



A participatory approach for implementing IWRM in Al-Batinah (Oman)

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Introduction

The study is focusing on a real management problem of the coastal agricultural region in South Al Batinah in the Sultanate of Oman

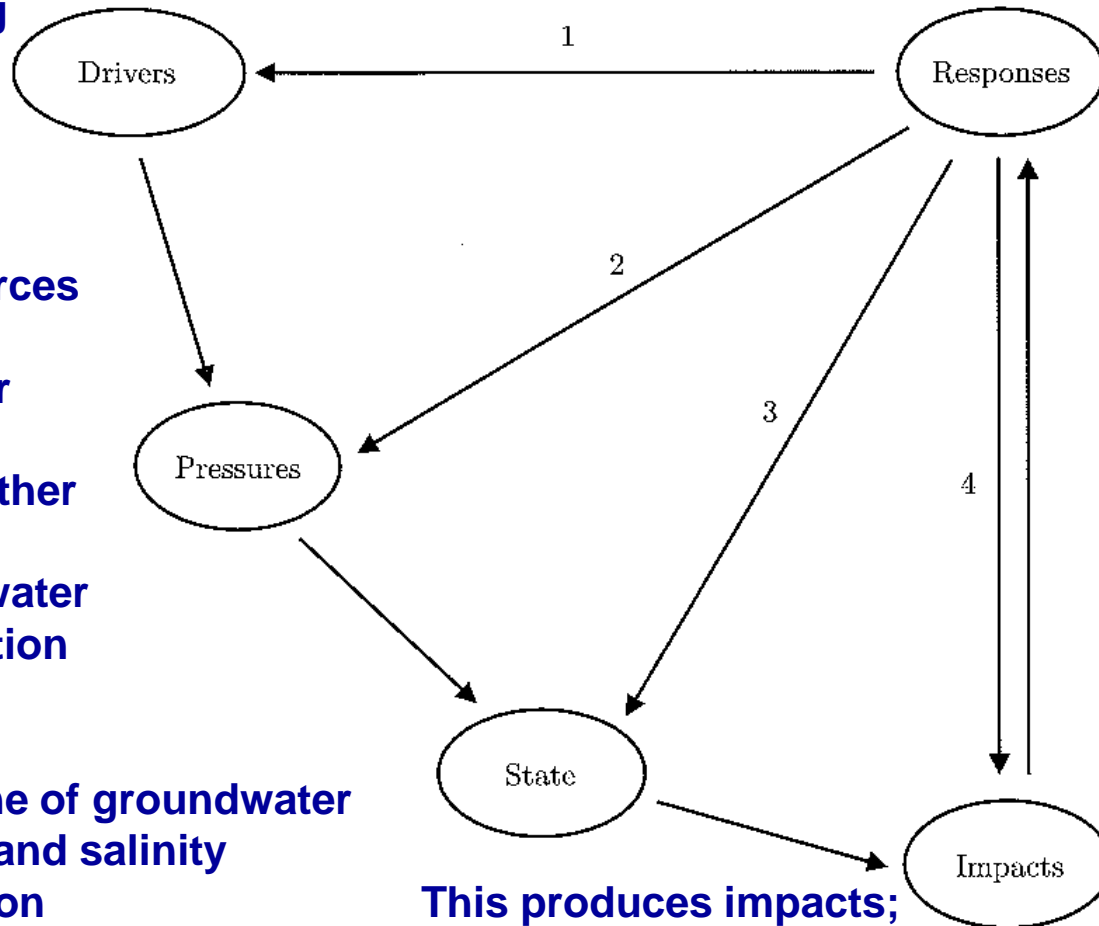


Clarification of the **DPSIR** framework using the South Al Batinah catchment basin - Focusing on the **AGRICULTURAL** sector

- The practices followed by farmers-farmers are pumping
- The recharge rates exceeded the abstraction rates

- The water resources are limited
- Increase in water demand for agriculture and other sectors as well
- Degradation of water quality and pollution problems

- Decline of groundwater levels and salinity intrusion
- Some farms have become abandoned



- This produces impacts;**
- On food production
 - Social consequences

- Design and Implementation of measures to:
- Maintain groundwater aquifers
 - Increase the water efficiency in irrigation
 - Increase agricultural productivity and income

Problem and challenges

Complexity of the situation

The hydro-system consists of several components (environmental, socio-economical)

Aquifer and agriculture relationship (nonlinear physical processes)

Different types of stakeholders (Farmers, decision makers, water and agricultural agencies, etc).

