

## “Principal-Agent” problems in irrigation – inviting rentseeking and corruption<sup>1</sup>

### “Principal-Agent”- Probleme in der Bewässerung – Wegbereiter für Rentseeking und Korruption<sup>1</sup>

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#### Stichworte

Bewässerung, Bewässerungsmanagement, Korruption

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#### Zusammenfassung

Die unzureichende Effizienz von Bewässerungssystemen in Entwicklungsländern ist geradezu sprichwörtlich. Im Rahmen der zunehmend kritischen Wasserknappheitssituation in vielen Regionen der Welt kommt der Effizienz der Wasserverwendung in der Landwirtschaft eine spürbar wachsende Bedeutung zu. Konventionelle Bemühungen zur Steigerung der Leistungsfähigkeit von Bewässerungssystemen konzentrieren sich auf die technische, finanzielle und organisatorische Leistungsfähigkeit der Bewässerungsorganisationen und – wichtiger noch – der Wassernutzer. Solche Ansätze übersehen meist einen Problembereich, dem solche Effizienzdefizite in vielen Fällen ursächlich zuzuschreiben sind. Dieser hat damit zu tun, dass suboptimale Effizienzen in der Wasserbereitstellung nicht selten dem Eigeninteresse einflussreicher Akteure entgegenkommen. Probleme dieser Art sind keineswegs auf staatlich verwaltete Bewässerungssysteme beschränkt. Sie sind in ähnlicher Weise anzutreffen, wo Bewässerungspersimeter in der Eigenregie von Wassernutzern betrieben werden. Es ist deshalb von hohem Interesse, der Analyse und Prävention solcher Probleme – die Rede ist hier von sogenannten „Principal-Agent“-Problemen – vermehrte Aufmerksamkeit zu widmen. Principal-Agent-Probleme sind Unzulänglichkeiten in der Ausgestaltung von Verträgen oder nicht-vertraglichen Vereinbarungen zwischen den Partnern in einer Austauschbeziehung. Der Artikel widmet sich zunächst der Darstellung der wesentlichen Merkmale solcher Defizite und zeigt dann an Beispielen auf, in welcher Weise der Bewässerungssektor davon betroffen sein kann. Er schließt mit Hinweisen auf mögliche Vermeidungsstrategien.

#### Abstract

Efficiency deficits in irrigation management are endemic in many countries. Conventional approaches to raising the level of performance of irrigation schemes focus on improvements to the technical, financial and/or organisational capacities of the irrigation agency and – more importantly – of the water users. Such approaches often overlook a number of significant problems which cause inefficiencies in the first place. These problems relate to the fact that efficiency deficits may well be in the interests of most of the

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influential stakeholders involved. Since problems of this kind may emerge both in systems administered by a state agency and in farmer managed irrigation systems, it is essential to focus more attention on their analysis and prevention. The paper addresses the so-called "principal-agent" problems, which are a major factor in this context. Such problems are specific deficiencies related to the contracts and agreements between the partners of an exchange relationship. After presenting their essential characteristics, examples are provided from the irrigation sector. Finally, coping strategies are highlighted.

## 1. Introduction

Recent irrigation reforms in the Indian state of Andhra Pradesh have produced a rather astonishing result in the Kakatiya canal reach of the Sriramsagar irrigation scheme. With the firm establishment of water user associations (WUAs) and some further reform steps in 1997, the actual area under irrigation increased from 37,450 hectares in 1996 to 95,900 hectares one year later, reaching 139,600 hectares in 1998 (MARUTI, 1999). What had happened? How was that tremendous "achievement" possible? Was the enormous increase in irrigation activity due to enhanced motivation after farmers had taken over certain management responsibilities?

