that international donors rarely commit to funding maintenance costs over the full time horizon of an irrigation system's life cycle. Maybe one of the reasons is, that they do not trust their local partners to use this regular, long-term flow of money according to their expectations. Thus, the donors refuse to commit themselves to maintenance funding in most cases.*

- *The problem could be solved if the governments of developing countries had a means to credibly commit themselves to not divert the funds to other purposes and always maintain the premises.*

These examples illustrate how important adequate screening and signalling mechanisms are. However, there is another category of informational problems that seems to be even more important in irrigation management than pre-contractual asymmetries. These problems will be examined in the following section.

### **3.2 Contracting against Moral Hazard**

An uneven distribution of information occurring after the contract has been entered into entails a **moral-hazard** risk<sup>25</sup>. **Post-contractual information asymmetry** can actually relate to two types of information.

First, it can refer to information on **contractually endogenous**, i.e. behaviourally determined, influences affecting the success of the contractual relationship. When this type of information is unevenly distributed, the resultant scenario is referred to as **hidden action**. The principal cannot observe or monitor the actions of the agent he has commissioned, only the results of these actions. However, since the results can also be influenced by factors outside the contractual framework, the result of the agent's activities says little about the effort the agent has put into achieving it. For example, a professor's teaching input can be assessed via the results his students achieve in nationally standardised tests. However, the students' exam results are subject to further influences, such as the effort they have made themselves, the way they feel on the day of the exam, their degree of talent and the quality of their previous education. Thus the

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<sup>25</sup> See Wolff (1995), pp. 49 ff.

examination results are probably not an appropriate indicator of the professor's teaching skills.

Second, the respective contractual partners may also be unequally informed about the **exogenous** factors influencing their contractual relationship - a situation referred to as **hidden information**. In this case, the agent acts after receiving new information, which is, at that stage, unavailable to the principal. The agent might be able to observe certain indicators and draw conclusions about changes in the immediate environment. In contrast, the principal remains unaware of the portent of these indicators because he is too far removed from the place of action. He is thus unable to determine whether the agent is really using this information to promote his interests as good he can<sup>26</sup>. Furthermore, the lack of relevant information can impair the quality of any further decisions the principal may have to make. The agent decides which information he will pass on to the principal. He is therefore at liberty not only to withhold information but to pass on incorrect information too, and so steer decision-making in his favour. This kind of conduct is most predominant in organisations with many hierarchical levels. Decision making systems that virtually invite influence activities tend to be inefficient. **Influence activities** is the term used to describe an opportunistic manipulation of information. They are one way to pursue **rent seeking**<sup>27</sup>. Influence activities generate costs in many ways, since they require resources themselves and also provoke defence mechanisms on the part of the principal, diverting further resources of their intended use. Hidden information thus precludes the maximum possible income from being achieved. As with hidden action, hidden information gives the agent a free hand to pursue his own agenda. Hidden information can entail losses even if the principal is able to observe the agent's behaviour. This can be illustrated by the example of the manager of a security-based investment fund. Even if the principal (the investor) can observe him non-stop, he is still unable to assess the quality of service the agent ( the fund manager) is providing, if he himself is not minutely informed about external factors such as general stock-market trends. The problem with hidden information is not so much that the principal **cannot observe** the agent's dealings, as with hidden action, but that he **cannot determine** how hard the agent is working or the value of the information being passed on.

If neither the agent's activities nor the external factors can be verified by the principal, we have the 'worst' case of moral hazard, because there is no way to base the price for the agent's service on either his effort or the result of the process.

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<sup>26</sup> See Arrow (1985), p. 39.

<sup>27</sup> See Milgrom/Roberts (1990) and (1992), pp. 271 ff., and Renger/Wolff (2000).

It is obvious that the theoretical description of 'moral hazard' as given above closely matches what we find in many maintenance processes in irrigation service provision<sup>28</sup>. Very often, we will find a combination of hidden action and hidden information making it particularly hard to determine the agent's performance. Being aware of this information asymmetry, the agent might be inclined to use his 'freedom' in order to pursue personal goals, which are detrimental to the project. Under these intransparent circumstances, it will be hard to hold the agent accountable.