This make the decision making process more complex

Who might have different interests and needs or even vision for managing the system

Which might generate conflicts between the different stakeholders regarding water availability and profitable agriculture.

The decision making process in Oman

Like many countries, decision makers (DM's) are responsible for the development process and the long-term planning to improve the quality of life and maintain the resources for future generations.

This is true even with water management and other environment issues

A global solution is needed;

- Communications in both directions need to be improved
 - Between relevant Decision makers
 - Between Decision makers and farmers
- The system need to be managed for the mean term and the long term

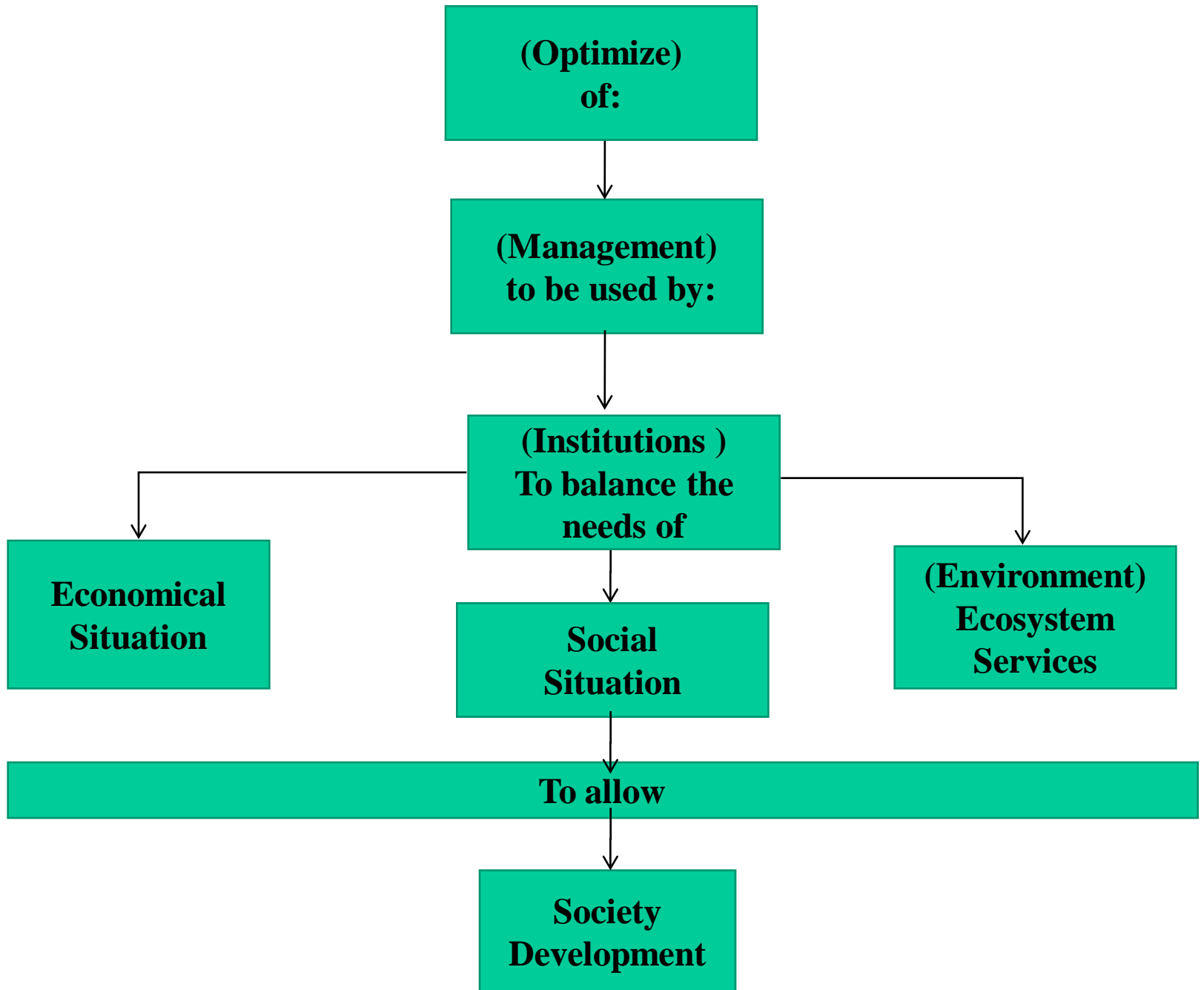
What is possible

What would work to solve such a complex problem?

An integrated water resources management (IWRM) approach, which allow for assessing different management polices and interventions.

The participatory approach

It is a two-way communication process that explicitly seeks to identify and to clarify the interests at stake, with the ultimate aim of producing a well-informed water management strategy that has a good chance of being implemented



Research objectives

General objective

The research aims to achieve the principle of integrated water resource management (IWRM) and the application of the participatory approach by building an integrated system for decision support in water resources management [Decision Support System (DSS)] in Al Batinah Governorate

Specific objectives

1. Identify relevant groups of stakeholders .
2. Identify potential conflicts which might occur amongst them.
3. Explore stakeholder's opinions and responses regarding several intervention measures.