Certainly, such results have to be judged with caution. Land use records were updated during this period and made much more inclusive. Also, in many cases, only a single irrigation in tail end areas was reported as "irrigated area" inflating the figures by ignoring the quality of irrigation service received by users. And finally, because little or no maintenance had been carried out hitherto in the Sriramsagar project before, the impacts of water users clearing blockages were exceptionally large. However, local officials of the State "Irrigation and Command Area Development Department" (ICADD) estimate that revisions made to the revenue records were the most important source of the increase (SVENDSEN and HUPPERT, 2000).

In case this observation is correct, it seems reasonable to assume that the following process took place after the creation of WUAs:

Before the reform, irrigation fees were collected by "village revenue officers" for a certain canal reach on the basis of the area irrigated. The revenues collected had to be handed over to the revenue department. Water users did not have access to revenue records and hence could not verify the amounts handed in by the collectors. At the same time, the revenue department did not have the means to carefully monitor and control the areas irrigated in a certain period, and as a result it had no accurate information on the amounts collected. This structural deficit opened doors to opportunistic behaviour of the part of the village revenue officers. There was a great temptation to hand in amounts of money substantially lower than the amounts actually collected - a temptation not easy to resist given the poor salary level of state employees. Hence, the figures in the revenue records did not at all reflect the actual area under irrigation. With the establishment of WUAs, the water users gained access to the

revenue records. More importantly, the reformers "have implemented several steps to modify the incentives relating to irrigation fee assessment and payment. The most important is tying WUA maintenance grants to the area registered with the Revenue Department".

Consequently, "the WUA receives a larger maintenance grant due to the expanded irrigated area on the tax roles. The benefit for the Treasury is an increase in revenue to the state" (SVENDSEN and HUPPERT, 2000). Thus, the enormous increases in area irrigated following the creation of WUAs are due to a limited extent only to the increased efforts of the water users. These increases are mainly the effect of institutional changes that put a stop to the corrupt practices of some of the stakeholders involved.

Problems like these are common in large irrigation systems where the institutional set-up leaves room for opportunistic behaviour, and where there is little risk of discovery and sanctions being imposed. UL HASSAN (1999) reports from large irrigation schemes in Pakistan that "...Financial indiscipline in terms of corruption in the management of canal systems has emerged as the most important issue that has led to a widespread mistrust between the canal managers and the farmers." He refers to BANDARAGODA and FIRDOUSI (1992) who found corruption to be widespread in the assessment and collection of revenues, construction and maintenance works related to irrigation and drainage, and water allocation and distribution.

One important lesson can be drawn from the reform experiences in Andhra Pradesh. Faced with system inefficiencies in irrigation, it is of utmost importance to analyse the incentive system which influences the behaviour of the various actors.

Irrigation management often suffers from adverse motivational structures inherent in the organisational design of the irrigation system. This is a fact often overlooked when analysing the causes of suboptimal performance of irrigation schemes. The aim of this paper is to draw attention to a particular range of problems - the so-called "principal-agent" problems. These are particularly common in medium and large scale irrigation systems all over the world and result in highly dysfunctional motivation patterns on the part of the key players. Such problems invite rentseeking behaviour and corruption, and tackling such problems is a delicate matter. This is why they tend to be "overlooked" in problem analyses, despite their visibility in everyday system operations. It is important to emphasise that structural problems like these will tend to encourage opportunistic behaviour wherever they occur - independent of the regional or cultural context in which a particular organisation operates. Hence, it is essential to be aware of such problems and to devise ways how to circumvent or counteract them.

The paper firstly makes some general remarks on motivation and coordination, and then proceeds to explain the characteristics of principal-agent problems.

Following this, the significance of such problems in the irrigation sector is highlighted and, finally, suggestions are made for coping with these problems.

## 2. Motivation and coordination – key factors in system design

A major insight of recent discussions on irrigation management concerns the nature of irrigation water delivery and system maintenance: they need to be looked upon as a service provision and not simply as the performance of a technical task (HUPPERT, 1989; HUPPERT and URBAN, 1998; MALANO and VAN HOFWEGEN, 1998; HUPPERT et al., 2001). Such irrigation services 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. If we look at irrigation water delivery and 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. 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.

