“Disrupting” Water Resources Management

A New World of Disruptive Technologies for Water Resources Planning and Management

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Economic and Social Commission for Western Asia (ESCWA)
March 3, 2020, Beirut, Lebanon
Multiple sectors, multiple institutions, linked by water and natural resources…

A Typical Watershed…

…Need for Shared Vision supported by modern information, institutions, and investments…
Transboundary Water Contexts:
- River Basins
- Lake/Inland Sea Basins
- Groundwater Aquifers
- Marine Areas
- Precipitation-sheds
What’s Broken?

**Information**
- Data coverage and quality
- Widespread use of modern analytical tools
- Public access to data, tools, and knowledge products

**Institutions**
- Technical capacity
- Meaningful stakeholder involvement
- Decision making
- Collaboration/Partnerships

**Investments**
- Infrastructure deficit (storage, power, transport, agriculture, sustainable land management, ...)
- Inadequate monitoring and forecasting systems
- Poor office infrastructure and equipment
- Investment coordination
Modernizing Approaches to Address these Challenges...

The 3 Is...

Information & Analysis

Institutions & Policy

Investments & Operations
Information & Analysis

- **Resource Information Base** (standards; harmonization; data rescue; monitoring; comprehensive spatial, temporal and other databases; improved use of satellite data; documents)

- **Knowledge Products/Special Studies** (maps, Atlases, interactive toolkits, surveys)

- **Access and Outreach mechanisms** (data services, publications, web portals, Apps with public access to open data services, technical/ success stories, multimedia documentation)

- **Analytical Tools** (models/Decision Support Systems for planning/operations support in an integrated systems context)
Institutions & Policy

- **Strengthening Institutions** (office modernization, stakeholder participation, capacity development and training incl. distance learning, improved links with academia, internships, visiting experts, professional networks/communities of practice; forums, competitions)

- **Strengthening Policies** (streamlining institutional design/policy/mandates, improving synergy, economic instruments, decentralization)

- **Innovative Instruments** (e.g. knowledge-driven facilitated diplomacy, policy instruments, incentive frameworks)
Investments & Operations

• Preparation of a new generation of modern investments (with adequate attention to technical, environmental/climate, social, economic, and institutional aspects) – upgrading existing infrastructure and building new infrastructure analyzed in a systems context and reflecting innovation and climate-smart development

• Implementation facilitation, monitoring, and lessons (adequate technical assistance, ownership, services, M&E)

• Infrastructure planning and operational coordination
There are many ongoing changes...

- Urbanization
- Rising Expectations
- Climate Change
- Disruptive Tech
“DISRUPT”
DECISION SUPPORT

- **Data Collection**: Monitoring/Surveys (in-situ sensors/IoT, Earth Observation, UAVs, crowdsourcing...); Digitization
- **Data Management** (telemetry, cloud services, open data services, Blockchain, ...)
- **Data Analysis** (Big data, Geospatial/AI/Machine Learning, modeling, script repositories ...)
- **Data Access** (open data APIs, data visualization, gamification, mixed reality-AR/VR, ...)
- **Outreach**: Platforms/Portals/Apps/e-books/Competitions
“DISRUPT” PRODUCTION

- 3D printing/additive manufacturing
- Automation/Robotics/automated transport
- Advanced materials/nanotech/biotech/clean tech/ smart energy/ smart farms...
“DISRUPT” INTERACTION

- Social Media
- Knowledge/Learning Platforms
- Crowdsourcing, gamification, competitions
- Mobile money, Fintech
- Maker movement/DIY/Tech Incubators
- Sharing economy
All Companies will be Data Companies...

90% of the World’s data has been produced in the last 2 years...

Two-thirds of the jobs today’s kids will pursue haven’t even been invented yet...

