

# Assessment of groundwater governance capacities in Jordan



Hannover, August 2020

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Commissioned by: Federal Ministry for Economic Cooperation and Development  
(Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung, BMZ)

Projects:

Sector Project Policy Advice Groundwater	Program – Groundwater Resources Management (BGR)
BMZ-No.: PN 2017.2106.7	BMZ-No.: PN 2020.2204.4
BGR-No.: 05-2401	BGR-No.: 05-2416

Date: 31.08.2020

Cover photo: Leaking groundwater well in northern Jordan

## Verkürzte Zusammenfassung

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Titel: *Assessment of groundwater governance capacities in Jordan*

Stichwörter: Groundwater resources management, governance, groundwater, over-abstraction, Jordan (Grundwassermanagement, Governance, Grundwasser-Übernutzung, Jordanien)

Grundwasser deckt in Jordanien **aktuell 60% der Wasserversorgung** und ist somit für die Wassersicherheit des Landes von grundlegender Bedeutung. Aufgrund starker Übernutzung nimmt jedoch die Quantität und Qualität zunehmend ab. Zudem ist die nachhaltige Finanzierung des Grundwassersektors ein zentrales Problem und externe Unterstützung vor allem aus Mitteln der Entwicklungszusammenarbeit stellt einen großen Anteil des Sektorbudgets. Diese Finanzierung steht, nicht zuletzt wegen der COVID-19 Pandemie, zunehmend unter Vorbehalt, so dass die Suche nach einer nachhaltigeren Finanzierung und eine verbesserte Governance des jordanischen Grundwassersektors eine entscheidende Zukunftsaufgabe des jordanischen Wasserministeriums darstellt und auch im Interesse der Geber liegt. Die vorliegende Studie thematisiert den Schutz des Grundwassers vor Übernutzung als einen zentralen Baustein für ein nachhaltigeres Grundwassermanagement. Grundlage der Analyse ist das Water Governance Capacity Framework (Koop et al.), welches Schlüsselbedingung und Indikatoren für Governance-Kapazitäten definiert. Als Basis für die Einschätzung der Indikatoren dienen 22 semi-strukturierte Interviews mit Experten und Schlüsselakteuren des jordanischen Wassersektors.

Zentrale Ergebnisse der Analyse sind:

- 1) Der Schutz des Grundwassers vor Übernutzung sollte maßgeblich von den wassernutzenden Sektoren adressiert werden, namentlich der Landwirtschaft.**
- 2) Es bedarf holistischer und integrierter Ansätze, die eine ökonomische Transformation vom aktuellen landwirtschaftlichen Entwicklungspfad hin zu weniger von Grundwasser abhängigen wirtschaftlichen Entwicklung unterstützen.**
- 3) Die internationale Zusammenarbeit sollte eine wichtige Rolle in diesem Transformationsprozess spielen. Aufgrund der Dringlichkeit und der nicht nachhaltigen finanziellen und ökologischen Situation bedarf es eines Systemwechsels, einer größeren Umstrukturierung der wesentlichen Grundwasser-nutzenden Sektoren, um Jordanien nachhaltiger zu machen. Dieser Paradigmenwechsel benötigt die aktive Unterstützung und Führung der höchsten politischen Ebene und kann so ein zentraler Baustein Jordaniens für einen SDG-konformen, nachhaltigen Entwicklungspfad sein.**

Eine Rolle für die deutsche Entwicklungszusammenarbeit könnte es sein, in der Gebergemeinschaft für einen solchen Prozess zu werben. Die BGR könnte die jordanischen Institutionen (v.a. das MWI) mit Daten und Informationen dabei unterstützen, a) das notwendige Bewusstsein für einen Struktur- und Strategiewechsel bei Schlüsselakteuren und in der Öffentlichkeit zu schaffen sowie b) den Grundwasserschutz als nachhaltige Wasserversorgungsoption ökonomisch zu bewerten und mit den langfristigen Kosten alternativer Ressourcen (Entsalzung) zu vergleichen.

## Executive summary

Groundwater resources are key for Jordan's water security as they represent **almost 60% of the current water supply**. Nevertheless, the current over-abstraction is resulting in a decrease of its quality and quantity. The financial sustainability of the groundwater sector in Jordan is critical and donors' contributions represent an important share of the sector budget. Given the general discussions within the donors' community of redistributing funds to other focus areas and regions - also a consequence of the current COVID 19 pandemic crisis - an analysis of long-term financing and governance models for Jordan's groundwater is urgent. The search for these models is in the interest of both the MWI and the donor community that supports the Jordanian government. This study aims at putting the issue of groundwater protection from over-abstraction at the center of discussion. It provides an assessment of groundwater governance capacities of the Jordanian water sector aiming at identifying governance gaps and recommendations how to overcome them. To do so, this study applies a Water Governance Capacity Framework. This framework defines three core dimensions for high governance capacities (Knowing, Wanting, Enabling) and nine conditions with 27 indicators to assess the status of governance capacities. Information has been gathered through semi-structured interviews of 31 persons from 22 different institutions. The assessment shows that the overall indicator ratings are quite low, which was expected given the selection of a problematic governance aspect.

The main findings of this study are:

- 1) Groundwater protection from over-abstraction should be addressed by the highest water consuming sectors, namely agriculture;**
- 2) There is a need for holistic/comprehensive approaches that support the economic transformation from the current agricultural business model towards a less-groundwater dependent way of economic development;**
- 3) The role of donors should be key in this transformation. In fact, given the urgency of the situation and the financially and environmentally unsustainable situation, there is a need for a system change, a larger project of economic restructuring in main groundwater using sectors, to bring Jordan closer towards a sustainable path. This process of paradigm shift needs to be entrusted and fully supported by the highest political level of the country, as it will need to become a crucial pillar of Jordan's effort to reach the sustainable path of development described in the SDGs.**

The German cooperation could contribute by convening the donor community of all relevant sectors (water, agriculture, energy) to engage and support such a process. BGR could provide technical information and data and help the MWI in raising awareness targeting key users and the public. BGR could also make transparent the cost of groundwater resources protection for sustainable drinking water supply compared to costs of alternative supplies from desalination, in particular showing the long-term costs of maintenance and operation.

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## Abbreviations

BGR	-	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
BMZ	-	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
EU	-	European Union
GIZ	-	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German Corporation for International Cooperation)
KfW	-	Kreditanstalt für Wiederaufbau (German Development Bank)
MP	-	Member of the Parliament
MWI	-	Jordanian Ministry of Water and Irrigation
NARC	-	National Agricultural Research Center
OECD	-	Organisation for Economic Co-operation and Development
RSS	-	Royal Scientific Society
SDC	-	Swiss Agency for Development and Cooperation
SDG	-	Sustainable Development Goals
USAID	-	United States Agency for International Development
YWC	-	Yarmouk Water Company
WAJ	-	Water Authority of Jordan
WANA	-	West Asia and North Africa Institute
WDM	-	Water Demand Management
WEAP	-	Water Evaluation and Planning System

## 1. Introduction

Groundwater resources are of strategic importance in Jordan as they represent almost 60% of the water supply in the country (MWI, 2017). Nevertheless, groundwater management is facing serious challenges due to over-abstraction, which is resulting in reduced groundwater quality and quantity. Recent research confirmed that all aquifers in Jordan are pumped to an extent that is far above their natural recharge and their safe yield. Consequently, in many regions groundwater levels are declining at high rates. Especially given the importance of this resource, groundwater protection, meaning controlling the overexploitation of groundwater, is a key task for the public authorities. While water practitioners and the governmental authorities are aware of this situation, and while more information on the status of Jordan's groundwater resources becomes available, it seems to be a challenge transforming theory into practice, specifically effectively implementing policy initiatives for the protection of groundwater resources (Bonn, 2013; Hussein, 2016; Yorke, 2016). In this context, the capacity to effectively formulate sound management and policy approaches and the ability to organize joint action to implement them is crucial.

The Federal Institute for Geosciences and Natural Resources (BGR) and the Jordanian Ministry of Water and Irrigation (MWI) have been cooperating in the field of groundwater resources for many years. This collaboration proved to be successful in increasing the knowledge and data concerning the status of the groundwater resources. More specifically, BGR has been actively working in development cooperation in Jordan for the past 60 years, and has celebrated this anniversary jointly with its Jordanian partners on the 14<sup>th</sup> of November 2019 with a conference in Amman titled "Groundwater Resources of Jordan" (MWI & BGR 2019, [Link](#)). The conference was attended by about 250 participants. BGR and MWI presented their new publication "Groundwater Resource Assessment of Jordan 2017". The study provides updated information on the status of the groundwater resources in the country, highlighting the negative impacts that over-abstraction of groundwater is having on the current and future availability of this resource. It calls for a stronger emphasis on their protection and on the necessity to use the resources in a more sustainable way. Nevertheless, the implementation and enforcement of groundwater management measures and regulations remains a challenge (Yorke, 2016; Hussein, 2016; Barham, 2012).

In this context, BGR is conducting this assessment on groundwater governance capacities for Jordan. To do so, the BGR sector project for policy advice on groundwater is currently working on methodologies to assess groundwater governance capacities at national level. The aim is to operationalize existing approaches and to develop a sound procedure and methodology for the assessment of groundwater governance gaps. It is intended to enrich the design and implementation of future cooperation projects in this field. The assessment follows a governance capacity framework (oriented in Koop at al. 2017), which defines nine core conditions with three indicators for each (see section below on methodology).

This assessment will target the following purpose:

- Assessment of groundwater governance capacities in the Jordanian water sector
- Identification of governance gaps and recommendations how to overcome them

The overall goal of the assessment is:

- Contribute to the common goals of enhanced groundwater management of the German-Jordanian cooperation
- Enhance long-term water security in Jordan

- Enhance mutual understanding of different stakeholder groups for groundwater management in Jordan
- Contribute to the development of a methodology to assess groundwater governance capacities in the context of international development projects

### 1.1. Definitions of groundwater governance

There are two approaches to groundwater governance. As an analytical concept, groundwater governance describes the interaction of formal and informal rules, norms and institutions that govern the use and development of groundwater resources as well as the human activities that affect its quality (for an overview see Villholth and Conti 2018). The last part of this definition highlights the processes between human activities and groundwater resources. In fact, once under influence of human activities, groundwater quantity, quality and its protection are strongly linked to social and economic developments like land use, agricultural practices, and urban development. Megdal et al. (2014: 2) define groundwater governance as “the overarching framework of groundwater use laws, regulations, and customs, as well as the processes of engaging the public sector, the private sector, and civil society” that “shapes how groundwater resources are managed and how aquifers are used”.

The second approach to groundwater governance comes from the practitioners’ world, which adopts it as a normative concept in the sense of good governance. In this context, good governance is in place when it complies and incorporates principles of sustainability, equality, participation, among others (see Table 1, OECD 2015).

Rogers and Hall (2003) argue that there is effective governance when institutions are responsive, efficient, and accountable. Linton and Brooks (2011) underline that groundwater governance requires the involvement of both governmental and non-governmental actors, while Mukherji and Shah (2005) emphasise the necessity of data availability to facilitate wider stakeholder participation.



Table 1: OECD Principles on Water Governance (OECD, 2015)

**Principle 1.** Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.

**Principle 2.** Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.

**Principle 3.** Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use

**Principle 4.** Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties

**Principle 5.** Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy

**Principle 6.** Ensure that governance arrangements help mobilize water finance and allocate financial resources in an efficient, transparent and timely manner

**Principle 7.** Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest

**Principle 8.** Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders

**Principle 9.** Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making

**Principle 10.** Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation

**Principle 11.** Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations

**Principle 12.** Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed

For the purpose of this study, the Water Governance Capacity Framework as developed by Koop et al. (2017) is applied. This framework understands governance capacity as “the ability of actors to continuously identify and jointly act on collective problems”. The capacities are “determined by actors’ interaction via socio-institutional settings and allocation of resources”, while these “interactions and the collective problem-solving are shaped by the actors’ frame of reference (values, culture, interests)” (Koop et al. 2017: 3430).