One 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 the activities of an organisation or of a project (MILGROM/ROBERTS, 1992, 1995a). Coordination implicitly assumes that everybody involved in a particular project is intrinsically motivated to strive for the targeted project goal. However, achieving some abstract service target, e.g. increasing the agricultural production of the irrigation system 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, all people involved – not only the farmers - 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. Coordination addresses the question: “Is everybody able to do what is required

to reach a common goal?”. Motivation addresses the question: “Do people actually want to do what they are required to do?” Of course, there are many coordination problems in irrigation management, e.g. technological ones. However, it looks like a lot of problems are not related to the ability or capacity to get things done but rather to discrepancies between individual and collective goals, i.e. motivation problems. One theoretical approach to address these in an analytical manner is the principal-agent approach.

## 3. Principal-agent problems, corruption and rentseeking

Generally speaking, principal-agent problems are deficiencies related to contracts and agreements between exchange partners, e.g. between the provider and the client of goods or services (e.g. MILGROM/ROBERTS, 1992). Problems of this kind are due to the fact that the provider side has more information about the provision process than does the client side. Such a so-called “information asymmetry” is, on the one hand, both necessary and desirable since it reflects the division of labour and the specialisation of the provider. On the other hand, though, the actor who is not as well informed, the “principal” (in our case the client of the service delivery) runs the risk of being exploited by the better informed provider side, the “agent”. Whether or not the agent will behave in such a manner depends on the nature of the “contract”<sup>1</sup> between the two parties.

There are three kinds of principal-agent-problems that need consideration: The so called “moral hazard” problem, the “hold up” problem and the problem of “adverse selection”. We will look at each of these problems in greater detail in the following paragraphs. Before doing that, it may be helpful to stress the point that analysing principal-agent-problems may help to understand the logic of corruption. With reference to principal-agent-theory, della PORTE and VANNUCI (1999) define that there is corruption

1. “where there is a secret violation of a contract that, implicitly or explicitly, specifies a delegation of responsibility and the exercise of some discretionary power.
2. when an agent who, against the interests or preferences of the principal, acts in favor of a third party, from which he receives a reward.”

“Rentseeking” may be defined as the striving for particular types of welfare transfers unmatched by any corresponding entrepreneurial or productive labour. It can also be perceived as a process of interactions between rent seekers and rent providers (RENGER and WOLFF, 2000). For example, principal-agent problems and the related

<sup>1</sup> The term „contract“ needs to be understood in a wide sense here and may relate to formal or informal contracts, to mutual agreements, common, practices, laws, rules, regulations or to a mixture of such coordination mechanisms.

intransparency or dependency of the partner may allow the agent as the rent seeker to behave opportunistically and – without acting illegally - give preferential treatment to a third party.

#### 4. Moral hazard problems

##### 4.1 Identifying Moral Hazard

An uneven distribution of information occurring after the contract has been entered into entails a moral-hazard risk (MILGROM/ROBERTS, 1992, WOLFF, 1995a, b). Post-contractual information asymmetry can actually relate to two types of information.

First, it can refer to information on contractually endogenous influences affecting the success of the contractual relationship. Such influences relate to the behaviour and the concrete activities of the agent. When this type of information is intransparent and unpredictable to the principal, 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 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 (ARROW, 1985). 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, i.e. the gain of material or immaterial advantages without being engaged in any productive activities. 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 outcome 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 to the principal even if he 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.

##### Box 1: *The Moral Hazard Problem*

A moral hazard risk may arise in situations where 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.