4. Evaluation of the implementation potential of several interventions measures in order to support a decision making process within the frame of an IWRM

Methodology

Data collection

- Stakeholders were identified e.g. water professionals, farmers from the study area and decision makers from different organizations
- Questionnaires were designed according to the information and data to be collected from the different groups of stakeholders
- A social survey has been performed
 - pre-test survey (22 December 2012 – 12 January 2013).
 - official survey (1st September to 24th October 2013).
- The information collected is a combination of environmental, social and economical data.
- The type of questions included were; selective questions, rating questions, filling gaps and open questions

Data processing & analysis

- The data were analyzed statistically for each group separately by using the **SPSS** (Statistical Package for Social Science) software package
- Examine the differences between opinions of the farmers and decision makers regarding potential interventions
- Explore if there is any differences between the farmers's actual opinions and what decision makers believe about farmers's opinions
- P-value was generated to accept or reject the hypothesis

Results and Discussion

Official survey

Handling & Mail (67)

STAKEHOLDERS

Face to face interviews (64)

**Decision Makers &
Water Experts**

Farmers

- 27 from Barka
- 37 from Musanah

Organizations

- MRMWR **23**
- MAF **7**
- PAEW **19**
- MECA **5**
- Research Org. **12**

Field of Interest

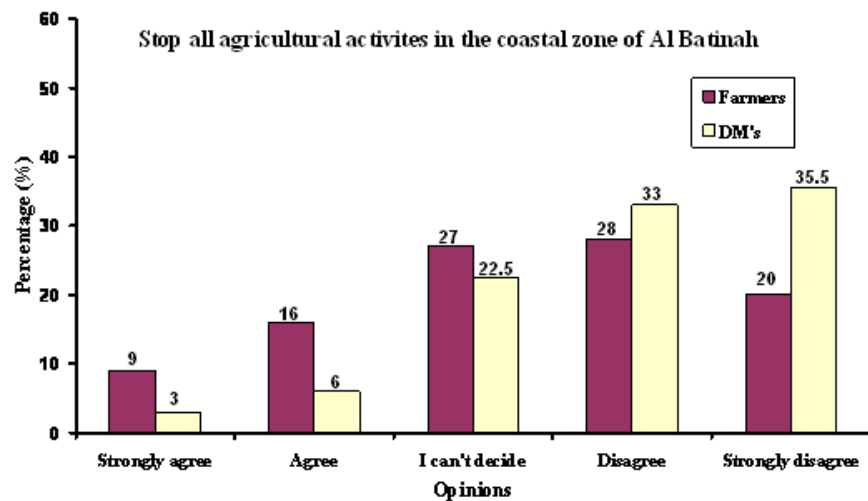
- Groundwater **36**
- Agricultural Water Use **19**
- Water resources management and planning **30**
- Surface and subsurface hydrology **8**
- Environment protection **22**



