Overview of Mashreq Groundwater Disruptive Tech Interactive E-book

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Mashreq Water Knowledge Series
Disruptive Technologies for Improved Groundwater Management in the Mashreq Region
15-17 June 2021
Groundwater Management Challenges

**Information**
Understanding and monitoring groundwater systems (e.g. aquifers, extraction, recharge, quality)

Analytic insights into specific groundwater links to water cycle and inform longer-term planning and shorter-term operational decision support

**Institutions**
Institutional arrangements to work across spatial and sectoral scales

Capacity, policies, and instruments to effectively manage groundwater effectively and sustainably

**Investments**
Planning and operation of extraction and recharge investments in a systems context

Development and climate scenario-based investment planning considering technical, environmental, social, economic, financial, institutional, and other sustainability aspects
The Groundwater Elephant

Government: I can regulate and make policies.

Hydrogeologist/Water diviner: I can tell you where the water is.

Driller: I can drill deeper and find water for you.

Researcher: I know exactly what is happening.

User: I need more water and want to pump out as much as I can.

Financier: I can give you the money and go and drill deeper.

Source: MARVI
A new world of “Disruptive Technology”

“Disrupt” data value chains

- **Data Collection**: Monitoring/Surveys (in-situ sensors/IoT/Biometrics, earth observation (satellite, aerial, UAVs), crowdsourcing, digitization...

- **Data Management**: Telemetry, 5G, cloud services, open data, Blockchain, ...

- **Data Analysis**: Big data, Geospatial/ AI/Machine Learning, modeling/ scenario analysis, script repositories, Cloud/Edge/Quantum computing...

- **Data Access**: Open data APIs, data visualization, gamification, mixed reality-AR/VR, ...

- **Outreach**: Platforms/Social Media/Portals/ Apps/e-books/Competitions...

“Disrupt” production value chains

- 3D/4D printing/additive manufacturing...
- “Digital Twins”
- Automation/SCADA...
- Robotics/ Autonomous transport...
- Advanced materials/nanotech/ biotech/genomics/energy tech/ green tech, ag tech...

“Disrupt” stakeholder value chains

- Virtual social networks/ Digital Platforms...
- Sharing economy...
- Crowdsourcing, gamification, competitions (e.g. hackathons, appathons...)
- Mobile money, fintech, cryptocurrency...
- Blockchain enabled value chains
- Maker movement/ DIY/Tech Incubators...
- Virtual learning/re-skilling...

http://www.appсолutelydigital.com/dt/
Mashreq Water Knowledge Portal

https://spatialagent.org/Mashreq/filter.html

MASHREQ KNOWLEDGE RESOURCES TOOL

Filter by Theme

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- MENA
- Mashreq
- Syria
- Turkey

- Working Together to Achieve Water Security
- Agriculture and economic transformation
- Agriculture land (% of Land Area)
- Middle East food security amid the COVID-19
- Drought monitoring and early warning systems
- Supporting drought action through satellite and satellite
- Supporting drought action through satellite and satellite
Anthropogenic depletion of Iran’s aquifers

Roohollah Noori, Mohsen Maghrebi, Ali Mirchi, Qiuhong Tang, Rabin Bhattara...
See all authors and affiliations

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Significance

Iran is facing a state of water bankruptcy that threatens its socioeconomic development and natural environments. Using an exceptionally rich measured groundwater dataset, we illustrate the extent and severity of Iran's groundwater depletion and salinization problems during the 2002 to 2015 period, when the number...
Mashreq Water Initiative

Disruptive Tech in Groundwater

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- Looking Ahead
Groundwater is classified into renewable groundwater and non-renewable or fossil groundwater stores. Renewable groundwater. According to the FAO, renewable water resources “...represent the long-term average annual flow of rivers (surface water) and groundwater” while non-renewable water resources are “...groundwater bodies (deep aquifers) that have a negligible rate of recharge on the human timescale and thus can be considered non-renewable.” The volume of groundwater that includes renewable and fossil groundwater has been estimated at 8-10 million cubic kilometers, or 98-99 percent of the total volume of liquid freshwater. In contrast, lake volume is less than one percent. However, the total groundwater volume is about one percent of the total volume of water available on Earth, which includes oceans. While this is the case, it is critical to note that most groundwater volume is fossil groundwater - only 10,000 billion cubic meters (10,000 cubic KM) are renewable.

The image below from the USGS visualizes what is meant by renewable and non-renewable groundwater sources. Renewable groundwater existing in “unconfined” aquifers and are recharged in days or years. Confined aquifers, however, are less easy to both recharge and access as they are located beneath confining beds and water represents centuries or millennia of recharge.
**“Top-Down” Data Acquisition System**

- Satellite & Aerial Earth Observation

**Cloud Services**

- Big Data
- Data Science

- Data Rescue
- GIS and other datasets

- Data Management
- Analytics/Models

- Machine Learning
- & other AI

- Platforms
- APIs

- ChatBots
- Crowdsourcing

**“Bottom-up” Data Acquisition System → IoT**

- Manual Monitoring
- Crowdsourcing

- Automated Monitoring

**Stakeholder Alerts**

- Dashboards/Portals/Apps/e-books/AR/VR

- Operational Control Rooms
Watersheds, Topography
High-Resolution Drone Services & Online Insights
Presentation: Remote Supervision Tools for Dam Safety

Collect Field Data - Photogrammetry Models (Construction I)

Photogrammetry model from Drone photos

Photogrammetry model from Cell Phone photos

(3D holograms visualized in the office using a HoloLens and Ada Platform)
INSFRASTRUCTURE, IMU SURVEY DATA, RESERVOIR MODELS, BOREHOLE DATA, GEOPHYSICS, INSTRUMENTATION, ETC.
Disrupt or Be Disrupted!

Thanks!

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