##### 4.2 Moral hazard problems in irrigation

The example most often cited when referring to moral hazard situations in irrigation relates to an irrigation engineer or ditch rider who maintains unpredictable service delivery, i.e. the farmer does not know in advance when and how much water he will receive (see e.g. the "classic" paper of Robert WADE, 1982). The engineer has information about water availability that is not accessible to the farmer. This "hidden

information“ enables him to use the situation to his advantage and extract illegal sidepayments for a service he is supposed to provide anyway. While a single case of such “petty corruption“ may be of little relevance as compared to large-scale corruption in the context of large infrastructure investments, it may seriously hamper efforts to improve the efficiency of irrigation water delivery if it becomes endemic. Since such a set-up may provide additional income to most of the (generally underpaid) irrigation professionals, and since large and wealthy farmers will get preferential allocation, the system can degenerate into a very stable condition of inefficiency. In fact, none of the influential actors (the irrigation engineers and the large farmers) will have any motivation to change this situation – on the contrary. It is clear that any effort to improve irrigation system performance by means of technical improvements or managerial prescriptions will stand little chance of success unless such motivational structures can be changed as well.

Moral hazard problems in irrigation may also accompany complex engineering services, e.g. those required to maintain and repair pumping stations or to rehabilitate complicated hydraulic structures in irrigation canals. Often, the agent is the one who has to specify the demand for the engineering services 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, e.g. from the farmer’s perspective, this lack of transparency has a considerable impact on his control over the service: he loses part of his “client sovereignty” and becomes dependent on the judgement of the service provider, the engineers. In most cases, the farmers are not really able to determine whether any additional technical works recommended by the engineers are truly necessary, or whether the engineers are acting purely out of self-interest. With this type of “offer-induced demand”, the farmers will have great difficulty in keeping service delivery in line with their actual needs.

At first glance, one may think that such problems occur in large “agency-farmer managed systems“ only, i.e. in irrigation schemes where an irrigation agency manages the main and secondary system and holds the authority to determine and implement the major structural improvements. However, even the transfer of such authority to the farmers does not necessarily exclude moral hazard problems of this kind. In contrary: 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” (SCHWARZ, 1992). Larger associations like water districts, need to employ specialised members or even professionals to take over tasks that are time consuming and require a high degree of professional know-how 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 and 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 principal 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 a 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 actual requirements. In presenting its maintenance budget requirements to the board of the irrigation district, 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. Following this line of action, the maintenance staff engages in “rent seeking” activities: trying to manipulate the decisions in such a way that they will ensure or even enhance their future job security and thus provide a (completely legal) “rent” without having engaged in any additional productive activity.

#### 4.3 How can moral hazard problems 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” (JENSEN/MECKLING, 1976). 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.

Concrete measures designed to limit the moral-hazard risk by way of redressing the asymmetrical information status include : task profiles that facilitate monitoring, management information systems or else co-ownership and team formation (for social control). Ways to improve incentives and bring the agent's interests in line with those of the principle may be bonus payments, prospects for future contracts or contract improvements 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 remarkable way of redressing the asymmetrical information status in water user associations has been reported from traditional irrigation schemes in the Andes (HUPPERT and URBAN, 1998). Irrigation farmers in the Bolivian Andes still apply the principle of "rotating tasks" ("cargos rotativos"). Members of different age groups are responsible for different tasks in the operation and maintenance of the irrigation system. This age-dependant rotation means that in the course of time everyone becomes familiar with all the essential tasks needed to keep the system functional. At the same time, it prevents one particular person from gaining specialised knowledge which is not available to the others. In other words, it prevents the emergence of an asymmetrical information status and hence the existence of moral hazard situations.

An exemple of an incentive based prevention of potential moral hazard risks in irrigation is provided by franchise systems like the one that the French Government is using in the Gascogne (HUPPERT and HAGEN, 1999). There is a 10-year mandate to the "Compagnie d'Aménagement des Coteaux de Gascogne" (CACG) to provide a certain maintenance service to water users in irrigation systems. If CACG as a 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 act as 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.