1 September – 24 October 2013

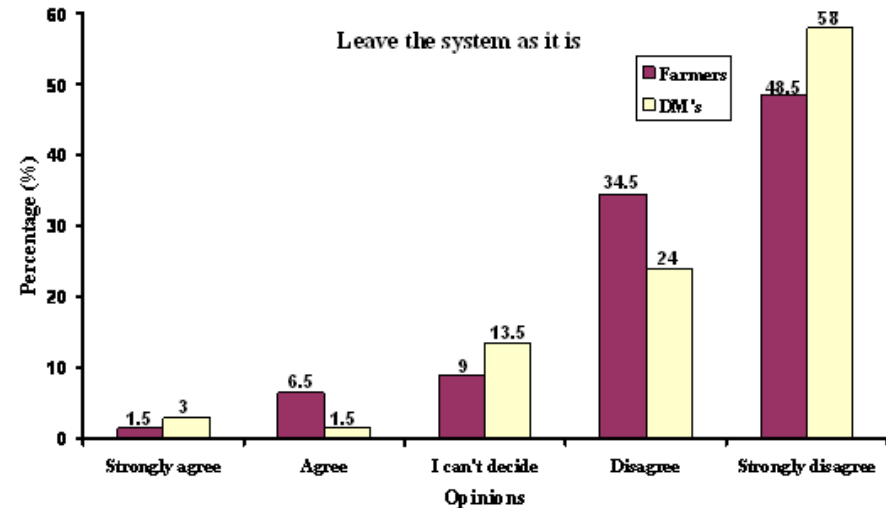
Visiting and give Explanation of the research

Opinions of Farmers and DM's regarding the water situation and agriculture sustainability in the region



- Very small proportions from both groups rated 'Strongly agree' or 'Agree', (9-16%) farmers & (3-6%) DM's

The majority choose Disagree & strongly disagree, 48% farmers and 68.5% DM's



- 8% farmers and 4.5 % DM's only choose 'Strongly agree' & 'Agree'

83% farmers and 82% DM's choose 'Disagree' & 'Strongly disagree'

Opinions of farmers and DM's regarding the water situation and agriculture sustainability in the region

Opinions of open questions (*farmers*)

Results showed:

- Farmers are not fully aware about the limitation of the natural system, especially in form of quantity.
- Many of them (26 farmers) expressed the situation saying; ‘*the water is available, but salty*’

Comparison of opinions between Farmers and DM's regarding potential interventions

