Summary of empirical results and a proposal for the initiation of capacity building workshops in the Doukkala

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Summary - A short empirical survey was conducted in the Doukkala irrigation scheme in Morocco in order to determine the institutional constraints which today impact irrigation efficiency. Since water scarcity is the prevalent problem in the Doukkala, which a modernisation to a certain degree should overcome, it was assumed that the present institutional constraints on irrigation efficiency are those which are at the same time potential future institutional constraints for an effective agricultural modernisation in the Doukkala. The identified constraints have manifested themselves in the mental attitudes of the farmers towards the access to water and the distribution and application efficiencies of irrigation. On the basis of the results of this study, it is proposed to organise capacity building workshops in order to facilitate collective modernisation in this irrigation scheme.

Key-words : Maroc, Doukkala, modernisation, disengagement, Office, irrigation scheme, participation of users, efficiency, water turn, transfer of technology, crop choice, role game playing, capacity building

1 Introduction

The aim of the project WADEMED (Water demand management knowledge base in the Mediterranean) for the perimeter of the Doukkala is to contribute to the debate of a collective modernisation of agriculture to increase irrigation efficiency and thus agricultural productivity under constrained resource conditions. This increase in agricultural productivity and irrigation efficiency requires certain institutional preconditions. If agricultural modernisation is foremost understood as a harmonized application of technology, in general, socio-economic parameters like, e.g., farm size (Diederen P. *et al.,* 2003[1]), capital availability (Foltz Jeremy D., 2003[3]), security of tenure (Pingali, Prabhu L. *et al,* 2001[4]) or the educational background, are taken as determinants on the effective application of productivity enhancing or water saving technologies. The short empirical survey which contributes to this report only searched for those institutional constraints which today impact irrigation efficiency. Since water scarcity is the prevalent problem in the Doukkala, which a modernisation to a certain degree should overcome, it was assumed that the institutional constraints on irrigation efficiency are those which are at the

same time potential future institutional constraints for an effective agricultural modernisation in the Doukkala.

"Institutional constraints" here are incorporated as a composition of "structural constraints" (that is : the regulations by the state) which are mirrored and at times distorted by the "mental attitudes" of the farmers and are realized by the resulting "reactions of the farmers". The three variables all act together as the actual institution governing irrigation. We apply them to three parameters which indicate the efficiency of irrigation water supply : application and distribution efficiency, as well as access to water supply. "Access" is of importance for the case at hand since the right to access irrigation water binds the farmer to the cultivation of a certain crop. Since farmers are not in favour of this crop, they do not give priority to it within the irrigation process which reduces the overall efficiency of this irrigation institution imposed by the state. The questions to be dealt with are : How is the access to irrigation water regulated by the state, in how far is this regulation accepted by the farmers, what is their reaction and in how far does it affect irrigation efficiency ? Which state regulations affect the irrigation efficiency of the individual farmer and what does result out of these regulations ? Here, security of supply, and especially the scheduling, as well as the technological know-how are supposed to play a major role. And finally, which governmental regulations do affect the coordination of irrigation among the farmers and how do farmers then actually coordinate their irrigation, and which impact does this then have on the distribution efficiency ? Here, the central term is the "distribution key".

In this paper, it is not the aim to get as far as the quantification of the different levels of irrigation efficiency. The aim of the short empirical research was to identify the institutional constraints, as defined here, on the functioning of the irrigation system and link them conceptually to the indicator "irrigation efficiency" (figure 1).