But how can one redress the moral hazard situation mentioned above, where an irrigation engineer or ditchrider tries to keep water delivery unpredictable to the farmer in order to secure illegal payments? Clearly, functioning management information systems may help to rectify such deficiencies. But what, if it is not in the interest of the engineers to make such a system function effectively? A 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 may solve the problem . However, this must be

coupled to the empowerment of the farmer-clients so that they gain access to relevant information, especially in cases where external influences (such as varying water availability) make it difficult to establish a fixed level of service (see SVENDSEN and HUPPERT, 2000).

Readers who are eager to learn how this can be done in practice may refer to lessons learned with recent irrigation reforms in Andhra Pradesh, India. SVENDSEN and HUPPERT (2000) report that previously, due to intransparencies of the kind described above, engineering staff could play one farmer off against another, opening up opportunities to secure and bid up side payment for preferential treatment in water delivery. However, irrigation reforms introduced two important changes: First, Water User Associations (WUA) were established at the level of the minor canals and committees were formed on the next higher level of canals (Distributory Committees). Secondly, specified on-site engineers from the responsible irrigation agency were allocated new roles as so-called Competent Authority (CA). They are charged with supporting the Committees and WUA's in technical matters. Under the new set-up, the Distributory Committee interacts with the Competent Authority to plan a water delivery schedule for all the WUA's represented in that Committee. Thus, water availability and water allocation are made transparent – also for the individual WUAs. SVENDSEN and HUPPERT (2000) observe: "The farmers now have a hand in arranging service delivery, a process which had previously bypassed them entirely. Their only function under the old setup was to use whatever water they received to grow crops. The change is important, in terms of incentives, because the users of the service are the ones with the strongest conceivable incentive to arrange the highest possible quality of irrigation service. They replace, in the function of arranging the water delivery schedule, irrigation technicians and engineers who have little or no stake in the quality of service they provide, and thus little incentive to act in the interests of the farmers." In this way, the farmers' new role in arranging service provision helps to close off the avenues for rent seeking behaviour open to water delivery staff.

## 5. "Hold-up" problems

### 5.1 Defining hold-up situations

Another typical contract problem can be caused by the specific investments that one of the partners in a service relationship is required to make (WILLIAMSON, 1985; HART, 1995). If one of the partners involved has, for example, procured a machine in attendance of a 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. 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.

### Box 2: *The Hold-Up problem*

A hold-up problem may result from a unilateral specific investment awaiting the upcoming service delivery. From this follows a dependency of the investing party of the good-will of the service providing party. The non-investing party can then try to extract additional benefits from the relationship for himself.

### 5.2 Hold-up situations in irrigation

In irrigation management hold-up problems are common: After a farmer has done his land preparation and 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". If hold-up problems of this kind are coupled with information asymmetries and moral hazard problems, this will create situations where farmers – especially the smaller water users in the tail reaches of canals who lack the resources to „play the game“ – loose motivation to engage in intensive irrigation farming. External evaluations often interpret such situations as "lack of technical knowledge" on the side of the farmers and devise training programs, predicable to little avail.

In irrigation, also many deficiencies including maintenance and repair problems can be traced back to hold-up situations. 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 loosing 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.

### 5.3 Toward solutions for hold-up problems

Increasing the degree of standardisation of a given exchange of goods or services (or reducing the required degree of investment specificity) is an important means of tackling hold-up problems of the kind described above. Because of the high level of standardisation, dependency on a particular supplier decreases. The irrigation organisation that uses standard pumping equipment will hardly have to face a hold-up situation as described above. Thus creating competition is one approach to avoid hold-up problems.

Contractual defense 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. In cases like those described above, where an irrigation farmer faces a hold-up situation due to his preinvestments in land preparation and seeds, such vertical integration will amount to a transfer of water delivery functions to the water users themselves. One may expect that such arrangements will help to overcome the hold-up risk. While this may be the case in many instances, one must be aware that vertical integration does not automatically solve the problems of inefficient internal organisation. If the transfer process creates bigger organisational entities within the water user organisation, moral hazard problems, as described above may come into play. Furthermore, there is also the possibility of intra-organisational hold-up problems, e.g. intraorganisational veto-positions. Head-end farmers may veto water delivery to politically weaker tail-end farmers who have already made investments awaiting water delivery. Thus, there is a trade-off between the problems a vertical integration solves and the new ones it creates.