## 2. Methodology

### 2.1. Water Governance Capacity Framework

For this study, the water governance capacity framework has been adopted as described in Table 2. The authors defined nine conditions for good governance capacity and formulated for each of them three indicators to assess their status (Table 2). Each indicator is rated on a Likert-Scale (five categories from very high “++” to very low “--”). The framework provides keywords and detailed descriptions for each of the five rating options of the 27 indicators (see EIP Water 2017).

Table 2: Governance Capacity indicator framework (Koop et al. 2017)

<b>Knowing</b>	<b>1 Awareness</b>	1.1 Community knowledge
		1.2 Local sense of urgency
		1.3 Behavioral internalization
	<b>2 Useful knowledge</b>	2.1 Information availability
		2.2 Information transparency
		2.3 Knowledge cohesion
	<b>3 Continuous learning</b>	3.1 Smart monitoring
		3.2 Evaluation
		3.3 Cross-stakeholder learning
<b>Wanting</b>	<b>4 Stakeholder engagement process</b>	4.1 Stakeholder inclusiveness
		4.2 Protection of core values
		4.3 Progress and variety of options
	<b>5 Management ambition</b>	5.1 Ambitious and realistic management
		5.2 Discourse embedding
		5.3 Management cohesion
	<b>6 Agents of change</b>	6.1 Entrepreneurial agents
		6.2 Collaborative agents
		6.3 Visionary agents
<b>Enabling</b>	<b>7 Multi-level network potential</b>	7.1 Room to manoeuver
		7.2 Clear division of responsibilities
		7.3 Authority
	<b>8 Financial viability</b>	8.1 Affordability
		8.2 Consumer willingness-to-pay
		8.3 Financial continuation
	<b>9 Implementing capacity</b>	9.1 Policy instruments
		9.2 Statutory compliance
		9.3 Preparedness

### 2.2. Study design

Semi-structured interviews with key experts and stakeholders of the Jordanian water sector were the main method of data collection. The interviews were conducted face-to-face during January 2020 in Amman and Irbid, Jordan, some in Arabic and some in English language. In total 31 persons from 22 different institutions were interviewed. The interviews were anonymised, therefore the identity of the interviewees will not be revealed within this study. Informed consent before each interview was sought orally. Interviews were not been recorded, but the interviewers took notes during and after the meetings.

Experts from the following institutions were interviewed:

### ***Jordanian government institutions***

1. Royal Court of the Hashemite Kingdom of Jordan
2. Royal Water Committee of Jordan
3. Ministry of Environment (MoE), Hashemite Kingdom of Jordan
4. Ministry for Water and Irrigation (MWI), Hashemite Kingdom of Jordan

### ***Water sector institutions***

5. Water Authority of Jordan (WAJ)
6. Miyahuna (Water Provider Central and Southern Jordan)
7. Yarmouk Water Company (Water Provider in northern Jordan), Irbid (Jordan)

### ***Donors / Development cooperation***

8. Federal Ministry for Economic Cooperation and Development (BMZ) at German Embassy Amman (Jordan)
9. Gesellschaft für Internationale Zusammenarbeit (GIZ), Office Amman (Jordan)
10. Federal Institute for Geosciences and Natural Resources (BGR) Project office, Amman (Jordan)
11. Kreditanstalt für Wiederaufbau (KfW), Office Amman (Jordan)
12. Embassy of the Kingdom of the Netherlands
13. Swiss Embassy, Swiss Development Cooperation (SDC), Office Amman (Jordan)
14. Delegation of the EU to Jordan, Office Amman (Jordan)
15. United States Agency for International Development (USAID), Office Amman (Jordan)

### ***Academia***

16. Al-Bayt University
17. National Agricultural Research Center (NARC) of Jordan
18. Royal Scientific Society (RSS) of Jordan
19. University of Jordan
20. West Asia and North Africa (WANA) Institute

### ***NGOs***

21. Inter-Islamic Network on Water Resources Development and Management (INWRDAM)
22. Middle East Water Forum (MEWF)

The interviewees were selected based on their knowledge, role, and expertise on groundwater related issues. The interviews were semi-structured with open questions, guided by the governance capacity framework (Table 2). Qualitative data analysis of the interviews was undertaken, informed by discourse analysis as a method of data analysis, while the water governance capacity framework served as a basic scheme of codification.

## **3. Jordan case study**

Groundwater resources in Jordan are very important, as they are the main source of water supply, and provide almost half of the country's renewable water resources. Most of the surface water resources (Yarmouk and Jordan Rivers) are of transboundary nature, while only the Zarqa River is not shared with neighbouring countries (Hussein, 2016; Salameh et al. 2018). As water demand exceeds the renewable resources by a factor of 2 to 3, Jordan currently relies on the over-abstraction of groundwater to cover its national water supply. Given the intensive abstraction, the groundwater

levels have dropped to an alarming level over the past 20 years; the decrease of saturated thickness varies in the most important aquifer (A7/B2) between 20 and 50 meters (Figure 1, MWI & BGR, 2019).

According to official figures, domestic consumption accounts for 55% of groundwater abstraction and industrial use for 4%, while 41% of abstracted groundwater is destined to irrigated agriculture (MWI, 2017). The latter is estimated to be far higher, as the abstraction rates for irrigation in the highlands in the registered as well as in the illegal wells are higher than officially declared (MWI, 2016).

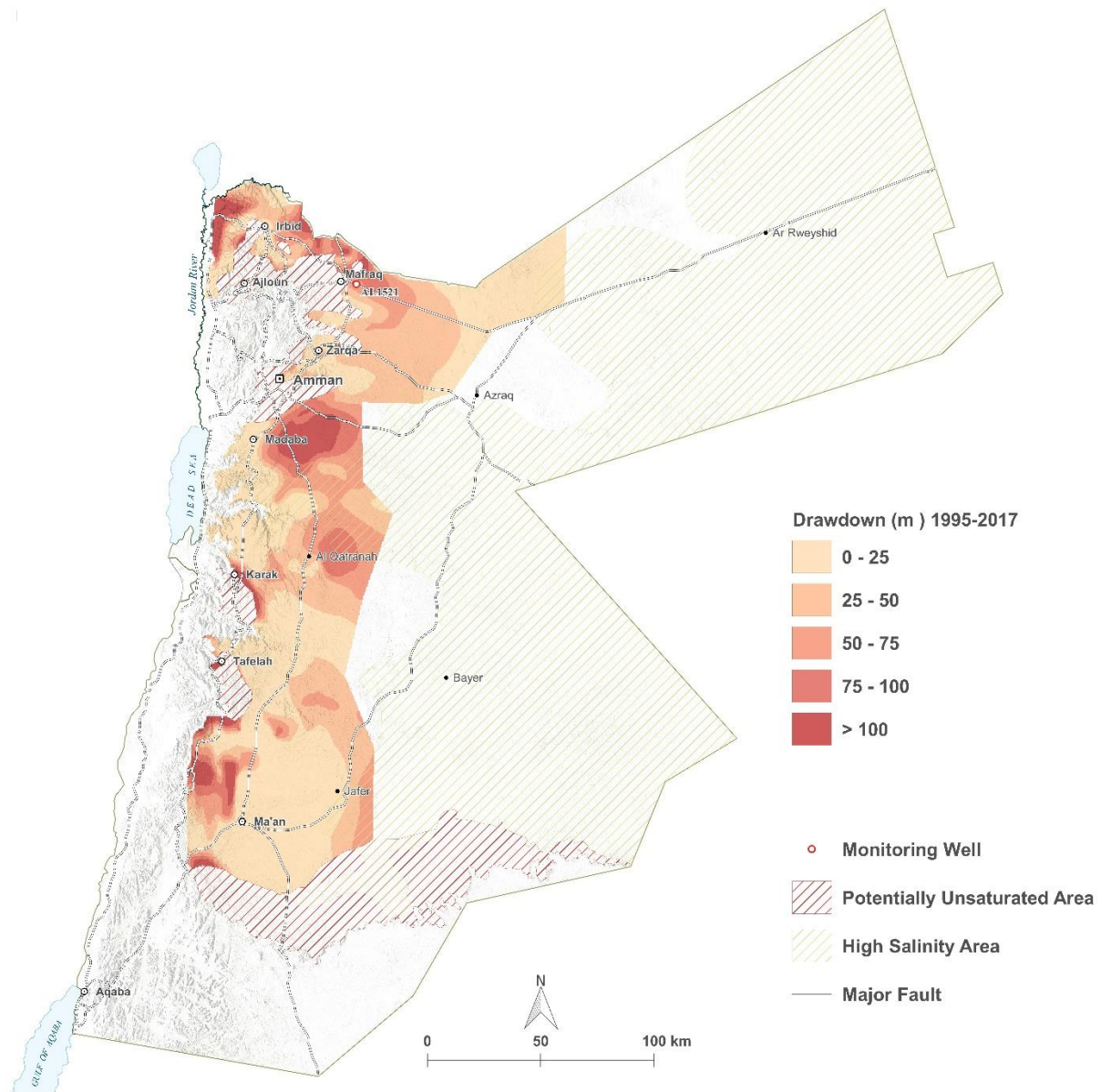


Figure 1 Difference in groundwater levels of the A7/B2 aquifer between 1995 and 2017 (MWI & BGR, 2019)

### Drivers of groundwater abstraction: domestic and drinking uses

Domestic supply accounts for 55% of groundwater abstraction. The water demand for drinking purposes has been growing since Jordan became independent in 1946 due to population increase and economic prosperity. The population of Jordan, currently at about 10 million people, is predicted to further increase in the coming decades, reaching about 14 million in 2050 (Figure 2, UN-DESA 2018). Several scholars have underlined population growth as one of the main reasons behind the increased water demand in the literature. As noted by Hussein (2018a) and Yorke (2016), population growth is

one of the most dominant discourses in Jordan when it comes to the causes of water scarcity. Haddadin – former minister of the MWI - dedicates the first chapter of his book “Water Resources in Jordan” (Haddadin, 2006) to the population issue. For them “Jordan’s population grew 11.5 times in 66 years, from 0.3 million in 1938 to 5.35 million in 2004, because of the abrupt influx of population in the wake of the turbulence that has been affecting the Middle East” (Salameh and Haddadin, 2006: 24-25), a development also observable in the population growth rate (Figure 2). This argument was mentioned also almost thirty years ago by Salameh and Bannayan, who in 1993 stated that “population pressure as a result of natural multiplication and refugee waves coming to Jordan” is one of the main causes of the water crisis (Salameh and Bannayan, 1993: 1). Currently, the debate of water scarcity in Jordan emphasises the impact that the Syrian refugees are having on increasing the water demand in Jordan (Hussein et al., 2020).