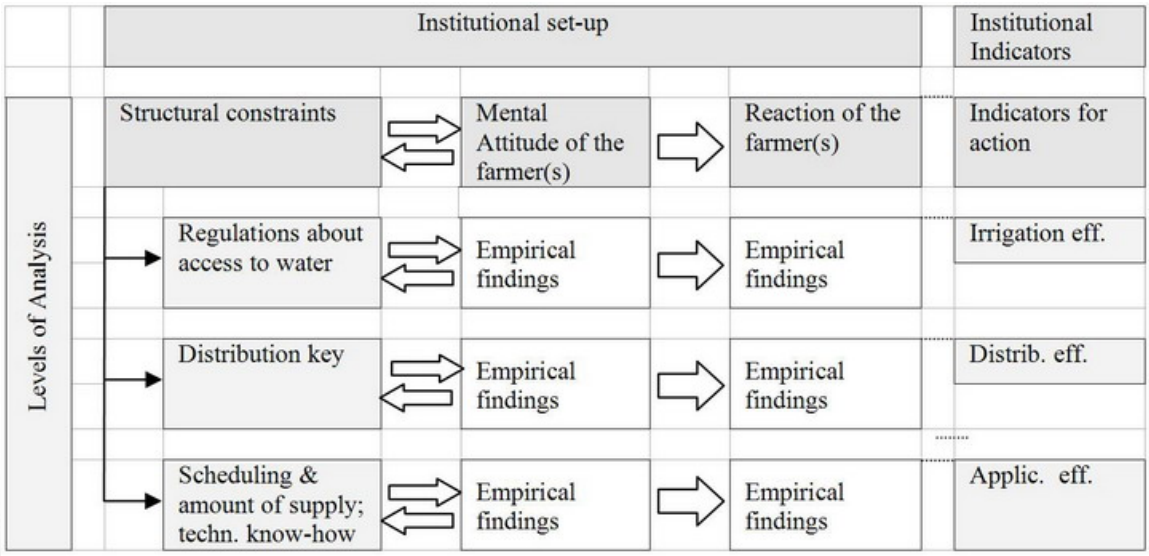

Fig. 1 – Framework of analysis

The identified structural constraints have manifested themselves in the mental attitudes and reactions of the farmers. The next step would therefore be to get the farmers out of their context and into the position of developing ideas by themselves about how they could ameliorate agricultural productivity and irrigation efficiency. This may be possible in the environment of a game-workshop, in which different scenario-settings, which are made up of different combinations of constraints, are given to the farmers. The workshop could provide them with information about agricultural technology, which would give them the possibility to reflect about potential individual and block-wise technology-change. It would give them the possibility to abstract from

reality and work out options for the development of their agriculture.

At the same time, the workshop would provide insight into the degree how the logic of a technological modernisation fits to the thinking of the farmers. One could see what a technological modernisation requires from the farmers, and in how far this does fit to the farmers' characteristics[1]. Questions may be answered like : How effective then may the initiation of a modernization be regarding its effect on the farmers to increase irrigation efficiency ? What would be the main principles that would promote an increase of irrigation efficiency by the farmers ? In how far do current constraints stand against the application of new technology ? Which conditions would have to be accomplished for an optimal realisation of the "instrument agricultural modernisation" ?

Empirical results from a survey conducted from the 12.12.2003 to the 16.12.2003 in the Perimeter of the Doukkala, as well as the results of the students' reports from their field surveys are used in this summary[2]. In its attempt to look for potential ways to initiate a collective modernization, it focuses on what they have to tell about the farmers' constraints to increase irrigation efficiency.

The information of the three days' survey was obtained in individual interviews with farmers, and a focus interview in the end together with farmers. Unfortunately, in many interview situations, a representative of the water resources office was present, so that part of the information must be questioned when dealing with the sphere of responsibility of the office. At the same time, the interviews held with the farmers were not enough to be representative in a quantitative sense. They were providing an insight into this problem area of the Doukkala to derive suggestions for the further proceeding of research.

2 Constraints in the agriculture of the Doukkala

Agriculture in the perimeter of the Doukkala is highly affected by the state. For the process of initiating an agricultural modernisation, WADEMED will have to consider these structural constraints and their effect on the attitudes of the farmers. A short summary of the structural constraints and mental attitudes will give a briefing of the survey results.

2.1 Determinant for the access to water

2.1.1 Structural constraints

The access to irrigation water is coupled with the cultivation of sugar beet. The sugar refinery forwards the revenues of the harvest to the Water Resources Bureau, which subtracts the expenses for irrigation water as well as previous advances for seeds and fertilizer, and then delivers the remaining revenue to the farmer. In dry years, only sugar beet, alfalfa and bersim would provide the right to irrigation water. The allocation takes place proportionally to the surface cultivated by the crop.

[1] "characteristics" may be "possessive" (socio-economic) as well as "processing" (the rationale of the farmers)

[2] Group 1 wrote generally about the administrative issues ; Group 2 : " Problématique du choix du système de production par l'agriculteur particulièrement en période de pénurie d'eau " ;
Group 3 : " Financement de l'agriculture irriguée dans le périmètre des Doukkala" ; Group 4 : Economie et valorisation de l'eau dans les Doukkala " ; Groupe 5 : " Associations professionnelles et gestion participative de l'irrigation "

2.1.2 Mental attitude of the farmers

From the perspective of the farmers, the cultivation of sugar beet assures the supply with water, allows to getting advances, and having revenue which is generally assured and can partly cover the alimentation of the cattle. But there are also many disadvantages. Sugar beet would need a lot of input (like labour which often is hired ; a high demand of fertilizer, and water), and its processing would be suboptimal (delay in the pickup, without reimbursement of the quality loss of the plant ; lack of transparency in the process of measuring the sugar content and weighing). The small profit of 0.20 Dh/ kg adds up to the disapproval with the crop.