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. As mentioned above, a ditch rider or water bailif responsible to organize water delivery 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 below the same canal outlet and downstream of the other farmers, he will have strong incentives to make sure, that the canal is well maintained and upstream losses are minimal and that water delivery performance is high. 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.

## 6. "Adverse selection"

### 6.1 Understanding 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 and/or the real quality of the service the agent is offering (AKERLOF, 1970; SPENCE, 1973; STIGLITZ/WEISS, 1981).

A well known example of such a situation is a used-car dealer (AKERLOF, 1970). 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.

#### Box 3: *The Adverse Selection Problem*

An Adverse Selection Risk may arise when 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.

### 6.2 Adverse selection in irrigation

Adverse selection risks in irrigation may occur both on an everyday operational level and the overall strategic level.

On the operational level, these risks can take many forms: similar to the above mentioned dealer of a used car, sellers of irrigation machinery, equipment or pumping gear may not reveal "hidden characteristics" of the items sold. They could use their expertise to recommend equipment that is too sophisticated, too expensive or simply not ideal for the job intended. However, since most dealers in rural areas rely on a long-term relationship with their water user clientele, such instances may be less frequent than, for example, in the used-car market in towns.

Much more important are the potential adverse selection risks that relate to strategic decisions to engage in irrigation in the first place, or to maintain subsidies to irrigated agriculture. In many countries influential farmer groups, their political representatives and the responsible irrigation agency combine to lobby for new investments and/or for the maintenance or even expansion of irrigation subsidies. These actors may be inclined to recommend and favour irrigation-sector investments even when they are aware of a whole range of problems related to the management of irrigation systems that will adversely effect irrigation performance. Similarly, farmer groups may lobby for the maintenance or even expansion of subsidies, even though they know that cost-covering irrigation charges represent only a small fraction of the benefits they would receive from the water allocations (compare the classic paper of REPETTO, 1986 on rent-seeking in irrigation). If lobbying is successful and such (adverse) selection decisions are made, the benefits to the principal, the state, will be negative compared to other selection options. However, the farmer lobby (not necessarily all the farmers) will be able to charge substantial rents, since new investments for further irrigation development will push land prices upward and increase their income from agriculture. Similarly, irrigation subsidies will provide them with the opportunity to reap a double economic rent: firstly, the rent resulting from the difference between the value of the water to the farmers and the cost-covering fees they should pay, and, secondly, the extra rent as a result of pushing through additional subsidies.

There are probably also examples of profitable transactions which were not concluded because one party did not trust the service or good offered by another party – although trust might have been justified. This is difficult to establish however, even ex post. One possible indication in this respect might be the fact that international donors rarely commit to funding maintenance costs of irrigation systems while they are often quite prepared to finance premature rehabilitation measures. They may not want to instil a "receiver mentality" on the part of the farmers by financing maintenance expenditure. However, an additional reason for not financing maintenance, even of large hydraulic infrastructure, may be a lack of trust in their



local partners to use this regular, long-term flow of money as planned. An adverse selection may be the result, involving rehabilitation measures – at a substantially higher cost.

### 6.3 Preventing adverse selection

In order to ward off efficiency losses in exchange relationships and to help to pair up suitable partners after all, strategies of using either signalling or screening mechanisms are most common. With signalling, the provider/agent bears the costs, for example, by providing certificates, 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 dealer of used pumps backs a quality claim with a 3-year warranty that puts the risk of failure on him, the promise of quality is credible. If he merely states, "This pump will last forever!", he is engaging in cheap talk.