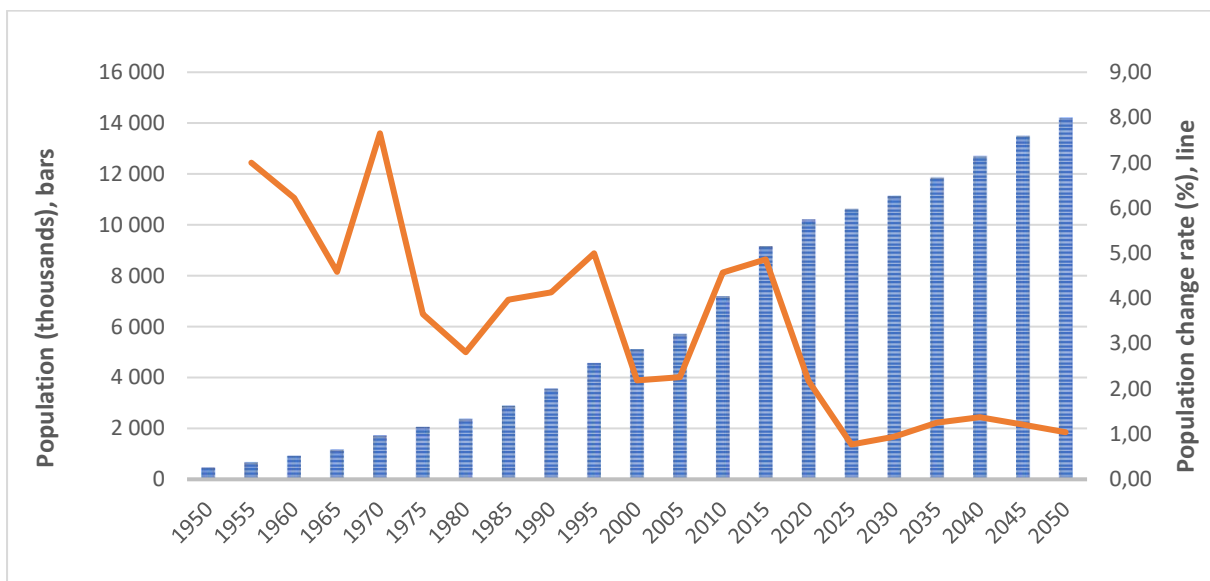


Figure 2: Annual Total Population at Mid-Year and projections (thousands) and rate of change (UN-DESA 2018)

While the rise of water supplied to households is certainly a function of growing population and living standards, the curve of increasing demand could be flattened. Water losses in supply infrastructure and distribution networks, both physical and commercial, remain a large burden or – in other words – a large potential to be untapped. The MWI reported non-revenue water to be 49 % in 2017 (MWI 2018) and set the reduction of water losses as a priority that also receives strong support from international cooperation.

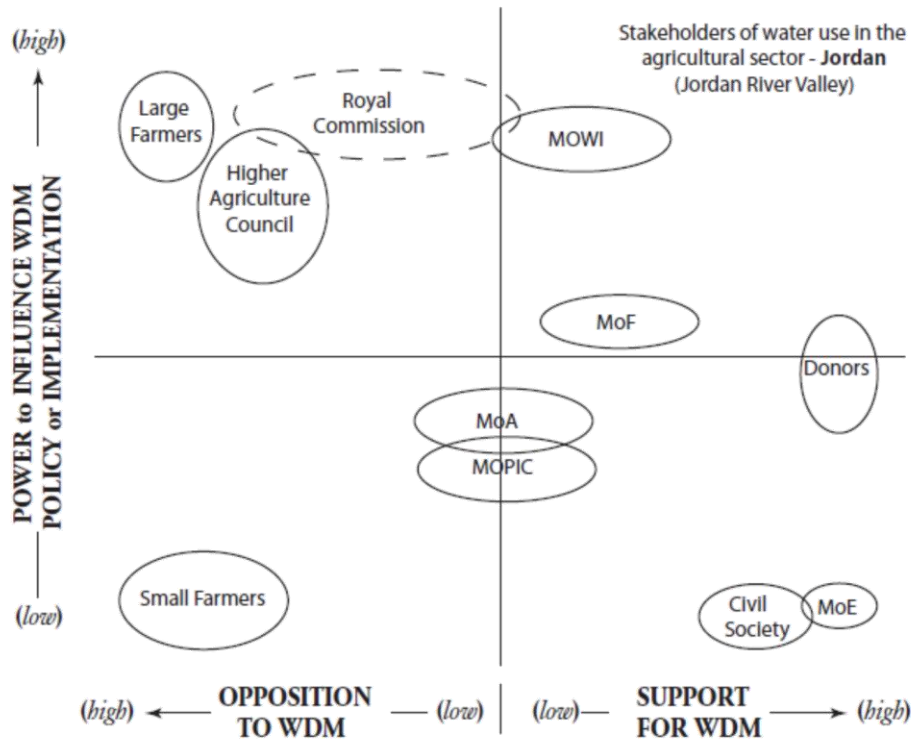
Drivers of groundwater abstraction: agricultural uses

About 41% of registered abstracted groundwater is destined for irrigated agriculture, mainly in the Highlands. The real amount is likely to be far higher, as an uncounted number of agricultural wells are not registered and the abstraction in the licensed wells may be higher than declared; nevertheless, groundwater research provides some good estimates in this regard. Recent studies carried out by the Ministry of Water and Irrigation using remote sensing techniques revealed that there are additional 225 million cubic meters (MCM) groundwater used annually for agricultural purposes in the highland areas (MWI, 2016); this additional amount would almost double the officially declared abstraction volume of 253 MCM (MWI, 2017).

According to the latest literature and research, the core problem seems to be the over-extraction of groundwater for irrigation especially in the Highland – often from illegal wells or in volumes exceeding the well license - and the fact that an extensive part of the agricultural products are exported. From

an (national) economic perspective, exporting “virtual” groundwater in agricultural goods from a water scarce country is critical, as domestic water demand, especially for drinking water, might become dependent on more expensive water sources like desalinisation. In this case, profits stay with agricultural exporters, while cost for alternative water supplies have to be paid by water users and/or public budget covering domestic water supplies. As highlighted by Barham (2012), irrigation in the Highlands is “problematic,” and that “despite the permanent discussions of allocate water inter and intra sectoral, [in practice the amount of] water for agriculture [...] remained unchanged” (Barham, 2012: 4). For Barham, this is due to a lack of implementation of the existing by-laws and regulations, as “the state is not in the position to activate laws against tribe leaders [and] investors in this area [which] consist of rentier-elite, high ranking state employees, military officers and tribal figures” (ibid.). Al-Karablieh et al. from the University of Jordan found that “Jordan utilizes large amounts of water in its exports, and in turn, it does not export goods with low water requirements [...]. Therefore, they have to be replaced with either imports or crops that optimize the water resources” (Al-Karablieh et al., 2011: 964). For Talozzi, Al Sakaji, and Altz-Stamm, it is necessary to view the virtual water usage numbers in light of how much water is used towards products that are exported from Jordan. “This raises the policy question of whether Jordan should be producing this quantity of fruits and vegetables, either for export or for its own use, with precious blue water resources that are needed in other sectors” (Talozzi et al., 2015: 477). As hinted by Barham (2012), Keulertz (2014), Yorke (2013; 2016) and Hussein (2016; 2018), this is due to the political economy of the country, in other terms to the “rentier state” nature of the state-society relationship, and to the “shadow state”, which are barriers to the implementation of by-laws and regulations. As noted by Al Naber and Molle (2017), regulations and policies exist, but they are not implemented and enforced; there is clearly a groundwater governance problem in Jordan.

Zeitoun et al. (2012) analysed and mapped the political support for water demand management in Jordan and found that crucial stakeholders do not support major changes in groundwater abstractions (Figure 3). For Zeitoun et al. (2012: 64) “the Ministry of Water and Irrigation is aligned with the Ministry of Finance, and parts of the Royal Commission, facing the Higher Agricultural Council, the Ministry of Agriculture, larger farmers, and rest of the Royal Commission.” For them, “the political economy that generates current unsustainable water use practice must be understood in its entirety, before more sustainable water use can be achieved. This would necessitate investigation into the pricing signals, target markets and habits of [...] banana producers and consumers, as well as into the political motives of the relevant ministries and the international donor community. This stream of research would be most useful if directed in particular at the generation and perpetuation of ideas that suspend the firm grip on ‘supply-side’ management, even in the face of overwhelming evidence of its destructive effects” (Zeitoun et al., 2012: 64).



MOWI: Ministry of Water and Irrigation; MoF: Ministry of Finance; MoA: Ministry of Agriculture; MOPIC: Ministry of Planning and International Cooperation; MoE: Ministry of Environment

Figure 3: Influence and support of stakeholder groups for water demand management (WDM) (from Zeitoun et al. 2012)

Groundwater governance is therefore an urgent and contested issue for both policy circles as well as a research gap, which needs to be addressed. This is a crucial challenge because groundwater resources are already over-abstracted, their level and quality is decreasing, and the drivers of groundwater abstraction are set to further deteriorate this situation: an expected growing population, and a growing agricultural production, especially for export.

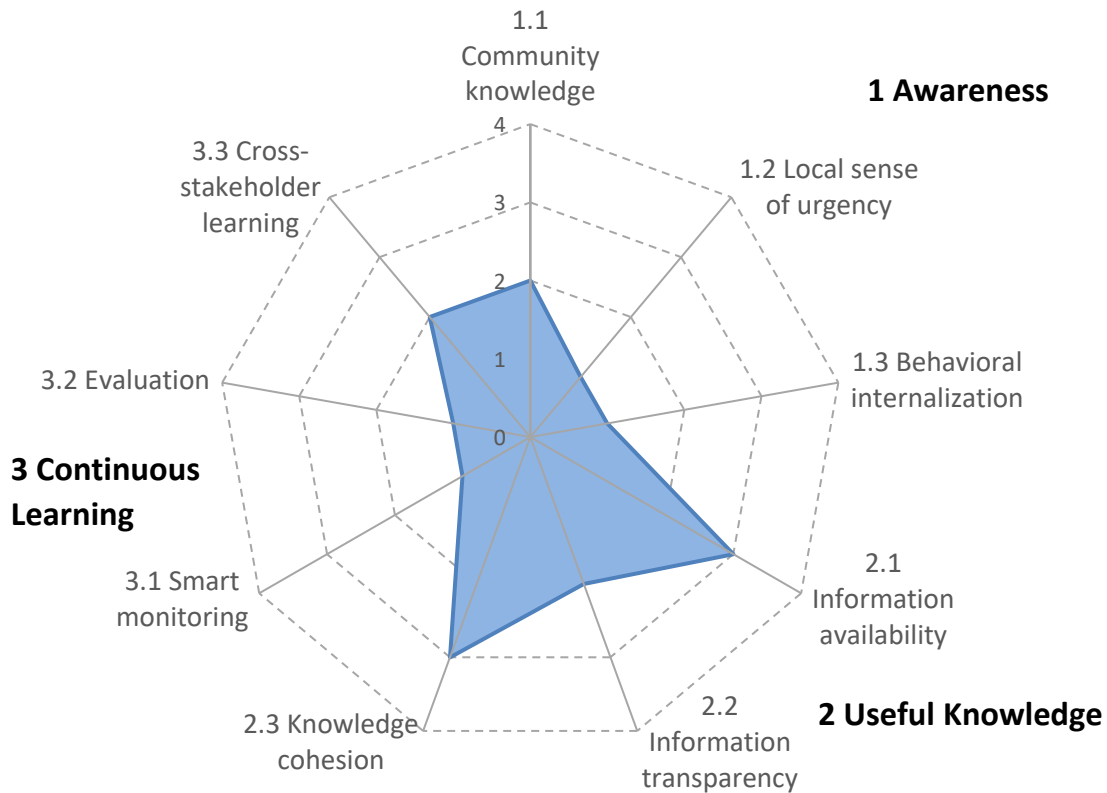
This study aims to contribute at filling this research gap as well as at providing important understandings for policy makers on the nature of this governance challenge. On the one hand, it focuses on the groundwater abstracted for agricultural use, which is considered not a vital purpose – compared with domestic drinking purposes. Agricultural groundwater use unfolds a governance challenge that can be addressed. A second motivation for the study is to analyse the interaction of the donor community’s policies and action with the Jordanian water sector and its implications for sustainability.

#### 4. Results – Indicator evaluation

This section presents and discusses the results, analysed within the governance capacity indicator framework. The following indicator descriptions and guiding questions are taken from the original framework, published in EIP Water (2017). Each indicator rating is presented in a box that indicates the Likert scale rating (“++”, “+”, “0”, “-”, or “--”), the keyword and the indicator rating description. The box is followed by a discussion of respective information gathered in the stakeholder interviews. The rating of the indicators was made by the authors of this study based on the interviews. The description of the indicator rating reflects the answers from the different experts. Although many

main stakeholders and perspectives were covered, different evaluations of the current governance capacity might exist. As the interviews were open to a certain extent, not all indicators could be addressed to an equal level of detail. While the rating tries to paint the picture as of now, there are initiatives as well as institutional and personal efforts that have the potential to substantially advance Jordan’s groundwater governance capacity.