### **Box 2: The Moral Hazard Problem**

A moral hazard risk arises whenever two actors are joined in a client-supplier relationship. The client (principal) commissions the supplier (agent) to perform a service on his behalf and thus confers a certain scope for decision-making on the supplier. If we presume that the agent's activities cannot be directly monitored by the client, and that the agent makes certain observations and experiences during the execution of the order which the principal has not made, then this leads to an 'asymmetrical information status' between the two actors concerned. If it is also presumed that the order is so complex that it can be influenced by many other external factors, the following problem can arise: Following conclusion of the contract, the agent might reduce his efforts to fulfil the order (reduce his cost), without the principal being able to call him to account. The agent can always claim that a poor result is due to circumstances beyond his control, thus relieving him of any guilt or responsibility.

The moral-hazard problem is particularly relevant to long-term service systems and therefore to maintenance systems. This is especially true when the service provider, the agent, has a considerable lead over the client in terms of knowledge of how to generate and provide a service – which is normally the reason why an order is granted in the first place. As a layman, the client cannot fully appreciate the value of the service, being offered by the provider in his capacity as an expert. Think, for example, of the complex engineering services required to maintain and repair pumping stations or to rehabilitate complicated structures in irrigation canals. Most often, the agent is the one who has to **specify the demand for maintenance and perform** the required tasks, just like a doctor, who provides the diagnosis as well as the therapy. From the client's point of view, this lack of transparency has a considerable impact on his control over the service: the client loses part of his 'client sovereignty' and becomes dependent on the judgement of the service provider. The client is, for example, not really able to determine whether any additional services recommended by the provider are truly

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<sup>28</sup> Huppert/Urban (1999), p. 54 ff.

necessary or whether the service provider suggested them to further his own interests. With this type of 'offer-induced demand', the client has great difficulty in steering demand as he sees fit. How can the moral hazard problem be solved?

"The principal can limit any detrimental impacts on his interests by generating suitable incentives for the agent and by taking on the costs involved in monitoring the agent's activities, with a view to blocking any improper behaviour by the agent. Moreover, it may even be worthwhile for the agent in certain situations to provide resources (a security deposit) as a guarantee that he will not undertake specific activities that might harm the principal. In most principal-agent set-ups, both the principals and the agents will incur positive monitoring and deposit/guarantee costs (may be both of a pecuniary and non-pecuniary nature). And in every case, the agent's decisions will deviate to a certain extent from the decisions that would maximise the principal's well-being"<sup>29</sup>. The design of incentive schemes, however, requires, first of all, that the 'true' motives and interests of the agent are known. Finding out his true agenda might require some 'empirical' research. Simply assuming that the agent will altruistically deliver the service required will most likely generate disappointing results.

Contractual mechanisms for resolving the moral-hazard problem are, in principle, either geared to redressing the asymmetrical information status or to bringing the agent's interests more in line with those of the principal. Both mechanisms generate costs. Attempts to balance out the information status generate monitoring costs, whilst harmonising interests calls for a system of incentives, which again produces costs. The basic idea behind all incentive-based service relationships is that, in principle, each player should be remunerated in terms of their productivity, since this is the best of way of promoting overall productivity and making people accountable for their behaviour. This idea has already been discussed in section 1.2. The search is thus on for a contractual mechanism that is able to motivate the respective agents to produce the optimal decisions and effort during the ongoing relationship. In this context, there is a trade-off between monitoring and incentive costs and the growth in productivity due to improved incentives. If creating 'perfect' incentives would incur monitoring and incentive costs which are higher than the value of the additional output, we should prefer not to provide such incentives. What is more, the respective agent's propensity to take risks must also be examined<sup>30</sup>. For example, some agents might not be able or prepared to bear any income risk because their income or wealth is very low to begin with<sup>31</sup>. A hired truck driver, for instance, will not be able to bear the full risk of damage to the truck. On the other hand, if he does not bear at least some of the risk, he might not have enough

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<sup>29</sup> Jensen/Meckling (1976), p. 308.

<sup>30</sup> See Wolff (1995), pp. 52 ff.