Intervention measures	Farmers (mean)	DM's (mean)	P value
Introducing water quotas.	3.47	1.88	.000
Introducing water quotas with subsidies in form of equipments for modern irrigation systems.	2.75	1.70	.000
Introducing water quotas with subsidies in form of guidance & training in agricultural management	2.94	1.58	.000
Introducing using treated wastewater for agricultural use, if it is available and the quality is acceptable.	2.17	1.61	.001
Encourage the farmer to reduce the withdrawal of groundwater pumped per day by guidance & training.	2.31	1.63	.000
Implementation of centralized well field water distribution system for agriculture which provides water in a good quality to farmers.	2.42	2.27	.458
Convince the farmer to change the type of crops to ones with lower crop water requirements.	2.48	2.03	.017
Encourage farmers to improve their irrigation methods.	2.02	1.45	.000
Encourage farmers to improve their irrigation methods with subsidies in form of equipments for modern irrigation systems.	1.66	1.72	.636
Encourage farmers to improve their irrigation methods with subsidies in form of guidance and training in agricultural management.	1.86	1.66	.115
Construction of injection wells near the coast line to form a barrier against the sea water intrusion, if water to be injected is available and the quality is acceptable.	2.19	2.13	.764
Construction of more desalination plants for brackish and seawater, in order to use it for irrigation.	2.14	3.09	.000
Increase the effectiveness of water use by public awareness.	1.55	1.46	.424
Introduce water prices for pumped groundwater.	3.92	2.48	.000
Introduce special energy tariffs for agricultural purposes.	1.86	2.49	.001
Forming water managers groups.	1.88	1.91	.819
Forming guidance & information water centre to support farmers in farm & water management.	2.11	1.63	.002
Farms need to be evaluated and the government should take a decision to close some of them and change the land use.	1.97	2.52	.006

Mean score ranges between 1 for strongly agree and 5 for strongly disagree

Comparison of opinions between Farmers and DM's regarding potential interventions

Findings

- Farmers were very different in opinions from the other group of stakeholders. (13 of 20 items)
- Differences were less obvious between the two groups in minority cases (7 of 20 items).
- Although the results in some options show differences in opinions between Farmers and DM's, it can be noticed that the differences are not absolutely in an opposite direction.
- **Farmers** were significantly **more likely** to;

Intervention measures	Farmers (mean)
Increase the effectiveness of water use by public awareness.	1.55
Encourage farmers to improve their irrigation methods with subsidies in form of equipments for modern irrigation systems.	1.66
Encourage farmers to improve their irrigation methods with subsidies in form of guidance and training in agricultural management.	1.86
Introduce special energy tariffs for agricultural purposes.	1.86
Forming water managers groups.	1.88

Mean score ranges between 1 for strongly agree and 5 for strongly disagree

Comparison of opinions between Farmers and DM's regarding potential interventions

Findings

- **Farmers** did not reject the idea of using treated waste water for irrigation, the mean is **2.17** as **75%** of them have chosen 'strongly agree' and 'agree'
- **Farmers** were more enthusiastic regarding improving the irrigation methods with subsidies in form of equipment compare to the other two options regarding improving irrigation methods as the mean is **1.66**

Intervention measures	Farmers (mean)
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Encourage farmers to improve their irrigation methods.	2.02
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Comparison of opinions between Farmers and DM's regarding potential interventions

Findings: **DM's were significantly more likely to;**

Intervention measures	DM's (mean)
Increase the effectiveness of water use by public awareness	1.46
Encourage farmers to improve their irrigation methods with subsidies in form of guidance and training in agricultural management.	1.66
Introducing using treated wastewater for agricultural use	1.61
Encourage the farmer to reduce the withdrawal of groundwater pumped per day by guidance & training.	1.63

DM's were less likely to

Construction of more desalination plants for brackish and seawater, in order to use it for irrigation.	3.09
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Only 35% of them agreed with the idea, 28% couldn't decide, and 37% disagreed

Mean score ranges between 1 for strongly agree and 5 for strongly disagree

Comparison of opinions between Farmers and DM's regarding potential interventions

Findings

Both groups were significantly **more likely** to;

Intervention measures	Farmers (mean)	DM's (mean)	P-Value
Implementation of centralized well field water distribution system for agriculture which provides water in a good quality to farmers.	2.42	2.27	.458
Convince the farmer to change the type of crops to ones with lower crop water requirements.	2.48	2.03	.017
Encourage farmers to improve their irrigation methods with subsidies in form of equipments for modern irrigation systems .	1.66	1.72	.636
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Mean score ranges between 1 for strongly agree and 5 for strongly disagree

The degree of significant differences is based on independent samples T-test

Comparison of opinions between Farmers and DM's regarding potential interventions

Findings

- **Farmers** were significantly **less likely** to accept the ideas of;
 - **Water quota** (Only 29% of farmers accepted water quota), and
 - **Introducing water prices for pumped groundwater** than the DM's.