## Knowing



### Condition 1: Awareness

Awareness refers to the understanding of causes, impact, scale, and urgency of the water challenge.

#### Indicator 1.1: Community Awareness

*To what extent is knowledge about risks, impacts and uncertainties of groundwater challenges dispersed throughout the local public and stakeholders, which may result in their involvement in decision-making and implementation?*

0	Underestimation	Most communities have a basic understanding of the water challenge. However, the current risks, impacts and uncertainties are often not fully known or underestimated. Future risks, impacts and uncertainties are often unknown. Some awareness has been raised amongst or is created by local stakeholders and communities.
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The interviews revealed that awareness about water scarcity is present in general among both water practitioners and the public. When it comes to awareness about the situation of groundwater



resources, there have been contradictory results: farmers and end-users seem to be less aware of the groundwater crisis and of the severity of the situation, while water practitioners – including governmental officials, donors, NGOs, and academics – are well aware of the groundwater crisis. This confirms the existence of two “opposed but untroubled” resource realities in the Jordanian water sector, as described by Bonn (2013).

In fact, according to academics as well as water and agricultural experts, parts of the public, including agricultural users, believe that below the ground there is a sea, and that the government does not want to allow them to profit from that hidden sea, imposing regulations and limitations on abstractions. For other farmers, they have been experiencing that the groundwater level is decreasing, but for them the solution is to dig deeper, believing that there is water, and that “you just need to dig deeper”.

Instead, among water experts, NGOs, academics, donors, and governmental officials, there is awareness of the situation of decreasing groundwater resources. As some of them mentioned, “water problems are yet to come and will be massive”. Their position is also reflected in reports and academic articles.

Therefore, for this indicator the governmental and donors’ position is aligned, and it differs from the end-users understanding of the situation.

**Indicator 1.2: Local sense of urgency**

*To what extent do actors have a sense of urgency, resulting in widely supported awareness, actions, and policies that address the water challenge?*

-	Raising of awareness by small groups	A marginalized group (e.g. the most vulnerable, environmentalists, NGOs) express their concerns, but these are not widely recognized by the public. Adaptation measures are not an item on the political agenda during elections.
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What emerged from the interviews and data collection is that overall there is some coverage in the media, some campaigns in schools, aiming at reaching the public. Nevertheless, the main users of groundwater resources – farmers in the Highlands – have little understanding of the causes, impact, scale, and urgency of the crisis. Moreover, the knowledge and awareness that users may have is not leading to a change in behaviour. Instead, as mentioned above, the solution that users identify is usually to dig deeper to find water and ensure water supply for irrigation.

In the interviews, similarly, water utilities explained that they see their role as water providers to the population, and do not envision groundwater protection as part of their mandate. For this reason, although they are aware of the groundwater crisis in the country, they would keep pumping water to the users – being primarily concerned to ensure domestic water supply rather than ensuring the sustainable use of groundwater resources.

The governmental officials are indeed concerned about the groundwater crisis; nevertheless, their top priority is to ensure water security for the country by finding new sources of water – for instance through desalination, increased treated wastewater, etc. – and mobilizing the financing for the planned measures through international cooperation.

Consequently, policies and governmental campaigns aiming at tackling the over-abstraction of groundwater have not received popular support; instead, they have faced challenges especially from

the users. Electoral campaigns and manifestos are usually silent about groundwater management and protection.

**Indicator 1.3: Behavioural internalisation**

*Do groundwater users reflect on their actions? Do groundwater users think on long-term aquifer sustainability? To what extent do local communities and stakeholders try to understand, react, anticipate, and change their behaviour in order to contribute to solutions regarding the water challenge?*

-	Recognized as an external pressure	The water challenge is partly recognized, mainly due to external pressure instead of intrinsic motivations. There is no support to investigate its origin or to proceed to action or changing practices.
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Water utilities, while aware of the situation, do not change their behaviour in light of the groundwater crisis, also because they do not perceive this as their mandate but rather the mandate of the MWI. Concerning domestic users, the interviewees underlined that campaigns in media and schools are having a good effect, shaping behaviour especially of young people at the domestic level. Moreover, receiving water on an intermittent way means that the local population is used and aware of the necessity to use water wisely and not to waste it. Some informants see a connection between firmer rules on (ground-) water abstraction and the degree of awareness about water scarcity among farmers. They state that water use behaviour changed, but not comprehensively.

Interviewees from donors working closely with local farmers confirmed that farmers’ behaviour does not change in light of their increased awareness and experiencing of decreased groundwater resources. Instead, pumping for irrigation purposes seems to have increased over the years rather than decreased, confirming that the decrease in quantity and quality of groundwater resources is not changing the behaviour of farmers. However, some interviewees from governmental institutions working on agricultural issues as well as from donors working with local farmers highlighted that especially small farmers are being pushed out of business due to the increased costs that may be associated with energy for pumping from deeper aquifers, or for digging deeper wells. The decision to leave or sell their farms does not arise from environmental sustainability considerations, but rather from economical concerns.

Condition 2: Useful knowledge

This condition describes the qualities of information with which actors have to engage in decision-making.

**Indicator 2.1: Information availability**

*Are all groundwater bodies/aquifers delineated and mapped? Are the users of sub-surface space registered and regulated? Is there a Groundwater Vulnerability (Pollution Hazard) Assessment? Is there Numerical Model of Groundwater flow?*

+	Information enhancing integrated long-term thinking	Strong effort is put in providing integrated information from various fragmented sources. Information gaps are identified and attempted to be bridged. This may be clear from extensive documentation on the long-term process. In addition, citizen knowledge may be taken into account.
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Interviews with donors, governmental officials, and academics revealed that concerning the availability of information and data on the groundwater resources in Jordan, BGR has been working extensively for the past 60 years, in cooperation with the MWI, to ensure that data and information on groundwater resources is available. BGR is recognised to be a key institution in producing data on groundwater issues in the country. Many interviewees referred to and mentioned the new MWI - BGR publication "Groundwater Resource Assessment of Jordan 2017", which was presented in 2019. This publication contributes to provide data and information on the status quo of the groundwater resources. It is the first comprehensive nationwide groundwater resources assessment; it delimitates the current extension of the aquifers, estimates the stored water volumes, analyses the water level trends and changes in stored volumes during the past 20 years. Further, the study projects the future development of the groundwater resources based on a national groundwater model that for the first time represents shallow and deep aquifers in one model. This comprehensive study was published online and distributed as a hard copy to main stakeholders in the water sector, marking a turning point in the information policy of MWI. Nevertheless, what is missing is recent and updated data on abstraction trends. Available numbers of groundwater abstraction underestimate the real groundwater use, as can be deduced from proxy data, such as remote sensing of irrigated areas. Groundwater level monitoring is problematic, especially since manual measurements have been drastically reduced and substituted by telemetric monitoring systems, which after a few years of operation are not delivering plausible groundwater data anymore.

A crucial information for sustainable groundwater management is related to the economic costs of groundwater abstraction. Holistic cost calculations are rarely undertaken with the consequence that cost factors cannot adequately be considered in decision-making.

**Indicator 2.2: Information transparency**

*To what extent is information on the water challenge accessible and understandable for experts and non-experts, including decision-makers?*

0	Sharing of very technical knowledge	There are protocols and procedures for accessing primary data from the MWI; however, it is not readily available. Although secondary data is openly available, it is sometimes difficult to access and comprehend because it is very technical. The water challenge is reported on local websites and reports.
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Most primary data on groundwater resources are owned by the MWI. Access to MWI data requires official letters and specific procedures and permits, which may result in delay. As an interviewee from the academic world put it, „what you know is who you know, it is about who you know, your networks. So, it is easier to me, but it is hard in general.” Therefore, it emerged that having good relations with the MWI, existing cooperation projects, may facilitate access to data. Donors and aid agencies usually have no problem in accessing MWI data. However, students and academics, especially if not based in one of the main universities of the countries, may face delays and denials in access primary data.

Aggregated data on groundwater are published since 2018 in a groundwater yearbook, and a detailed assessment of Jordan’s groundwater resources was published in 2019. The translation of technical information and scientific result to decision makers is getting increased attention within the MWI,

while dedicated formats to communicate groundwater status information are still to be developed / strengthened.

Data exchange between ministries dealing with groundwater quantity is poorly developed, also due to low demand and interest to act on groundwater issues (see Indicators 2.3/5.3).

Some interviewees from the donors community that have been working closely on projects with the MWI highlighted that the MWI would be willing to share their data (especially with donors and aid agencies), but one of the challenges is that their data are not well organised. Nevertheless, they have recently started to upload their studies and strategies online, facilitating access to studies and MWI data.

Different interviewees from the academic sector also highlighted that access to data of the Meteorological Department are not free, and students and academics for instance need to pay for each data entry they require. While this is common in many countries, it is reported to be a challenge especially to local academics and to students writing their dissertations, due to limited grants and funding to conduct their research.

**Indicator 2.3: Knowledge cohesion**

*To what extent is information cohesive in terms of using, producing and sharing different kinds of information and usage of different methods?*

+	Substantial cohesive knowledge	Sectors cooperate in a multidisciplinary way, resulting in complete information regarding the water challenge. Besides multiple actors, multiple methods are involved to support information. Too many stakeholders are involved, sometimes in an unbalanced way. Knowledge about effective implementation is often limited.
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Data produced by projects of donors’ organisations contribute to the data sets of the MWI, as they are usually projects conducted in collaboration and under the umbrella of the MWI. Different institutions are collecting data, including the MWI, RSS (quality of groundwater), the water utilities, and the Ministry of Environment. However, these data are not assembled in a combined database or dataset, although there were attempts to develop such an overarching structure.

Academics and donors underlines that monitoring activities between sectors and agencies should be better coordinated, and more work should be done to build and facilitate trust between different institutions when it comes to data sharing. This vision was also shared by governmental officials from the ministry of environment and from the agricultural sector. Mechanisms to coordinate research, academic work, and knowledge creation are currently lacking and should be enhanced. However, according to the MWI interviewees, coordination with other ministries and sectors is overall successful.

**Condition 3: Continuous Learning**

Monitoring is a key condition to sustainably address groundwater protection, as it provides updated data on the resource, allowing policy makers to act accordingly. Monitoring is important, as the status of groundwater resources is not static but rather dynamic. Based on reliable data, policy interventions and approaches can be reviewed and reconfigured, if necessary. Apart from the learning from data, social learning by multi-stakeholder interaction across sectoral and disciplinary boundaries is another condition that fosters sustainable and adaptive groundwater management.

### Indicator 3.1: Smart monitoring

*To what extent is the monitoring of process, progress, and policies able to improve the level of learning (i.e., to enable rapid recognition of alarming situations, identification or clarification of underlying trends)? Or can it even have predictive value?*

-	Reliable data but limited coverage	Monitoring occurs; however, the monitoring system does not cover all facets of the water challenge, with sometimes incomplete description of the progress and processes of technical and policy measures. Monitoring is limited to singular effectiveness or efficiency criteria and cannot identify alarming situations.
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New technologies are being introduced by the MWI and donors to monitor groundwater resources. MWI with the support of different donors since five years is implementing an automatized hydrological monitoring network with telemetric data transfer. The objective of MWI is to modernize the monitoring and reduce the costs for personnel and fieldwork. Regrettably, the experience with the first implemented projects shows that the new systems have a very short technical live span, mainly because of vandalism and the lack of maintenance.

Donors and technical water experts explained that, as a result, monitoring activities of the status of groundwater resources in Jordan have decreased during the last years. Actual information is limited, particularly concerning the levels of abstractions or discharge of springs. Consequently, the interviewees from donors and academia highlighted that policies and strategies are not informed by the monitoring of groundwater resources. Nevertheless, the national water strategy of 2008 “Water for Life” was updated in 2015 due to the new political context, especially due to the Syrian crisis impacts on Jordan, the SDGs, and increasing impacts of climate change (Hussein, 2019). The revised version updated the amounts of the Disi groundwater resources to be supplied to the northern part of the country.