2.1.3 Reaction of the farmers

Farmers only use a part of the water to irrigate sugar beets. In the irrigation turn, they first divert water to the wheat that they also grow on the plot, and then to alfalfa, which they grow for their cattle. Milk serves as a regular income, and allows for capital-mobilization right in the moment in which it is needed. Sugar beet is often given the last priority in the irrigation turn. Still, the lower the sugar beet harvest, the less likely can the farmers pay back previous advances.

2.2 Constraints for irrigation efficiency

2.2.1 The influence of the security of supply on application efficiency

The *de facto* and perceived security of supply are central to application efficiency[3]. "Security of supply" in this case is composed of two structural components : the cutbacks in the supply within recent years ; and the irregularity in the quantity and schudling of irrigation water supply. Additionally, the know-how how to deal with irrigation technology has an impact on application efficiency.

Development of irrigation water supply Structural constraints

Before 1999, water was supplied on demand to the farmers for two irrigation seasons. Farmers mostly cultivated vegetables in summer, and sugar beet, alfalfa and wheat in winter. But in 1999, supply was cut back to the winter irrigation season only. Additionally, water was distributed to the farmers on the basis of a predetermined volume of water per irrigation turn. In 2003 then, farmers had to sign a contract in which they guarantee that they apply 90 % of the water to sugar beet only, while they can take the rest for alfalfa. But the influence of the ORMVAD goes beyond irrigation. With the introduction of irrigation, the ORMVAD had promoted, introduced and then monitored the cultivation of sugar beets, alfalfa and winter wheat. It later also introduced cattle breeding to the farmers. Thus, innovation and technological know-how until now was dominated by the ORMVAD. One recent example for this may be the fact that farmers were instructed which sprinkler heads to take now that the pressure on the system fell and the pressure on the sprinkler has to remain stable. In everyday issues, the Office furthermore provides the farmers with tools to repair the irrigation infrastructure. It is said that its influence on farmers' individual decision-making increased competition among the farmers. That the government now wants to withdraw from its engagement, further hampers (together with the deterioration of the resource) the situation for the farmers.

[3] Irrigation efficiency here is divided into "application efficiency" and "distribution efficiency" ; while "application efficiency" refers to irrigation practices and technologies of the individual farmer, "distribution efficiency" refers to the smooth delivery of water among the farmers.

Mental attitude of the farmers

Farmers are said to be discontented with, or even fear the disengagement of the Office from its tasks (Group 5 : 5). They would be accustomed to the Office being in charge of irrigation, and would not be ready to take the initiative (Group 5 : 7). Thus, up until today, the "individualistic spirit" (Group 1 : 7) of the farmers, and the resulting lack of motivation for and mistrust in collective management is said to pose a major difficulty on a collective organization. There would be no point of reference or tradition in collective action in the region (Group 5 : 6), and conflicts would come up over the management of shared equipments already. The frequency of conflicts among the farmers is also seen as one constraint for a collective management of equipment of a localized / micro irrigation system (Group 4 (2003) : 14). Farmers would fear to discuss and regulate internal conflicts by themselves, and prefer that a third party does the mediation between conflicting groups within this "climate of mistrust and competition" in a global context of land and water scarcity (Group 5 : 8). This need mirrors the circumstance that the Office is said to lack an actual will to develop decentralized irrigation management because it is afraid that with the regrouping of the farmers, a reinforcement of the negotiation power of the farmers could take place (Group 5 : 9).

When asked about alternatives to the current situation, many farmers said that they would not have a choice to change anything, because they would plant the most necessary, and if the drought increased, the cultivation pattern would just remain the same. The most favourite project for the future was to plant vegetables again. The second most important project was to drill a well. A well would guarantee a security of supply, if water was not saline and the success of this project questionable. The gradual reduction of water supply not only affects the perception of the security in the conduct of agriculture, it has distinctive economic consequences. The summer crop (vegetables) was the surplus income of the farmers, additionally, it created jobs for rural labour. Without these additional sources, farmers would not get bank loans anymore[4]. A village mediator said that farmers would seek work in urban areas.