<sup>31</sup> See Carruthers/Morrison (1994), p. 45, fn. 24.

incentives to take proper care of the truck. The same problem applies to irrigation farmers, who are not wealthy enough to bear the risk of running an expensive irrigation system on the bases of their own resources.

Concrete measures designed to limit the moral-hazard risk include: co-ownership, bonus payments, task profiles that facilitate monitoring, team formation (for social control), and manipulating the agent's various alternatives for action (in order to prevent him from having more attractive options to the use of the resources available to him). A mechanism that offers an agent the best possible incentive is deemed to be **incentive-efficient**. In this case, the so-called **agency costs** are kept to a minimum. Agency costs include the principal's monitoring and incentive costs, the agent's signalling costs and the remaining welfare losses in comparison with the theoretical first-best solution<sup>32</sup>. If a complex network of service relations is organised completely by incentive-efficient contract mechanisms, the organisation as a whole operates efficiently since nobody has an incentive to divert any resources for other purposes. This is, in a fairly theoretical way, a preliminary answer to the question from section one: What is the secret of successful organisation?

*Moral Hazard risks are at the roots of one of the most pertinent problems of the management of associations, the so-called 'completed staff work'.<sup>33</sup> Larger associations like water districts, need to employ professionals to take over tasks that are very time consuming and require a high degree of professional specialisation that association members cannot provide. This situation is inherently prone to a Moral Hazard problem of the following kind: Professionals like District Managers, as agents, provide a service to the principal, the association, or, more precisely, to the governing board of the association. If decisions have to be made based on complex technological considerations, the president or the board of the association, as laymen, have to rely on the agent to provide them with timely and sufficient information on where and when interim decisions have to be made that influence the final result. However, the agents may take such interim decisions by themselves (following their own interest) and not inform the principle about them. On the basis of hidden information and hidden action, they may present the principal with a final solution that he or she can either accept or reject but never evaluate or change – thus the term 'completed staff work'.*

*The staff of the professional maintenance unit may, for instance, prepare a maintenance plan. In doing so, the staff might, on the basis of its professional judgement, make the interim decision to replace certain infrastructure parts with new equipment. But they may also decide to plan a level of maintenance well above the requirements. In presenting its maintenance budget requirements to the board of the irrigation district,*

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<sup>32</sup> See Jensen/Meckling (1976), p. 308.

<sup>33</sup> See Schwarz (1994).



*the professionals submit a ‘completed staff work’ that leaves little room for the board members to understand or even change underlying decision criteria – just like a patient of a highly specialised doctor can hardly judge the therapy, if he does not even understand the diagnosis.*

- *A solution to this problem could be provided by franchise systems like the one that the French Government is using in the Gascogne<sup>34</sup>. There is a 10-year mandate to the ‘Compagnie d’Aménagement des Coteaux de Gascogne’ (CACG) to provide a certain maintenance service. If this provider does not perform in the desired way, another provider will be chosen for the next term. Creating a credible ‘threat of competition’ between alternative providers will create an incentive for them to restrict themselves and not to deviate too far from the buyer’s interests when deciding upon the allocation of scarce resources. If wasteful suppliers fail to comply with the buyer’s interests, they lose their source of income.*

*Another example: The Central Directorate of the Jordan Valley Authority, responsible of the irrigation system in the Jordan Valley in the Kingdom of Jordan, faces the following problem of moral hazard<sup>35</sup>. The Central Directorate is supposed to allocate water to three main irrigation areas that are administered by three so-called ‘O&M-Directorates’. To be able to do this, the Central Directorate needs ex-ante information about the water demands of each of the three regions. We can consider the Central Directorate assuming the role of the client (the principle) that has entered into a service relationship with the O&M Directorates (the Agents). The service to be provided by the Agents includes the provision of accurate water demand information, which allows the Central Directorate to make proper water allocation decisions. It is, however, difficult for the O&M Directorates to provide accurate and up-to-date water demand projections because many farmers do not file their demands as requested. Thus, information about existing cropping patterns and actual areas irrigated is generally incomplete. This means that the O&M Directorates have to estimate their demands to a certain degree. For the Central Directorate, on the other hand, it is impossible to judge whether or not an individual O&M Directorate is intentionally overestimating the amount of water required in order to secure a larger share for itself. The Central Directorate does not have access to this ‘hidden information’ and hence cannot verify whether the information provided is correct or whether it has been manipulated for opportunistic reasons.*

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<sup>34</sup> See the example to ‘unilateral decision-making authority’ in section 2.2 of this paper, and Huppert/Hagen (1999).