So, while it is difficult to have long-term water strategies, they are updated when needed. The MWI underlined the need of having a Groundwater Monitoring Centre, where emerging trends could be captured and analysed. The MWI expects that a new telemetric system would be instrumental for advancement on this monitoring aspect, although experiences with this automatized systems showed that the lack of maintenance led to the failure of the system after few years only. The national groundwater model developed by BGR coupled to WEAP supports the informed decision-making; decisions on water distribution, demand management or infrastructure can be modelled in the WEAP model, while the coupled groundwater model allows simulating the impact of the decisions on the groundwater resources as well as its future development.

On this indicator, the MWI and governmental officials believed and emphasised that the monitoring of the broader context and of the policies is leading to updating and improving the policies and actions, while donors and academics had a different perspective, as explained above.

### Indicator 3.2: Evaluation

*To what extent are current policy and implementation continuously assessed and improved, based on the quality of evaluation methods, the frequency of their application, and the level of learning?*

-	Non-directional evaluation	Evaluation is limited regarding both frequency and quality. Evaluation occurs sometimes, using inconsistent and even ad-hoc criteria. In addition, the evaluation is not systematic. There is no policy on the performance of evaluations, only the evaluation(s) itself is reported.
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Different interviews with donors and academics revealed that there is no consistent evaluation of policies. For instance, donors have underlined that there has been no evaluation of the policy on abstraction, or on the tariffing system or on the illegal wells. There is no process of continuous assessment of such policies; there is some sort of evaluation that brings practitioners to believe that the tariffs are too low, or that the illegal wells should be closed, but these conclusions do not stem from a process of continuous assessment, which in fact is not in place. In addition, the conclusions of that sort of evaluation did not bring any implementation, also due to political and broader context constraints. Academics underline also that policies, strategies, and reports in the MWI are often drafted by donors, which show a structural dependency of the Jordanian institutions on foreign advisory services that might result in low ownership.

The governmental view of the MWI on this aspect, instead, points to the evaluation of the National Water Strategy of 2008, which has then been updated in 2015 to actualise the situation on the ground (Syrian crisis), proving therefore that strategies and policies in the water sector are based on technical and policy evaluations. Also, minor work done by the MWI in this direction is represented by the “Structural Benchmark Action Plan to Reduce Water Sector Losses”, the last one from 2018, and “Control campaign water resources and network”, which is a regular short evaluation report to the Prime Ministry (MWI, 2018; 2019). Clearly, the donors and MWI positions differ on this indicator.

### **Indicator 3.3: Cross-stakeholder learning**

*To what extent are stakeholders open to and have the opportunity to interact with other stakeholders and deliberately choose to learn from each other?*

0	Quite open for stakeholder interaction	Stakeholders are open to interaction, though not much learning is going on due to the informative character of the interaction. Often, a number of stakeholders that do not necessarily share interests or opinions are involved in the decision-making process.
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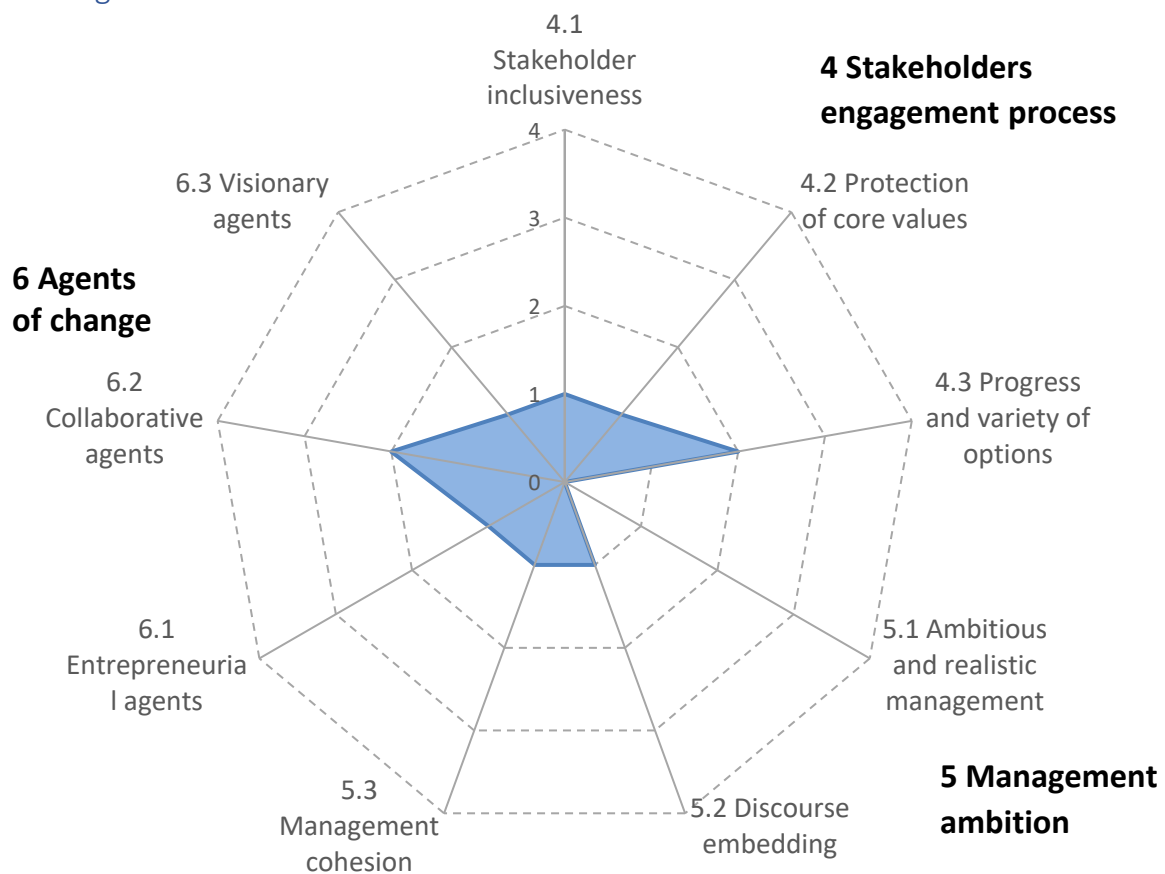
There is collaboration and exchanges between stakeholders, for instance between academics (especially those based in Amman), among donors, research centres (e.g. RSS, NARC). However, the big elephant in the room are the users. Interviews confirmed that there is no or little interaction with users of groundwater resources from the agricultural sector. GIZ started projects in this direction, for instance in 2000 in the Jordan Valley with the Water Users Associations, which is considered to be a successful project (GIZ, 2018; Mustafa et al., 2016) and another one called the Highlands Water Forum (HWF) in 2008 (GIZ, 2018: 97). The latter, under the patronage of HRH Prince Faisal, focused on facilitating dialogue between different stakeholders, including farmers, in the Highlands. “The HWF is a good example of trying participation and a bottom-up approach because top-down approaches have failed repeatedly over the years in reducing overexploitation of groundwater” (GIZ, 2018: 100). It facilitated dialogue between stakeholders, bringing them to sit at the same table, discussing face to face. In fact, “the overall objective of the HWF was described as development and implementation of

a roadmap towards sustainable management of groundwater resources, including a clear agenda for implementation” (GIZ, 2018: 101). “The most important direct result from the HWF is the improvement of communication between government and farmers. There was a building up of trust that led to a new level of relationship and increased the available information on both sides. Apart from these atmospheric improvements, a number of projects that were developed by the Azraq Basin Committee have been implemented. Different donors have shown interest in the priorities of the stakeholders, even before the Action Plan was developed” (GIZ, 2018: 105).

Nevertheless, it was deemed not to be effective and the MWI closed it in 2015. With its closure, however, all bridges for dialogue with the users have been closed, and there have been no attempts to reinstate a similar project or platform to ensure such a cross-stakeholder exchanges and learning opportunity.

Cross-stakeholder learning and bottom-up processes, especially in highly contested arenas like the HWF, tend to be slow and suffer setbacks. The slow pace of the HWF process has been contrasting the expectations of donors and senior governmental officials, who considered bottom up approaches and dialogue with farmers as not useful and ineffective. On the other side, the evaluation of this process among donors at project management level, academics and NGOs was more positive. They valued the approach for involving and building trust and dialogue with farmers in the Highlands as an important step for solving structural issues of the groundwater crisis. This consideration comes in particular from the conclusion that top down approaches have failed due to challenges that the MWI has been having in efficient implementation of by laws and regulations.

## Wanting



#### Condition 4: Stakeholder engagement process

Stakeholder engagement is required for common problem framing, gaining access to a wide variety of resources and creating general support that is essential for effective policy implementation.

##### Indicator 4.1: Stakeholder inclusiveness

*To what extent do stakeholders interact in the decision-making process (i.e., are merely informed, are consulted or are actively involved)? Are their engagement processes clear and transparent? Are stakeholders able to speak on behalf of a group and decide on that group's behalf?*

-	Non-inclusive involvement	Not all relevant stakeholders are informed and only sometimes consulted. Procedures for stakeholder participation are unclear. If involved, stakeholders have only little influence. Stakeholder with scarce resources are not able to participate.
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Stakeholder inclusiveness in the decision-making process is ranked as low because not all stakeholders are involved throughout the process. In fact, it was recognised in several interviews with MWI officials that there is a good coordination at the inter-governmental and inter-ministerial levels and that donors are well involved in coordination and included with the MWI. However, for some of the interviewees from the donors' community more work should be done in facilitating the coordination at different levels especially between the MWI and the Ministry of Agriculture. Another aspect that was highlighted by donors and researchers on agricultural issues was the lack of a coordinated vision and strategy for the agricultural sector, which makes inclusiveness of the agricultural sector more challenging although more important. There are also donors' coordination meetings.

Nevertheless, as noted by several donors, users - especially large farmers in the Highlands - are not included in this process, which is striking given their relevance in groundwater uses in the country. Only some "open minded" large farmers that shared the problem framing are involved in projects of donors, especially in the field of irrigation technology.

Here the positions of donors and of the MWI differ with the MWI believing to be conducting a good and inclusive coordination with other sectors, while donors and academics underline that the inter-ministerial coordination is usually at the top level. They state that there is not much coordination and inclusiveness of farmers in the Highlands and between the MWI and the agricultural sector (apart from minister to minister- or similar - type of meetings).

##### Indicator 4.2: Procedures and quality of stakeholder engagement

*Are stakeholders actively participating and committed to the process? To what extent are procedures clear, realistic and legally defined? Do stakeholders have trust and feel comfortable with the process? Is there an acknowledged and accepted lead (institution) of the process?*

-	Non-inclusive and low influence on results	Most stakeholders are engaged, but the level of engagement is low (informative or sometimes consultative). There is a low influence on the result, which invokes resistance, for example on internet platforms and newspapers. Stakeholders that push the process are a minority.
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As mentioned for indicator 4.1, the involvement of stakeholders is overall fine at the inter-ministerial level and with donors, but could and should be improved in relation to the users. In fact, there are inter-ministerial committees in place to facilitate this process of interaction and coordination between ministries. However, this happens at the higher level, and at the lower and middle levels of the ministerial employees, there is usually a lack of knowledge of what is being done exactly in the other ministries. However, interviewees from academia, donors (working on agricultural issues), and agricultural researchers highlighted that within the agricultural sector there seem to lack a national strategy, a lead, a vision, with the effect that strategic decisions on agricultural development are taken by economic actors without any guidance of agricultural policies, and even less consideration of water policies. Projects are mainly conducted at local level, in terms of pilots, and the challenge is to scale them up at the national level, for which a strong ministerial vision and strategy would be needed. Farmers do not have a mechanism for their participation and inclusion, a mechanism that they accept as a valid instrument of decision-making. The Highland Water Forum seemed like such an instrument, but it was unsuccessful.