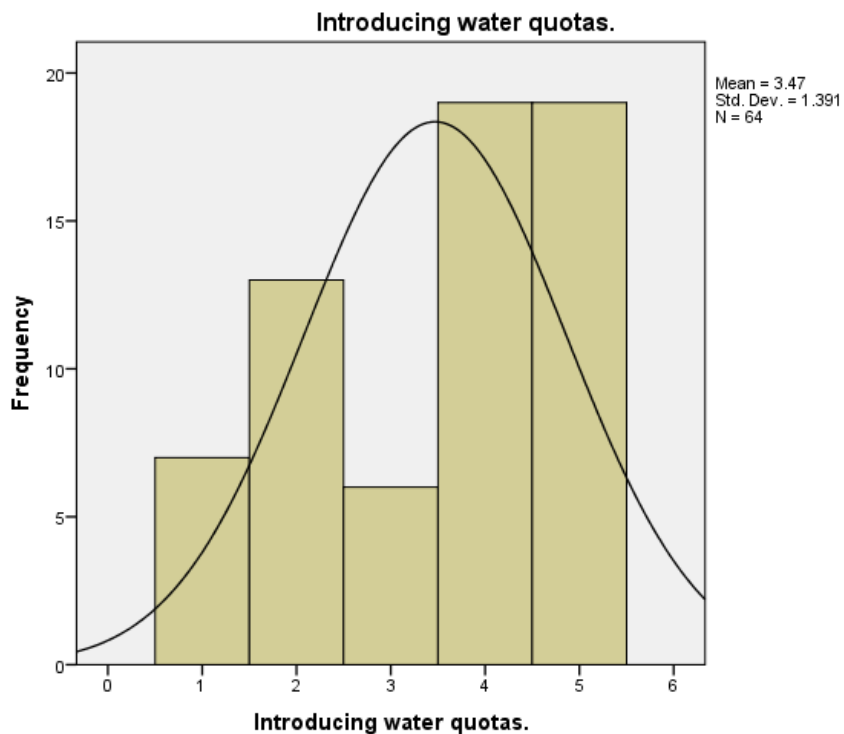
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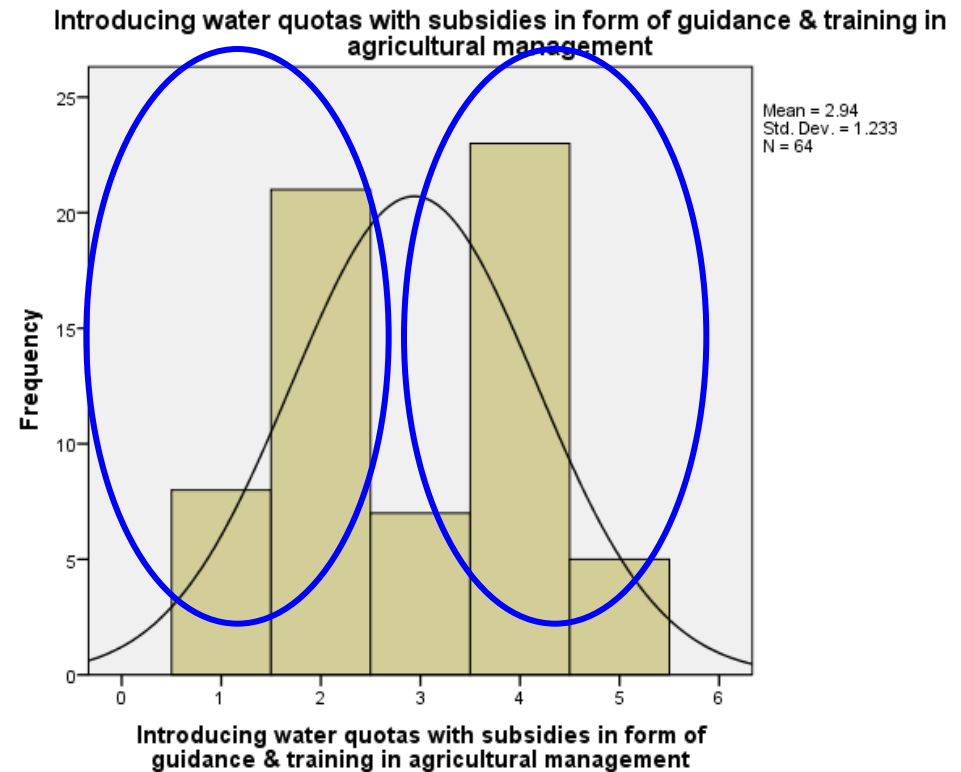
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Farmers