When mentioning alternatives to the current situation, farmers remained within the margin of the suggestions by the Office[5]. This may indicate their lack of information for alternatives. Farmers are attested a lack of technological competence, which would let them fear that they would not be on the level of responsibilities for a collective management (Group 5 : 8). When a technology is introduced by the Office, farmers are said to complain that there is no further monitoring after the introduction of the technology. Thus, it can be expected that with the decrease in the supply of irrigation water, farmers are most likely more risk-averse. Since the constraints on agriculture increased, it seems that they are not motivated to invest.

Reaction of the farmers

Today, the water allocation of the farmers differs from the agreement which the farmers signed in 2003. They still allot water first to wheat, then alfalfa, then sugar beet. But now, after the contract is signed, they illegally divert water to the crop that they need for their livelihood. Thus the insecurity of supply has increased even more.

The shift from "on demand" water supply to a water turn gave the farmers the incentive to fully use the terminals during the time when they are open. Since the network was designed for an "on demand" supply, and not to the case that all the terminals of the same branch are opened to the maximum at the same time, the flow rate falls during operation. Additionally, farmers have added sprinklers and narrowed down the distance between them, thus the flow rate decreases even more and the water is not evenly distributed anymore around the sprinklers.

[4] Other financial resources for investment often are the cattle.

[5] Another example for that is that farmers would like to install an individual meter, since it provided for more justice, and would allow a more accurate allocation of water. This is exactly the argumentation of the Office. Additionally, they wanted to bury the pipes in order to ensure a smoother irrigation, which was also initiated by the Office. The technical orientation of the farmers to solve the problem most likely comes from the Office.

Those situated "downstream" suffer even more from the low rate of flow.

Scheduling of water supply Structural constraints

Each farmer receives a predetermined volume of water per irrigation turn. The ORMVA decides on the implementation of the irrigation turn, its duration, and the volumes per hectare, depending on the availability of water in the storage reservoirs. Farmers say that they can estimate only short-termed, from the announced number of irrigation-hours as well as from the pressure on the sprinklers, if they will receive a lot or not much water. They can get a more precise idea of it in retrospect when looking at the water bills. The irrigation scheme where the survey took place comprises three branches, while at each branch, the irrigation-turn lasts approximately five days. There therefore should be an irrigation turn every fifteen days.

Mental attitude of the farmers

When asked how long before the irrigation turn they get to know about the water supply, farmers' responses varied between one day to one week. Sometimes, water would also come as a surprise. The majority of the farmers said that one irrigation turn within a bloc would last between two to five days. The answers varied to a big extent when it came to the duration between two irrigation turns : the biggest length of time was given with 10 – 28 days, which deviates with seven days from the average 15 days. Concerning the varying amount of water and information about the irrigation timing, the supply situation seems to be (perceived as) very instable. Farmers report of frequent network breakdowns (Group 1 : 10), and are not satisfied with the water turn which would be irregular in time (Group 4 : 6). Considering these conditions, farmers have no real incentives to save water. The insecurity when the next irrigation turn will provide water makes the farmer just apply all. They have to pay for all of it anyhow. With the fixed amount of water supplied to the field and the lack of possibilities to divert the water to higher value crops (or at a later time), all the water which arrives at the field is applied.

Determinants on application efficiency There does not seem to be much room for farmers to increase application efficiency. First of all, inefficiency of application is sustained by the insecurity when the next irrigation turn may come, so that farmers just apply as much water as arrives on the field. The allocation principle which is based on the surface of cultivated crop furthermore does not set incentives to save water. Since irrigation scheduling is done by the Office and the water turn irregular, farmers cannot apply water according to the growing stages of their (potentially individually different) cultivations. Since the government still has influence on the choice of crop, and here above all sugar beet, there is no real incentive to increase water productivity, to change the cultivation. Additionally, with the insecurity of supply, investment is too risky, since farmers would not know if it can capitalize. With no side-income, they moreover have no basis for higher investments. The income of and their cultivations in general can just cover their basic needs.

What makes things more difficult is farmers' orientation towards the Office, so that they do not seem to be very pro-active in finding a solution for their weak agricultural income.

2.2.2 Distribution efficiency

Structural constraints The question of the efficiency of distribution orientates at the distribution key which in the case of the Doukkala is defined by the state. Every farmer gets water according to the planted surface of the state prioritised cultivations. The responsibility of the Office for the management of water supply stops at the quaternaries, and there is therefore no official administration of the quaternary sprinklers (Group 1 : 4), but farmers regulate it among themselves. When each farmer has a holding of 5 ha (as originally foreseen by the government),

irrigation within one block seems to be clearly defined. But bequeath has led to a parcelling out of land holdings, which has increased the number of irrigators and thus the potentiality of conflict.