What is needed is a platform that could allow building trust and a common framing of the problem, which needs to be improved and envisioned among stakeholders. Within the water sector the MWI seem to have the role of a lead or could be the one leading.

**Indicator 4.3: Progress, outcomes, effectiveness**

*To what extent are stakeholder groups part of decision-making process? Are there variety of alternatives co-created and thereafter selected from, and are decisions made at the end of the process in order to secure continued prospect of gain and thereby cooperative behaviour and progress in the engagement process?*

0	Consultation or short active involvement	There is a clear procedure for consultation or short active involvement of stakeholders, but the opportunities to consider all relevant alternatives is insufficient. Decisions are therefore still largely unilateral and solutions suboptimal. The suboptimal character of a solution can be observed from evaluations or difference in opinions.
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Especially at the MWI, it clearly emerged both in the interviewees as well as in the ministerial reports – such as in the National Water Strategy - that “the only solution is desalination” (MWI, 2015). This clearly shows that, even if there may be consultations with stakeholders, the MWI has already identified what the solution should be, side lining any other solution such as water demand management. In addition, this solution was decided centrally from the ministry and was not co-created with all stakeholders of the sector.

More engagement throughout the process would be needed, for co-creating possible solutions and policies for the sector, allowing and giving space for all alternative and possible solutions to be considered.

Condition 5: Management Ambitions

Management ambitions assesses if current policy is ambitious, feasible, well embedded in local context and if it forms a cohesive set of long-term and short-term goals within and across sectors.

**Indicator 5.1: Ambitious and realistic management**

*To what extent are goals ambitious (i.e., identification of challenges, period of action considered, and comprehensiveness of strategy) and yet realistic (i.e., cohesion of long-term goals and supporting flexible intermittent targets, and the inclusion of uncertainty in policy)?*

*Are groundwater management goals oriented in long-term sustainability/safe yield? Are there groundwater management plan or action plans on groundwater quality protection?*

--	Short-term, conflicting goals	Goals consider only contemporary water challenges, are short-sighted and lack sustainability objectives. Goals are arbitrary and sometimes conflicting, and the character of policy is predominantly reactive.
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What the interviews with donors, water utilities, and academics revealed is that practices of groundwater use are not sustainable and not long-term oriented. For instance, the goal and mission of the Yarmouk Water Company (YWC) is to provide water to its customers, and they will ensure this by pumping rather than including considerations of sustainability.

When it comes to priority goals and strategies to ensure water security in the country, most people see desalination as the only/main solution. However, some interviewees from governmental institutions explained that desalination would help in protecting groundwater resources, as it would be a way to relax pressure on groundwater over-abstraction. However, this would need a clear strategy on how to control water abstraction for irrigation in the Highland to stop over-pumping. Without this strategy, the relief of pressure on groundwater due to desalination for drinking water supply will be reversed by the use of the released resources by agricultural activities.

Some interviewees from the academic and donors sectors reported about the lack of measurement of abstractions, as the licensing and monitoring of water wells is very far from being comprehensive and extensive illegal abstraction is taking place. This reveals a basic challenge of groundwater abstraction management, as quantitative management goals are hard to track and control under these circumstances.

Finally, it emerged in interviews with donors that when it comes to planning and strategies the policies and solutions envisioned are not financially and economically sustainable but rely on external aid and support. For this reason, the current and envisioned use of groundwater resources lacks components of sustainability, but it is oriented to short-term goals, mainly the increase of supply through technology. This perspective is not shared by the MWI, who instead believes that the envisioned strategy is sustainable also economically, mentioning past examples of BOT projects done in Jordan such as the Disi and the Al-Samra wastewater treatment plant.

**Indicator 5.2: Discourse embedding**

*To what extent is sustainable policy interwoven in historical, cultural, normative and political context?*

*Is groundwater management and protection actively being related to broader political agenda and (national) narratives of water resources management?*

-	Persistent reluctance and poor embedding	Actors feel reluctant to execute current policy as it conflicts with their norms and values. Policy hardly takes the local context and existing discourses into account. Moreover, the policy does not correspond with societal demands. This may lead to distrust between actors, inefficient use of resources and ineffective overall implementation.
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Interviews showed that there are several discourses and local beliefs that shape users' behaviours on groundwater use. **The first one**, which emerged in several interviews with academics, donors, water utilities, and some low level governmental employees, is that many local users believe that there is a "sea below the ground". For this reason, they dig legal or illegal wells and over-pump, as for them there is an infinite quantity of water below the ground. If the well dries up, the solution is to dig deeper.

**Another discourse** is that water is "gift from God" and therefore should be free. With this justification, many users do not pay their water bill, especially in the rural areas. Nevertheless, the official religious take is that while water is indeed free, users need to pay for the service of delivering the water, and this is emphasised in many of the awareness raising campaigns initiated by the MWI, for instance in the textbooks used in the Jordanian schools.

**A third discourse** embedded in the local culture is that "if it is on (or below) my land, I own it". For this reason, several people especially in the rural areas feel free and right to dig (illegal) wells and to over-pump groundwater resources, and they feel that water belongs to them rather than to the state, as it is below their land.

**A fourth discourse**, present especially in the border-areas in the north and in the west of the country, is that "if we don't use the water, it will flow to our neighbour, including groundwater resources of transboundary nature". For this reason, they believe they should be entitled to pump as much water as possible; otherwise, the water will be lost at the benefit of the neighbouring country, which will be able to use it instead than the Jordanians. However, the restrictions of digging new wells for Jordanians is seen as a secret-deal between the Jordanian government and foreign governments, at the benefit of the neighbouring countries, which allow their citizens to dig wells and use the "Jordanians' water".

**Indicator 5.3: Management cohesion**

*To what extent is policy relevant for the water challenge, and coherent regarding 1) geographic and administrative boundaries, and 2) alignment across sectors, government levels, and technical and financial possibilities?*

*Is groundwater management and protection actively being related and coordinated to agricultural policies, urban planning, urban drainage, solid waste management, mining activities? Do the management mechanisms cross political borders (both intra- and interstate)?*

-	Opposing sectoral policies	Overall water policy is characterised by fragmentation and imbalance between sectors. The majority of resources is spent on the dominant policy field and overlap between sectors lead to inefficient use of resources.
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What the interviews revealed is that policies are not coherent across sectors, between the MWI and the ministry of agriculture. It emerged that there is no national agricultural strategy, no regulations on crops patterns or directions on what to grow/where. Moreover, there seem to be two opposite directions between the MWI and the ministry of agriculture, the former aiming at capping groundwater abstraction for irrigated agriculture – although without a clear strategy on how to achieve this – and the latter aiming at expanding agriculture.

Nevertheless, it also emerged that there is coherence in terms of geographical and administrative boundaries, as – given water policies are centralised - there is coherence and national considerations, including water transfers across different areas in the country. Groundwater resources used for domestic purpose in Amman are in fact transferred from as far as the Disi/Aqaba area. Moreover, also in the 1994 Peace Treaty between Israel and Jordan, there are water transfers envisioned between the two countries.

There is also cohesion when it comes to groundwater quality considerations for issuing new permits for industrial or commercial activities as they may pollute groundwater resources; hence, “Land-Use Licensing Committees”, an inter-ministerial committee, is involved and needs to provide its approval for any such licensing. The lack of coordination in the field of groundwater abstraction control seems therefore being related to the conflicting interest in that area and not to a general failure to act in a coordinated manner.

#### Condition 6: Agents of change

In order to drive change, agents of change are required to lead, show direction, motivate others to follow and mobilize the resources required.

#### Indicator 6.1: Entrepreneurial agents

*To what extent are the entrepreneurial agents of change enabled to gain access to resources, seek and seize opportunities, and have influence on decision-making? Are there incentives for innovations in groundwater monitoring? To what extent digital technologies are integrated in groundwater management and monitoring? Are there mechanisms to upscale pilot projects?*

-	Room for short-sighted entrepreneurship	Agents of change struggle to gain access to resources to address imminent water challenges. Windows of opportunity to identify and to act upon perceived risks are limited. Opportunities to address stakeholders with potential access to resources are rarely seized
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The interviews revealed that there are minor initiatives aiming at promoting young entrepreneurs in the water sector, such as the CEWAS Middle East. However, those are supported by foreign donors, and there are currently no mechanisms in place to upscale these pilot projects. Moreover, these young entrepreneurs have no influence in the decision-making process.

Some donors stated that conditions for agricultural entrepreneurs to develop alternatives to extensive groundwater use are not sufficient and need to be improved.

#### Indicator 6.2: Collaborative agents

*To what extent are actors enabled to engage, build trust-collaboration, and connect business, government, and sectors, in order to address the water challenge in an unconventional and comprehensive way?*

*Are there groundwater user committees or similar institutions? Are there other forms of ad-hoc or permanent institutions for groundwater management? Are there stakeholder meeting / forums? Do these meetings cross sectoral boundaries? Who and how organizes exchange of science and policy makers?*

-	Agents are enabled to enhance conventional collaboration	What emerges is that the traditional coalitions are preserved, maintaining the status quo, for instance farmers versus MWI, as emerges for instance from the decision of stopping the participatory bottom-up dialogue of the Highlands Water Forum. There has been limited space to bridge this gap and creating new collaborations.
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In the past, there have been collaborations between stakeholders. Best example, as mentioned above, was the Highland Water Forum. It aimed at building trust, connections, and at providing all stakeholders with a platform to meet and exchange views. Another example is the Water Users Association in the Jordan Valley, although it deals with surface water and not with groundwater resources. Nevertheless, it provides some sort of institution for the users to manage the water resources.

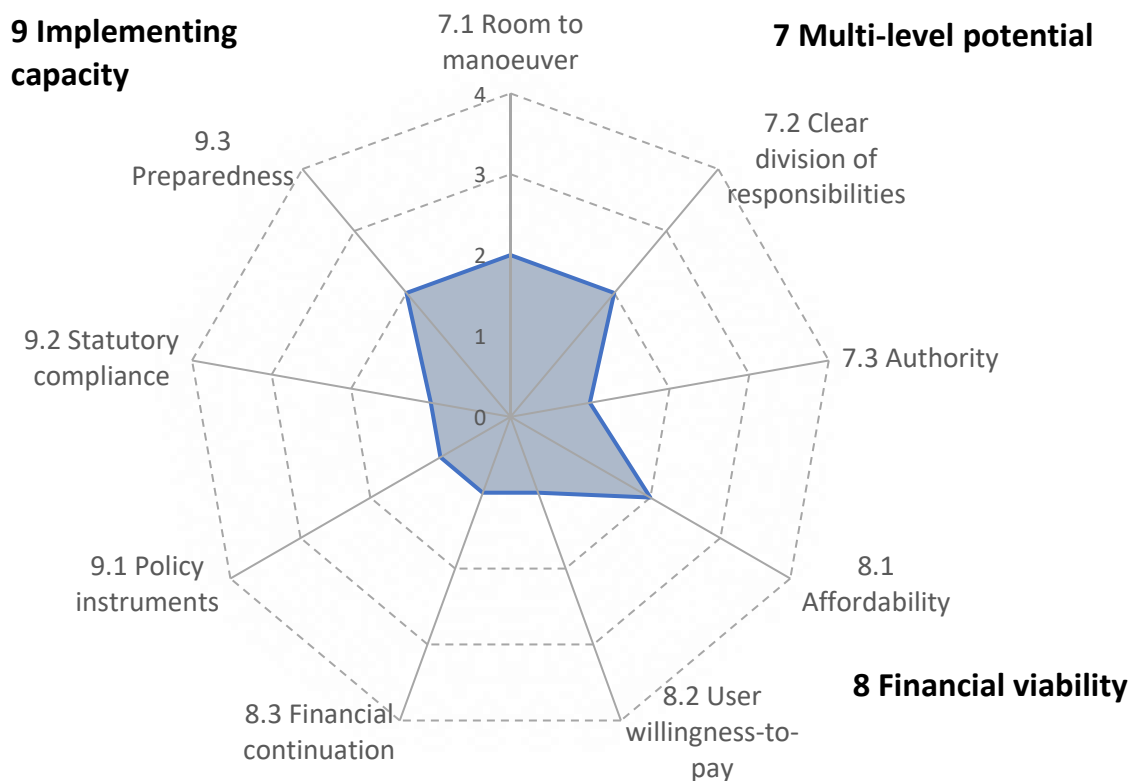
What emerges is that the traditional coalitions are preserved maintaining the status quo, for instance farmers versus MWI, as emerges from the decision of stopping the participatory bottom-up dialogue of the Highlands Water Forum. There has been limited space to bridge this gap and create new collaborations. Solutions are sectoral rather than holistic, while there would be a need for a better coordination and envisioning common strategies between the water and agricultural sectors.