Introducing water quotas



Introducing water quotas with subsidies



Score ranges between 1 for strongly agree and 5 for strongly disagree

Involvement of relevant stakeholders in the decision making process

Organization	n	Yes%	No%	No Idea%	No Answer%
Farmers	64	95.3%	1.6%	0%	3.1%
Ministries and Water issue Organizations	54	88.9%	5.6%	10.8%	1.9%
Research Organizations	12	83.3%	16.7%	0%	0%
Total	130	91.5%	4.6%	1.5%	2.3%

Findings

- Majority of the respondents (91.5%) believe that involvement of water users in the decision making process is important
- Only 4.6% of all respondents indicated that they are not agreeing with the idea.
- Most of the decision makers groups indicated that they agree with the idea, by at least 80% of the total respondents.
- Researchers were more cautious about the idea, at least 16% of them thought that it is not a good idea.

Farmers were asked to identify if they are ready to be members in these meetings or associations

- More than half (78%) of them were interested in taking place in meetings and negotiations, while
- (22%) were not interested to be involved in such type of meetings.

Main benefits from the survey

- Obtaining different professional judgments through decision makers and water experts opinions



- The idea of the participatory approach is not rejected by the different groups of stakeholders.



General Results

- Majority of the respondents agreed that the water quality and quantity is at risk and the situation is getting worse with time.
- The need of improvement and implementing new management strategies is supported by all groups of stakeholders.
- In most cases, farmers were more likely to the solutions of **increasing water availability** especially of good water quality, while DM's were more likely to the **management** issues especially demand management.
- Farmers were significantly **less likely** to accept the idea of water quota.
- Majority of the farmers reported that they require subsidies from the government in form of equipment and better marketing facilities to sell their products.

Outlook & More expected Results

- The obtained data will be used for more advanced statistical analysis
 - to identify differences in opinions and conflicts within the same group of stakeholders
- Evaluating a Bayesian Network (BN) approach (Subagadis et al. 2014) will be used to combine environmental, social and economical data
 - for mapping the stakeholder's behaviours based on statistical analyses in order
 - to show the strength of relationship between dependant and predictor variables
- Based on BN results an analysis of the implementation potential of different water management policies will be possible
 - by combining them with general performance indicators of the management interventions within the APPM framework

Conclusions

- The study underlines the importance of a participatory approach with contributions from all relevant stakeholders in order to achieve a real IWRM implementation process.
- Water management strategies should not only focus on the technical means, but should also be directed to improve management practices and social behavior changes.
- Decision makers and all other stakeholders should play a role in implementing appropriate changes.
- The decision making procedure should not be limited (only) to considering information collected from the stakeholders, they should (instead) be treated as if they were DM's that must negotiate about the proposed alternatives.
- A coordinated response is needed between relevant organization, farmers as well as the media to help this message become part of local understanding.

Thank you



APPM

- An integrated **A**ssessment, **P**rognosis, **P**lanning and **M**anagement-Tool (**APPM**) have already developed.
- To consider the interaction and nonlinearities between the hydrologic, meteorological, agricultural and socio-economics systems in the region.