With screening, the principal takes the burden to gather sufficient information with respect to the provider and to the offer so that he may not fall into adverse selection traps. This may be the only option for the higher decision making level (the principal) in the case of the lobbying of irrigation farmers (the agents) for new irrigation investments or for the maintenance of irrigation subsidies. However, (not only) in theory, the higher decision makers may "play the game" and turn legal (even if illegitimate) rent-seeking attempts into practices of corruption: they may be aware of the potential gains in rent and ask their share in exchange for appropriate decisions. These decision makers as agents who are supposed to provide sound decision making on irrigation investments/subsidies to their "client", the civil society (as principal) use the fact that such decisions and the subject matter they deal with are highly intransparent to the public. For civil society, this again corresponds to a moral hazard situation that is particularly prevalent where large sums of investment are at stake.

**Table 1: Types of Principal-Agent Problems and Solutions in Service Relationships (adapted from WOLFF and HUPPERT, 2000)**

	'Adverse selection'	'Moral Hazard'	'Hold up'
Type of Problem	Risk of a suboptimal selection of a service provider/Agent by the client/Principal	Risk of insufficient service provision due to opportunistic behaviour of the provider/Agent, who, however, cannot be held accountable	Particularly strong risk of 'Moral Hazard' due to pre-service investments incurred by the client/Principal and resulting crucial dependence of the client from the service provision
Origin of Problem	Information Asymmetry	Information Asymmetry	One-sided dependency caused by specific pre-service investments (sometimes in combination with information asymmetry)
Causes behind Information Asymmetry	Qualification of service provider/Agent and quality of service provision not	Detailed activities of provider/Agent and external influences on these activities not known	Detailed activities of provider/agent and external influences on these activities not known
Time when Problem is Acute	Ex ante	Ex post	Ex post
Theoretical Approaches to Problem Solution	Create/improve selection mechanism	Create/improve incentive systems that counteract 'Moral Hazard'	Vertical integration or creation of mutual dependencies
Examples	- 'Signaling' or exposing proof of qualifications or information on service delivery	- Improve return/compensation for service delivery - Team building - Manipulation of 'Outside Options'	- Create joint property of resources for agent and principal - 'Exchange of hostages' or handing over security to Principal

## 7. Summary and Outlook

In a world of growing water scarcity, achieving efficiency improvements in irrigated agriculture is a key challenge. Common reactions to this challenge include the improvement of technical, financial and/or organisational capacities of the involved stakeholders and, to a growing extent, the transfer of management responsibilities to the water users. While such efforts may be justified in many cases, they run the risk of overlooking some of the major causes of inefficiency in the first place. This paper has highlighted principal-agent problems as one of the major impediments to

efficiency improvements, since they pave the way for rent-seeking activities and corruption.

The analysis of principal-agent problems is simple when irrigation water delivery and maintenance are perceived as services to be provided in a system of multiple actors. The challenge here is to look at the exchange relationships between sets of such actors and to examine the mechanisms which are supposed to ensure coordination and motivation. Are the mechanisms that coordinate interactions between farmers, revenue collectors and the revenue department such that optimal revenue remittal to the treasury is in the interest of all the players? Or can the lack of transparency be used to evade proper control? Do irrigation engineers have an incentive to provide high quality services to the farmers? Or can they engage in the preferential allocation of services in order to secure illegal payments? Are the contract details with commercial firms such that they are unable to exploit information asymmetries to their own advantage at the expense of the client? Apart from presenting an impressive example of how to cope with principal-agent problems in irrigation, the reforms in Andhra Pradesh have made another point fairly clear. They have shown that the necessary precondition for solving problems of this kind is a firm government commitment to promote these kinds of solutions. Without such an "enabling environment", irrigation managers may have little interest in solving potential principal-agent problems and improving irrigation efficiencies - at the expense of their own advantages.

Still, we believe that raising such questions will help to promote efficiency improvements in irrigation. Growing water scarcity constraints certainly will induce many donors and governments in the near future to raise issues like these more stringently even if that may not be in the interest of some of those involved.

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