### **Indicator 6.3: Visionary agents**

*To what extent are actors in the network able to manage and effectively push forward long-term and integrated strategies, which are adequately supported by interim targets?*

-	Unilateral and short-term vision	There is a unilateral vision regarding the water challenge, which considers a limited group of actors. The vision often has a short-term focus, with a maximum of 3 to 4 years.
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The MWI has a vision, which is described in the national water strategy produced by the Royal Water Committee that emphasises the necessity of desalination as the main solution, and the MWI is successful in pushing for it (MWI, 2015). However, this solution is not in line with our normative assumption, which has sustainability as its core. Otherwise, it could have been argued that the MWI has a clear vision and strategy for the long-term. However, when considering sustainable solutions, although in the past the MWI had some clear solutions, due to the broader political and geopolitical context, Jordan had to respond to sudden shocks, such as wars and instability in the region, resulting in the reception of refugees. For this reason, often long-term plans have been affected by sudden events. An example that has been cited many times during the interviews was the Syrian crisis, which resulted in the reception of refugees in Jordan that affected the plans concerning the use of the Disi groundwater.



Condition 7: Multi-level potential

Groundwater protection involves a variety of actors and interests from all levels of government, organizations and (private) stakeholders. For sustainable solutions, working in networks is an essential determinant for effective solutions.

**Indicator 7.1: Room to manoeuvre**

*To what extent do actors have the freedom and opportunity to develop a variety of alternatives and approaches (this includes the possibility of forming ad hoc, fit-for-purpose partnerships that can adequately address existing or emerging issues regarding the water challenge)?*

0	Limited room for innovation and collaboration.	Actors are given the means to perform predefined tasks for dealing with problems that are framed with a narrow, short-term and technical-oriented scope. There is limited room to deviate. Solutions are sought in own sectoral field and expertise.
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The interviews with donors, researchers on agricultural issues, and NGOs showed that NGOs, donors, and stakeholders experiment and try different initiatives, with local pilot projects. Nevertheless, this is allowed as long as certain issues are not challenged, or certain boxes not opened. **First of all**, the interests of large farmers; challenging the type of crops they are using, or the over-use of groundwater resources, may be risky. **Second**, transboundary issues are seen as very securitised and therefore stakeholders tend not to engage in pilots or discussions over this politically sensitive issue. **Third**, the support of donors’ organisation is vital for the MWI, therefore calling for a disengagement of donors

in Jordan would not be viable (Bonn, 2013). **Fourth**, the issue of water tariffs is seen as a very political one, as it may have socio-political consequences, especially in the years of and after the so-called “Arab Spring”. **Finally**, the reuse of treated wastewater in the northern Jordan Valley is seen as conflicting with local cultural norms, and initiatives in this sense oppose to the beliefs of local communities.

Therefore, overall there is room to manoeuvre as long as the initiatives do not conflict with the aforementioned issues.

**Indicator 7.2: Clear division of responsibilities**

*To what extent are responsibilities clearly formulated and allocated, in order to address effectively the groundwater challenge? Is there a lead agency as Groundwater Custodian?*

0	Inflexible division of responsibilities.	Responsibilities are divided over a limited set of conventional actors. Opportunities for new cooperation and more effective division of responsibilities are not seized or even recognized. Sometimes conventional actors get more tasks to deal with new water challenges.
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The interviews with the MWI and the other ministries showed that the governmental institutions are well aware of their responsibilities and there is a clear division in responsibilities amongst the different ministries. However, responsibilities are divided in terms of water management rather than with a focus on groundwater protection.

Concerning the lead agency as Groundwater Custodian, the interviews revealed that this role is and should be within the MWI. Nevertheless, even if the MWI may be seen as the one responsible for the protection of groundwater resources, it is not successful in addressing this challenge. One of the reasons is that, per its nature, groundwater is abstracted locally and not managed centrally, so monitoring and enforcing laws and regulations is very important to be successful in groundwater protection. Moreover, the MWI has little mandate compared to the Ministry of Agriculture over the agricultural sector strategies and approaches.

**Indicator 7.3: Authority**

*To what extent are legitimate forms of power and authority present that enable long-term, integrated and sustainable solutions for the water challenge? Is there a political "weight" and leadership for the solution of the groundwater challenge?*

-	Unfruitful attempts.	The water challenge is put forward by individuals or a group of actors, but there is only little interest, which is also fragile due to poor embedding of sustainability principles in current policy mechanisms, interests, and budget allocation. The challenge may have been mentioned in reviews or reports but left unaddressed.
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While there is a political will at the MWI to protect water resources, including groundwater, they are also aware of the power relations in the country and of the influential stakeholders, especially the large farmers in the Highlands. An interesting example comes from the so-called “illegal wells campaign” launched by the MWI in 2012-2013. It aimed at and included: monitoring and collecting data using satellite and remote sensing; study of laws and bylaws and what needs to be amended; collaboration with Interior Ministry to stop drilling of new wells; setting up in the MWI a monitoring

centre for surveillance, cameras, online calls connected to the police department; a public awareness campaign to ensure support from the wide majority of the population (as there is general sympathy with the farmers); collaboration with the members of parliament (MPs) to pass the laws (as bylaws are work of the government). Therefore, this shows that there have been examples of collaboration between different departments and governmental institutions under the leadership of the MWI. Nevertheless, when looking at what has been achieved, implementation of the campaign was not overall successful. Although leadership might exist, power relations constrain the effectiveness of such measures that conflict with interests of influential and large farmers. The political-social stability of the country, and therefore maintaining the status quo and the privileged position of those benefiting from such situation, seems to overrule the implementation of policies for the protection of groundwater resources.

Some interviews with academics and donors pointed to the fact that the Ministry of Finance could step in and take a leading position and role, giving more autonomy and space for commercial change; this could result in the water utilities getting smaller debts.

#### Condition 8: Financial viability

Sufficient financial resources are crucial for good water governance and for ensuring a sustainable water sector. Willingness to pay for water services is important to gain access to reliable funding for long-term programs. At the same time, sanitation services that prevent groundwater contamination need to be affordable for everyone including poor people or people being disproportionately affected.

#### Indicator 8.1: Affordability

*To what extent are groundwater development services and groundwater protection measures available and affordable for all citizens, including the poorest?*

+	Limited affordability of groundwater protection measures	Serious efforts are made to support groundwater protection measures for everyone, including small farmers. There is often recognition that poor and marginalized groups are disproportionately affected by the water challenge. This is increasingly addressed in policy and regulation
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The use of water savings techniques and technologies is not affordable to all farmers. Small farmers would benefit from programmes and subsidies for water saving technologies. Water meters are affordable, but farmers often refuse to use them in order not to pay the bills. Farmers using groundwater see increased water tariffs as a threat that pushes them out of business, as emerged in some of the interviewees.

Nevertheless, interviews with donors also pointed to the fact that improving efficiency in agriculture may result in an increased use of water to expand the farm, and therefore the business. Technological improvements should therefore be linked to maintaining the same amount of cultivated land or fixed water volumes that each farmer or farm could use.

Regarding domestic water tariffing, several interviewees from academics, donors, and even governmental institutions, speaking on a personal level, state that tariff system that gives incentives to save water is economically feasible, but on the governmental side, concerns for social and/or political implications and a popular backlash prevail.



### Indicator 8.2: User willingness to pay (or to accept a set quota of abstraction)

*How is expenditure regarding the water challenge perceived by all relevant stakeholders (i.e., is there trust that the money is well spent and charges fairly distributed among users)?*

-	Fragmented willingness to pay	Willingness to pay for measures addressing the water challenges are fragmented and insufficient. Each stakeholder perceives the importance and risks differently. Generally, their estimates of the cost are substantially lower than the actual costs.
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Interviews with academics, water utilities, ministries, and donors revealed that domestic users would be likely to pay an increased price if there was a good and improved service. While current tariffs are perceived as low/fair, increasing them is perceived as socially and politically unfeasible/risky. All stakeholders shared this view.

Instead, interviews with academics, donors, and agricultural experts hint to the fact that farmers would not be inclined to accept restrictions on the volumes of groundwater to extract in order to protect groundwater resources, given they believe, as seen above, that there is a sea below the ground.

Concerning the domestic water consumption in YWC, interviews confirmed that there are several problems: money, as for them water is a financial issue; abstraction is a duty of the government and should be free. However, water does not have a financial value, this believe is among both users and the institution. The focus is to keep customers fine, not happy, and those crying louder will get more water. There is no water demand management at all, no plan. Miyahuna started having a water demand management unit since last year. Interviews also highlighted the challenges of the YWC, which has not prioritised bills collection for several reasons, including the danger of bills collection for the YWC employees and the heavy reliance on donors' financial support.

### Indicator 8.3: Financial continuation

*To what extent do financial arrangements secure long-term, robust policy implementation, continuation, and risk reduction?*

-	Inequitable financial resource allocation	There are potential resources available to perform basic management tasks regarding the water challenge, but they are difficult to access, are distributed rather randomly and lack continuity. No clear criteria can be found on the resource allocation. Resources allocation is ad hoc and considers only short-time horizons.
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As seen per indicator 8.2, the water sector has been financially in deficit. The total debt amounts to 1.7 billion JD in 2019 according to WAJ, an amount far higher than expected in the Water Strategy 2016-2025 and with increasing trend. In fact, financial arrangements for drinking and domestic water are unsustainable, especially for the YWC, and the utility is not always able to collect revenues and bills. Water tariffs are too low and highly subsidised. Increasing tariffs for the higher classes of the society would be feasible, but it may be politically and socially risky.

The Ministry of Finance should get concerned of the extensive debt of the water sector, which is growing every year. Interestingly, as a result of the development policy loan 2018 (KfW-AFD financial cooperation) the debts of WAJ were centralized in the Ministry of Finance.

Large priority projects, such as desalination, are technically feasible but lack financial sustainable plans (see indicator 2.1). The water sector heavily relies on donors for the construction and implementation of large projects and for supplying the water companies with bulk water. This means that funds depend on project cycles of donors – usually of 3-10 years - pushing towards short-middle term planning and supply-side projects and lowering incentives for politically more difficult demand management approaches and the reallocation of water resource from agriculture to drinking water supply.

#### Condition 9: Implementing capacity

Implementing capacity is about the effectiveness of policy instruments with respect to the water challenge. Part of the effectiveness is also due to the level of compliance to policy and regulation and the familiarity with (calamity) action plans.

#### Indicator 9.1: Policy instruments

*To what extent are policy instruments effectively used (and evaluated), in order to stimulate desired behaviour and discourage undesired activities and choices?*

-	Unknown impacts of policy instruments	Instruments are being used without knowing or properly investigating their impacts on forehand. The set of instruments actually leads to imbalanced development and inefficiencies that are hardly addressed.
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Depending on the political will, policies and initiatives can be instrumental to make change happen, such as in the case of the illegal wells campaign mentioned above. However, there are policies in place, but they are often not implemented or enforced due to other related constraints such as socio-political context and stability considerations as well as influential and powerful interests (Hussein, 2018b; Yorke, 2016; 2013). The same rational applies to the water tariffing system and related subsidies. In those cases, policy instruments are not effectively used to enhance groundwater protection due to powerful groups’ interests and considerations of political stability. For example, water prices are considered to too low to steer change in groundwater abstraction patterns.