Mental attitude and reactions of the farmers Farmers accepted this key as a transparent mechanism and respected the irrigation time allocated to them[6]. It was not quite clear from the few interviews, whether farmers stick to the rules because mutual distrust increased mutual monitoring, or whether they are just loyal to water distribution rules in general. Farmers did not seem to have problems in harmonizing their cropping patterns to allow for a stable pressure in the irrigation system of the block. Still, cases of conflict within the irrigation turn do exist, and farmers' willingness to help each other out seems to be limited (figure 2).

3 Capacity building workshops as a first step to facilitate a collective modernisation

Since the Office will increasingly withdraw from its tasks on site, students recommended the creation and initiation of functioning associations among the farmers (Group 2 : 19), or the taking over of responsibilities by (formally) existing water user associations in order to reduce the police-function of the ORMVAD in the supervision of water supply (Group 1 : 8). As a unit of administration, the terminal is suggested in the case of sprinkler irrigation : if farmers considered it as private property, they would look after its operation and maintenance (Group 1 : 11). Additionally, a sensitisation, as well as a frame for realizing the importance of water saving and a better valorisation of water would be required (Group 4 : 10). A regrouping of the farmers to increase the surface and reduce investment costs, e.g. in localised irrigation, would be needed (Group 4 : 13). Through the surveys, it got clear that with the withdrawal of the state, farmers would have to organize themselves in one or the other way to ensure a systematic organisation of infrastructure operation and maintenance.

According to Group 2, the future adoption strategy of most of the farmers[7] to water scarcity would be to reduce the surface under vegetable cultivation (which mostly is for private consumption), increase the surface under wheat in sprinkler-irrigation districts (which would increase the indebtedness of the farmers), or the sugar beet and fodder cultivation in the gravity system. – In a game-workshop one could take the identified main institutional constraints on the farmers (like reduced supply with water ; no supplemental supply (groundwater) ; surface-based allocation of water ; water supply not on demand, but in a water turn ; irregular timing of water supply ; insufficient information about timing and amount of supply ; no side-income ; no availability of bank-loans ; coupling of cultivation and paying the water-price, as well as receiving advances for buying seeds and fertilizer ; ...) and build scenarios together with the farmers, what may be undertaken under different constellations of constraints. Taking the above mentioned constraints on irrigation systematically away, would allow building scenarios with the farmers under more optimal conditions. If, for example, farmers could rely on a timely and sufficient water supply, which crop would they grow, which investments would they undertake ? This would then allow discussing the next step : how could they achieve a supply "on demand" ? Or how could they make less water still be enough for the crop that they would like to grow ? If the technological options which have been examined by the IAV (or any other agricultural and development institute) were reformulated in games, this would allow the farmers to get to know options for an increased irrigation efficiency, as well as options for different cultivations.

[6] See also (Group 1 : 2) : the observed organisation of the water turn would correspond with the theoretical organisation, and "seems on the whole well functioning"

[7] (the group which grows sugar beet, fodder, and wheat)