<sup>35</sup> Huppert/Urban (1999).

*Thus the Central Directorate may fall prey to whichever O&M Directorate can play this game best. For this reason, it may end up giving priority allocation of scarce water to the O&M Directorate least in need. Yet, the O&M Directorate in question cannot be held accountable for such overestimations, since its financial and human resources are such that it can only predict about 80% of the demand accurately, while the rest has to be estimated. Therefore, the last 20% can be attributed to unpredictable external circumstances.*

*Solutions to these problems can be sought along the following lines:*

- The Central Directorate could intensify monitoring activities, trying to reach a better insight into the process of demand estimation.*
- The O&M Directorates could support the Central Directorate's monitoring efforts by actively creating transparency about the basis of their demand projections (signalling).*
- The O&M Directorates as well as the Central Directorate could try to create transparency about the demand of all three O&M Directorates, thus avoiding information asymmetries about the demand in the first place. (All of these approaches result in efforts to improve the existing Water Management Information System.)*
- The Central Directorate (backed by the Government) could raise the price of the water such that it reflects the scarcity conditions in Jordan. This would create incentives for the O&M Directorates and the farmers not to overestimate their demands.*

Maintenance management in irrigation lends itself to Moral Hazard problems by the very nature of the tasks involved. There are many opportunities to not provide or to misrepresent information required to make efficient maintenance decisions. If the party supposed to provide information is likely to benefit from not delivering the correct information, a Moral Hazard Problem is clearly predictable. However, once it is predictable, it can be prevented by establishing adequate contractual mechanisms, tying everybody's action to the results they generate. **The guiding principle is to try to link service level and quality to the respective actors' payoffs** (monetary and non-monetary). Thus unifying decision rights over input resources – coordination – with the right to collect payoffs in relation to the service benefit – motivation – from those decisions solves the problem (as illustrated by figure 2).

### 3.3 Contracting against Hold-Up

Another typical contract problem besides pre- and post-contractual information asymmetries can be caused by the **specific investments** that one of the partners in a service relationship is required to make. If one of the partners involved has, for example, procured a machine for the particular service relationship which he cannot use for any other purpose, there is a real danger of his becoming economically dependent on the other partner. In irrigation management: After a farmer has brought out the seeds, he is absolutely dependant on a timely and sufficient water supply. Even though there is no information asymmetry involved, the farmer might, after he made this investment, be exploited by the delivery agency, for instance, by being asked for a 'tip'. One-sided dependencies between partners such as this are known as **hold-ups**. On the one hand, specific investments can considerably enhance the overall operating result. On the other hand, they can be exploited by the non-dependent party for that party's own opportunistic aims, thus exposing the dependent actor to the very real danger of losing all of his benefits from the transaction relationship. Consequently, this kind of transaction relationship is unattractive for potentially dependent partners. Indeed, since exploitation is anticipated, such relationships are not ventured into unless some way is found to ensure that no exploitation can take place.

*In irrigation, many deficiencies including maintenance and repair problems can be traced back to such 'hold-up' situations (not only the farmers' dependency on water). Situations where special 'tailor-made' equipment has been acquired that is unique on the market (e.g. particular equipment for automatic downstream water control; special sets of pumping gear etc.) are examples of this problem. When the irrigation organisation has already heavily invested in such equipment it is at risk of losing parts of these investments or of needing expensive adjustments in case it tries to change the supplier. Hence this is a situation where the high 'specificity' of the investment may be exploited by the original supplier who might attempt to demand excess prices for spare parts, servicing or additional equipment. However, specificity does not only refer to material assets. In many cases, it is know-how, skills or decision-making power that is specific and, thus, the root of "monopolistic" power to exploit other parties.*