#### Indicator 9.2: Statutory compliance

*To what extent is legislation and compliance, well-coordinated, clear and transparent and do stakeholders respect agreements, objectives, and legislation?*

-	Moderate compliance to incomplete legislation	The division of responsibilities of executive and controlling tasks is unclear. Legislation is incomplete meaning that certain gaps can be misused. There is little trust in local authorities due to inconsistent enforcement typically signalled by unions or NGO’s.
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Interviews with donors highlighted that there is low compliance by water users because they do not trust the government and feel that other users are also not respecting the laws. This results in illegal wells construction, not paying water bills to YWC, cheating with metering systems in the case of agricultural users, violent obstruction and rejection of paying, not allowing governmental personnel to enter their property. Several interviewees among academics and donors also mentioned that many large farmers dug illegal wells and covered them by building a room. In several instances, such rooms were under the ground, and MWI controls proved several times unsuccessful.

It emerges that while legislation is overall clear, the problem is the lack and difficulties in implementation and enforcement of such legislation, and the lack of trust between users and the government.

**Indicator 9.3: Preparedness**

*To what extent is the country prepared (i.e. there is clear allocation of responsibilities, and clear policies and action plans) for both gradual and sudden uncertain changes and events?*

0	Low awareness of preparation strategies	Based on experiences, there are action plans and policies addressing the water challenge. Actions and policies are clear but actual risks are often underestimated and the division of tasks is unclear. They are not sufficient to deal with all imminent calamities or gradually increasing pressures. Damage is usually greater than is expected or prepared for.
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Jordan has a long experience dealing with sudden shocks and crisis. Over the years, it has received a large number of refugees from neighbouring countries due to wars and regional crisis and instabilities. Although there is no set plan, the MWI comes up with updated strategies and action plans on how to deal with the crisis as soon as a crisis erupts. This is facilitated by the support of the international organisations and of donors. However, the interviews showed that the MWI is not prepared for the gradual ongoing crisis caused by groundwater depletion and environmental degradation.

## 5. Discussion

The assessment shows that the overall indicator ratings are quite low. At the one hand, this does not come as a surprise, as the study took a problematic issue of Jordan water policy, the protection of groundwater from over-abstraction, as the core governance challenge to assess. The applied governance indicators provide principally a rating of the capacity to act *jointly* on the challenge of groundwater over abstraction. While for single indicators or certain questions, particular responsible actors might be identified, conclusions on how to effectively address the challenge should move beyond a classical “blame game” towards the development of more intersectoral, interdisciplinary and innovative mechanisms to govern groundwater issues.

Jordan has experienced a strong population growth over the last decades, mainly due to refugees from neighbouring countries finding shelf in the country. Population growth is expected to continue in the coming years and decades, further increasing the water demand for drinking purposes. Simultaneously, agricultural production and development is also increasing, as well as the export of agricultural products. Given that export-oriented agriculture is not an indispensable water user when compared to drinking water supply, and given the increasing export of agricultural products, this has provided a useful governance challenge to be explored and solved.

The research of the groundwater governance challenges in this study highlights the necessity to focus on:

***Groundwater protection from over-abstraction has to be addressed by the water consuming sectors, mainly by the agricultural sector***

Falling groundwater levels are perceived as a problem of the water sector institutions and the problem is supposed to be solved by the water sector. From this viewpoint, the water sector should supply

water as demanded, without further management of water demand. Not only in Jordan, this approach showed to be inappropriate to make water and especially groundwater use sustainable (Allan 2007). For a coherent approach (Indicator 5.3), groundwater irrigated agriculture should actively participate in an evidence-based dialogue that leads to the formulation and implementation of groundwater policies. There is an urgent need for a clear agricultural strategy, which should be in line with the national water strategy particularly with the Groundwater Sustainability Policy. Agricultural business models in the Jordan highlands, especially those that refer to major groundwater abstractions, are based more or less strictly to economic logic. Consequently, the best way to regulate these activities (and the thereby triggered groundwater abstraction) is by economic incentives while considerations of environmental sustainability do not play a major role (Indicator 1.1, 1.3). Are information and awareness campaigns that seek to sensitize for environmental concerns and costs of groundwater abstraction then useless? Most probably not, as they are crucial in establishing a discursive ground that brings together different “resources realities” and sets the base for the acceptance and effective implementation of economic incentives (taxes, tariffs and transfers) for agricultural groundwater use. Past attempts with limited results show, that an in-depth analysis on which kind of incentives farmers are susceptible to change their practices should precede the design of new economic incentives.

***Need for holistic/comprehensive approaches that support the economic transformation from the current agricultural business model towards a less-groundwater extractive way of economic development***

Previous approaches to enforce stricter measures of groundwater abstraction control, e.g. the closure of illegal wells and the setting of abstraction quotas and charges, did not result in substantial changes in abstraction patterns (Hussein 2018b). Therefore, a comprehensive strategy to tackle agricultural water use should approach the issues from at least three sides:

- a) establish a common understanding of the status quo of groundwater resources and the projection if business-as-usual continues. A platform that could allow to build trust and a common framing of the problem, which needs to be improved and envisioned among stakeholders, especially on groundwater users (farmers and policy makers). Lessons learnt from previous attempts should also be taken into consideration.
- b) create a transformation strategy for agribusiness to reduce water consumption. It should be acknowledged, that - besides of the relatively small share of agriculture in Jordan economy - a substantial reduction of groundwater irrigation implicates a major economic transformation. As such, it should be managed by the highest political level and organized as joint effort of all relevant ministries and institutions. Within the water sector an institution that could have the role of a lead or could be the one leading should be identified - possibly the MWI, which then however needs a much stronger and wider mandate as it has now.
- c) cut or reform subsidies for groundwater abstraction. In fact, currently groundwater pumping is double subsidised, once on the water side and once on the electricity side to pump it (FAO, 2018: 46-47). What should be done is to “focus the policy on increasing water productivity (producing more with less water). Adopt incentives to advance technologies by subsidizing the technology that uses water rather than water itself” (FAO, 2018: 46).

***Reflecting the role of donors in shaping Jordan water policies***

Moreover, the role of donors should be key in this transformation. In fact, the hypothesis of this assessment was that the donors make it easy for the government not to force reduction of groundwater abstractions given they can support the MWI financially in its quest to increase the supply through technical solutions. What is needed is more coordination within the donors’

community about the way forward, and an open meeting between the donors and the Jordanian stakeholders to discuss where water should come from in the future, and who will pay for it.

In addition, as emerges in this assessment, there are instances in which the donors and the MWI position coincides, and others in which they differ. Donors should learn from this assessment and understand where there are joint and common understandings and positions with the MWI, and how to maximise synergies.

Donors can have different roles: helping; challenging; and enabling. Donors can suggest reduction of extractions. Donors can leave things as they currently are in terms of groundwater extraction, and follow and support the MWI water priorities towards technical solutions to increase the supply. However, donors can also coordinate, and identify an exit strategy, including a financial strategy. In the latter, the donors would openly discuss and ask the MWI what is the Jordanian strategy to reach a (financially) sustainable water sector in the medium and long term, aiming at a future water sector without support of donors. The current crisis around the Corona pandemic might accelerate a shift of funding within donors organisations, create a momentum for re-thinking the water and development pathways of Jordan towards a more sustainable water management.

The MWI and the Jordanian government will then be faced with two options to deal with over-abstraction, a soft and a hard approach. A wise strategy ideally would contain elements of both approaches. The soft way would support a dialogue with farmers and end-users to design and identify a joint and participatory solution through farmers' engagement and dialogue. The tough approach instead would be with force and police, similarly to some extent to the illegal wells campaign. What will be key is to have the highest support from the government and state to identify and implement a cohesive and coherent agricultural and water strategy.

Jordan's policy on groundwater and especially agricultural water management shows signs of a lock-in effect observable in the political, social and economic arenas, as since decades there are no substantial changes in groundwater abstractions patterns. At the same time, donors and the Jordanian government – or different branches of the government - seem to be accommodated in different "resource realities" (Bonn 2013) under the circumstances of a nearly permanent mode of crisis.

To set up and steer the transformation of Jordan's groundwater-irrigated agriculture, it may help to learn from similar processes in other parts of the world (e.g. Schlüter et al. 2010, for Uzbek irrigated agriculture) and conceptual work on transition management in general (e.g. Huntjens et al. 2011, Smith et al. 2005). Economic activities tied to strong stakeholder groups, in a difficult geo-political environment, partly embedded in local culture and traditions and based on weak and contested resource base or ecosystems can be found in other places. The transformation of the overfishing of the oceans or coal mining in old European industrial areas, for example, are problems that challenged the governance capacity of governments and societies. By looking at these examples, the Jordanian government and the international cooperation could enhance its capacities to govern this economic and water challenge and finally find integrated, cross-sectoral, fair and effective models for the co-management of agriculture and water resources.

This will certainly include substantial financial resources (transfers, compensations, investments, etc.), but it should be considered that the alternative to that option (e.g. large-scale desalinization) as well causes investment *and* long-term operational costs.

## 6. Outlook for development cooperation

A **transition to water saving agriculture and economic development is a precondition for a sustainable domestic water supply and long-term economic stability** in regard to Jordan geopolitical context. An important step to trigger a broader transition in agricultural groundwater use is to **gather key actor groups behind the ideas to strategically address and manage this transition**. Given the diametric interests and power relations among stakeholders, admittedly not an easy task. For BGR and the German cooperation it could be a first step to convene (and convince) the donor community of all relevant sectors (water, agriculture, energy) to engage and support such a process.

In this context, at least three fields of action for development cooperation can be identified:

**First**, a widely recognised institution of the donor community working on water and supporting groundwater protection should lead the process, and be the convenor of the whole donor community on this issue. It could be the facilitator within the donors, and the meetings done during this assessment report with donors can help in bringing together the donors community, maybe for a discussion of the findings of this report.

A **second** role that German cooperation - specifically BGR - could have (or continue to have) is to provide data on groundwater issues, and keep on monitoring groundwater in Jordan in order to evaluate whether the work that the donors and the MWI will be doing is producing results. One topic that this report stated is the lack of information within the groundwater users. Here BGR can support MWI to create awareness on the groundwater resources situation. A second topic identified in the report, is the missing long-term financial sustainability of costly large-scale water supply projects. Here BGR can provide transparent cost comparison of groundwater demand management programs or reallocation of agricultural water rights vs. large-scale desalination. The additional long-term costs of the technological solutions can be a strong argument for the Jordanian Water Sector to look into the demand management/reallocation and for the donor community to ask for the long term financing strategy of desalination schemes. This is important, as a common problem framing. This means a shared understandings of the status and dynamics of groundwater, is an important preconditions of the transition process. Due to its long-standing experience and expertise, the contributions of BGR in this field were and remain very important.

**Third**, taking stock of the findings of this report and operationalizing a possible transition process, BGR's important hydrogeological work should be combined with a governance component – which is key to achieve successful groundwater protection. This governance component of German cooperation would aim at following and facilitating the improvement of groundwater governance. This would include, for instance, supporting the MWI to reach a joint vision with the Ministry of Agriculture, and generally working closely with the Ministry of Agriculture, the farmers in the highlands and with the agricultural sector to build a dialogue, trust, and solutions to ensure groundwater protection in the country. The lessons from previous attempts in this field, like the Highland Water Forum, should be carefully reviewed in order to design effective methods of collaboration and manage expectations and ambition of the process. The cross-sectoral approach to tackle the groundwater abstraction should start within the donor community and being reflected in the shape and organisation of cooperation programmes.

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