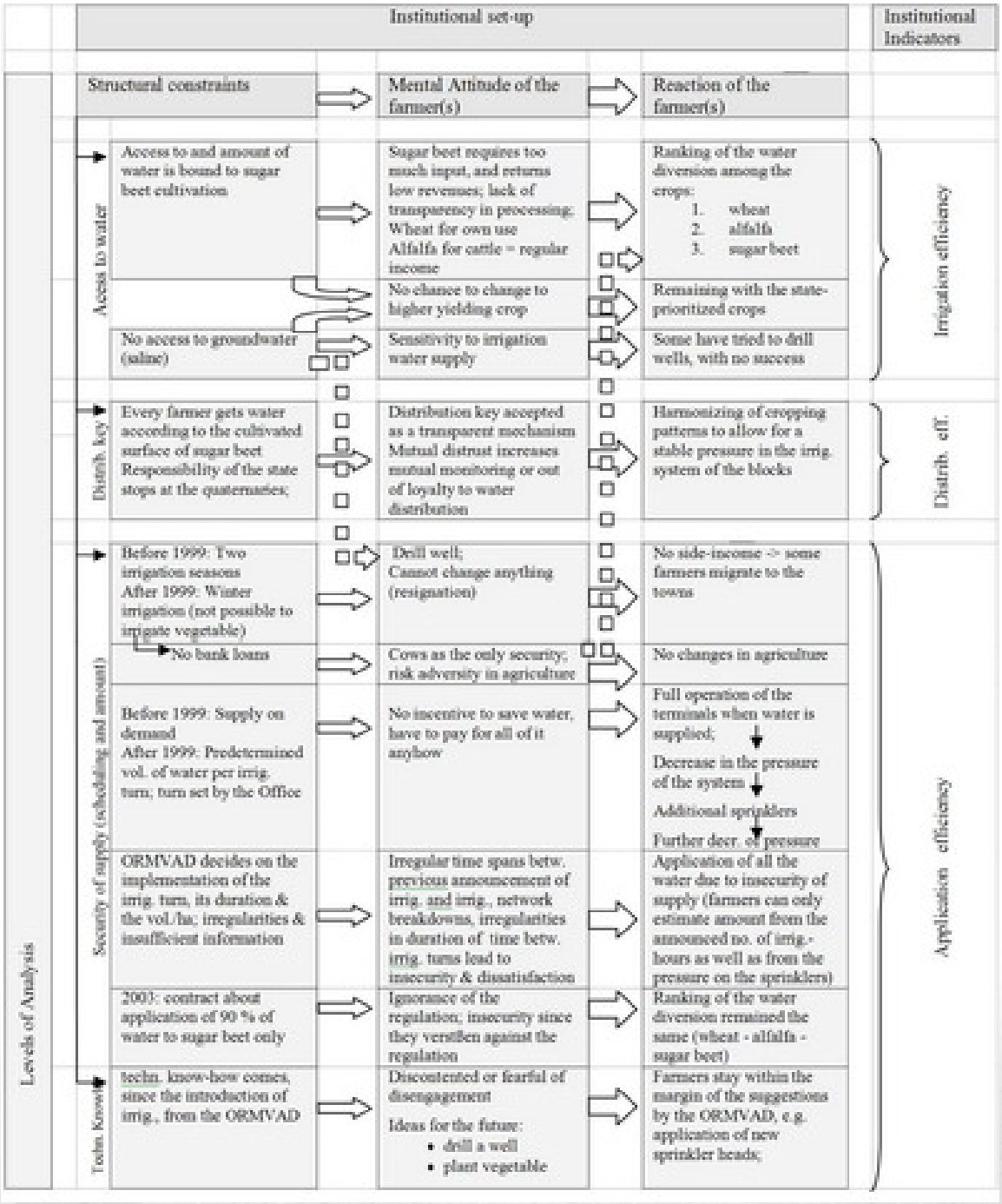

FIG. 2 – Mental attitude and reactions of the farmers

Farmers could learn about the effects of the technology application, and improve application within the proceeding of the game. After each round, their action would get a feedback (which may be quantitative or more indicative). The players could exchange thoughts about strengths and weaknesses of the technology, and therewith comprehensively get to know the technology, without being dependent on reading skills[8] and also realize that its application may need a collective investment and management. Which rules of a collective administration would they then have to set up ? Which new constraints would be imposed on the farmers, –and would they see the advantages of such regulations ? –The interrelatedness with other players in the course of a game would get clear, and ways of a collective organization of irrigation and technology application may be tackled out.

If one took the geographical unit of a block to select participants in such "game-workshops", farmers could even more precisely start the discussion about difficulties in technology-application, and the game-instructors could get clearer about the argumentation why farmers would not like to collectively invest. This would enable to get away from the general statement "farmers don't trust each other" to more situational criteria of when cooperation does not work. Since the technical orientation of the farmers is rather high (as technical solutions were always the solutions given by the Office), one should try and connect with the farmers at that point, because it is the thinking and the way of problem-solving they are used to. Maybe, if farmers are not very trustful in each other, they would need a more issue-orientated and transparent point of cooperation[9]. If farmers, in the course of the workshop, collectively reflected about technology application in real life, they would have made the first step of collectively thinking about changing their current state within the unit of a block.

The results of the workshops could be presented to the administration. They may make clear which requirements would evolve for the administration if there was a clear and realistic preference for farmers to apply a certain kind of technology and cultivation. They could provide the basis of a round table between administration and researchers to reflect in how far a modernisation on the small scale needs a transformation on the large scale.

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[8] The high illiteracy-rate among the farmers was mentioned several times in the reports of the students.

[9] Water user associations were said to not generate any benefit but demand financial participation to guarantee the maintenance and functioning of irrigation water supply, that's why they were rejected.