In tackling 'hold-up' problems of this kind, suitable forms of organisation for transaction relationships are chosen along the following lines: **The greater the degree of standardisation of a given exchange of goods or services, i.e. the fewer specific investments there are to be made, the more suitable a market approach will be.** Because of the high level of standardisation, there are no information requirements that cannot be covered by prices. At the same time, the transaction partners do not have to enter into longer-term commitments, because they can be exchanged at any time at minimum cost. Consequently, unilateral dependencies are not to be expected. Thus,

with regard to the exchange of standard services, it can be deduced from the simple line of argumentation above that market-based exchanges generate fewer transaction costs than more integrated organisational forms, for example the hierarchy of one big organisation. Integrated, hierarchical organisational forms are considered more efficient in the case of highly specific tasks. Hierarchical forms of organisation constitute a stable, long-term framework, within which the requisite production factors can be acquired or generated without the use of resources to secure specific investments against opportunistic behaviour by third parties. The less specific a service relationship is, however, the less a hierarchical, stable framework of this kind is required. Indeed, it becomes increasingly inefficient.

### **Box 3: The Hold-Up Problem**

A hold-up problem results from a unilateral specific investment. This results in a dependency of the investing party on the good-will of the other party. The non-investing party can then try to extract all the benefits from the relationship for himself. An integration of all assets required into unified ownership or 'hostages', which turn one-sided into mutual dependencies, are solutions to hold-up problems.

One way to reduce the risk of being held up is to redefine the task at hand in order to **reduce the required degree of investment specificity**. Sometimes a respecification of the service required or a change of technology can reduce the degree of specificity enough that it can be procured on a competitive market. Alternatively, respecifying and subdividing the project might help to create a market. For instance, instead of just hiring staff to run a complete public transport system in a given area, the authorities could also specify a certain service, e. g. running a certain amount of passenger trains, to be auctioned off for a limited period of time. Thus, different entrepreneurs will compete for the project by offering the service required at the lowest possible rate.

Can similar procedures be applied to tasks in irrigation management? It has been done before, for example in France<sup>36</sup>. Competition is the driving force for efficiency in markets. But competition can also help to render agents within hierarchical systems more productive, for instance, by means of relative performance evaluation and remuneration. **If competition between alternative agents can be established, it will most likely increase the efficiency of the process at stake.** Unfortunately, this is not always possible at reasonable cost.

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<sup>36</sup> See the example to 'unilateral decision-making authority' in section 2.2 of this paper, and Huppert/Hagen (1999).

Contractual defence mechanisms to protect the client against the risk of hold-up lead to the '**vertical integration**' of both partners' assets; i.e. their investments come together in one organisational fold, so that potential conflicts of interest are put aside in favour of a joint profit objective. The reason why hierarchical organisational forms protect specific investments is that all specific assets required in the process are owned by the 'client'. Allocating more ownership rights to the water users is, hence, a good idea because it protects their specific investments. But vertical integration does not automatically solve the problems of inefficient internal organisation, which we often find in irrigation management. Bigger organisational entities are prone to moral hazard problems, which might outweigh the advantages of investment protection. Furthermore, there is also the possibility of intra-organisational hold-up problems (e.g. intraorganisational veto-positions). Thus, there is a trade-off between the problems a hierarchical organisation solves and the new ones it creates. The problem in maintenance management is, very often, to create less rather than more hierarchy.

Creating a '**hostage**' can be another solution to hold-up problems: the party that does not have to make a specific investment offers the one that does some form of collateral, a 'hostage' as it were, as a service guarantee. A hostage can be considered as a voluntary specific co-investment, which turns a unilateral dependency into a bilateral or mutual dependency. This has the effect first of underlining the **credibility** of the non-investing party's good intentions (as a signal) whilst secondly offering the party making the investment an **economic safeguard** against any attempts at exploitation by the non-investing actor. A 'ditch rider' or 'water bailif' responsible to organize canal maintenance may create a hold-up situation for farmers who are in need of water after having done pre-investments for seeds and land-preparation. However, if the 'bailif' owns property at the end of the canal, he will have strong incentives to make sure, that the canal is well maintained and upstream losses are minimal.<sup>37</sup> His own fields provide the hostage for the other farmers depending on his service.

Hostages do not necessarily have to come in the form of material assets. In some cases, an agent's reputation might serve as a sufficient bond. This, of course, requires that he has a positive reputation to begin with.

Many contractual relations will be somewhere between 'market' and 'hierarchy'. The service required might not be suitable for sufficient standardisation to be procured on an anonymous spot-market, e.g. clearing a canal after heavy rainfall. Yet, hiring somebody to perform the task using vertically integrated assets might also be inadequate. Thus, many contracts will rely on some kind of 'hostage' mechanism.

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<sup>37</sup> See the example to 'shot-gun clause' in section 2.2.

#### **4. Summary and Outlook**

Each type of exchange-system and human interaction can be described as an explicit or implicit contractual relationship. The provisions of the contract specify the mutual claims and obligations in a relationship that is, in the end, beneficial to all parties. If the process of fulfilling these claims and obligations can be designed in a verifiable and enforceable manner, all parties will contribute and receive whatever it takes to make everybody better off. Unfortunately, it is not always possible to write a contract specifying all the details the relationship entails. Not all exchange contracts are complete 'by birth'. Long-term relationships will always be incomplete in as far as the future is not completely predictable and there are limits to the amount of information an actor can gather and process. Information asymmetries as well as unilateral specific investments leave room for opportunistic behaviour. If the people involved in irrigation schemes have private interests other than the good performance of the scheme, there might be incentives for actors to try taking advantage of other parties. This is not a question of 'good' or 'bad' people but a question of efficient or inefficient organisation design. It will usually be easier to change rules than to change people.

In order to cope with the problems resulting from contractual incompleteness, we, first of all, classified different types of contracts. Classical contracts are contracts which are complete 'by birth' in a given legal and cultural environment. Neo-classical contracts are contracts which can be made more complete by contractual design. Neo-classical contractual provisions can help to make contracts self-enforcing so they are less dependant on external enforcement mechanisms, such as courts of law. Relational contracts, however, are incomplete by nature. They depend on the personal relationships and common values of the actors who enter into them.

A more detailed analysis of incomplete contracts was then provided, distinguishing between adverse selection, moral hazard, and hold-up risks in exchange relations. Avoiding information asymmetries or unilateral specific investments, or co-aligning the actors' incentives are the ideas behind all mechanisms to cope with these problems. The following Figure summarises the three types of contractual problems and the approaches designed to achieve a systematic solution.

**Table 1: Types of Contractual Problems in Service Relationships**

	<b>Adverse Selection</b>	<b>Moral Hazard</b>	<b>Hold-Up</b>
<b>Reason for risk</b>	Asymmetrical information status	Asymmetrical information status	One-sided specific investment
<b>Reason for the asymmetrical information status</b>	Lack of information coupled with uncertainty	Completely informed and certain	(Information status is not the problem)
<b>Time of occurrence in relation to signing of contract</b>	Ex ante	Ex post	Ex post
<b>Theoretical contractual approach to solving problem</b>	Selection mechanisms (or reduction of information asymmetry)	Incentive systems (or reduction of information asymmetry)	Vertical integration or generation of mutual dependencies (or avoiding specific investments)
<b>Examples</b>	<ul style="list-style-type: none"> <li>• Signalling via certificates</li> <li>• Screening via contract menus or tests</li> </ul>	<ul style="list-style-type: none"> <li>• Bonus payments</li> <li>• Job design and decentralisation</li> <li>• Team formation</li> <li>• Co-ownership</li> <li>• Manipulating 'Outside Options'</li> </ul>	<ul style="list-style-type: none"> <li>• Unified resource ownership</li> <li>• Exchanging 'hostages' by providing some form of security</li> </ul>

In reality, one will often find combinations of these problems. But one will equally often be able to find a remedy which can cope with more than one of these risks. Otherwise, we abundance of remedies might be created.

Even though it is not particularly easy to apply all these rather theoretical ideas to a given situation of irrigation service provision, a lot can be gained by simply stopping to ignore the motivational aspects of service provision altogether. In many cases, there has been too much emphasis on the financial and technological aspects of the service at stake. More 'human-oriented' concerns have often been neglected. The hope remains, that more of this organisational logic will eventually be applied to maintenance efforts, not only in irrigation.

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