- IoT can add US$2.7-6.2 trillion annually by 2025...
- Autonomous transportation could have a US$7 trillion annual revenue stream...
- Blockchain will deliver US$3.1 trillion in value by 2030...
- AI will add US$15 trillion to the global economy by 2030...
- AR/VR will disrupt a US$30 trillion industry...
- 3D printing will disrupt the US$30 trillion manufacturing sector...
- Robots could disrupt the US$15.5 trillion construction industry...
- Clean energy tech could be a US$50 trillion industry...
- The sharing economy could be $335 billion by 2025...
- Nanotechnology is already a US$1 trillion industry...
- Fintech eyes US$124 trillion of transfer payments...
>900,000 worth of applications in a smart phone today

<table>
<thead>
<tr>
<th>Application</th>
<th>$ (2011)</th>
<th>Original Device Name</th>
<th>Year*</th>
<th>MSRP</th>
<th>2011's $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video conferencing</td>
<td>free</td>
<td>Compression Labs VC</td>
<td>1982</td>
<td>$250,000</td>
<td>$586,904</td>
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<tr>
<td>GPS</td>
<td>free</td>
<td>TI NAVSTAR</td>
<td>1982</td>
<td>$119,900</td>
<td>$279,366</td>
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<tr>
<td>Digital voice recorder</td>
<td>free</td>
<td>SONY PCM</td>
<td>1978</td>
<td>$2,500</td>
<td>$8,687</td>
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<tr>
<td>Digital watch</td>
<td>free</td>
<td>Seiko 35SQ Astron</td>
<td>1969</td>
<td>$1,250</td>
<td>$7,716</td>
</tr>
<tr>
<td>5 Mpixel camera</td>
<td>free</td>
<td>Canon RC-701</td>
<td>1986</td>
<td>$3,000</td>
<td>$6,201</td>
</tr>
<tr>
<td>Medical library</td>
<td>free</td>
<td>e.g. CONSULTANT</td>
<td>1987</td>
<td>Up to $2,000</td>
<td>$3,988</td>
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<tr>
<td>Video player</td>
<td>free</td>
<td>Toshiba V-8000</td>
<td>1981</td>
<td>$1,245</td>
<td>$3,103</td>
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<tr>
<td>Video camera</td>
<td>free</td>
<td>RCA CC010</td>
<td>1981</td>
<td>$1,050</td>
<td>$2,617</td>
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<tr>
<td>Music player</td>
<td>free</td>
<td>Sony CDP-101 CD player</td>
<td>1982</td>
<td>$900</td>
<td>$2,113</td>
</tr>
<tr>
<td>Encyclopedia</td>
<td>free</td>
<td>Compton’s CD Encyclopedia</td>
<td>1989</td>
<td>$750</td>
<td>$1,370</td>
</tr>
<tr>
<td>Videogame console</td>
<td>free</td>
<td>Atari 2600</td>
<td>1977</td>
<td>$199</td>
<td>$744</td>
</tr>
</tbody>
</table>

**Total: free**  
**$902,065**
"Disrupting" Development
An Interactive Primer on Disruptive Technology in Development

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- Disrupting our Challenges
- Explore Global Resources at your Fingertips
  - Interactive Tech Application Explorer
  - Casestudies
Looking Ahead
- Regulatory Environment
- Moving Ahead...

World Bank e-book on Disruptive Tech (draft)
http://www.appsolutelydigital.com/dt/
Disruptive tech could change Development

Making “smart development” wrt climate, water and natural resources, energy, food, waste, mobility, knowledge, services, networks.

Online Services

Green Energy

Broadband & Smartphone Access

Apps, e-services & e-learning

Access to a new world of Data, Information, Knowledge and Services

Planning

3D Printed Infrastructure

Sensors/IoT (e.g. for soil moisture)

Drones/UAVs (e.g. for monitoring, seeding, delivery)
Fundamental Project Design Implications

Solar-covered Canals

“Floto-voltaics”
Many multi-sectoral implications (incl. for the Amazon!)

A third of global agricultural water use is for fodder!

70% of agricultural land is used for pasture (~28m km²)!

<table>
<thead>
<tr>
<th>Water Use</th>
<th>GHG Emissions</th>
<th>Land Use</th>
<th>Production Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Animal-based</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1799 gallons</td>
<td>16 pounds</td>
<td>260² ft</td>
<td>$1.05</td>
</tr>
<tr>
<td><strong>Lab-grown</strong></td>
<td></td>
<td></td>
<td>$12</td>
</tr>
<tr>
<td>324 gallons</td>
<td>3.52 pounds</td>
<td>2.6² ft</td>
<td></td>
</tr>
</tbody>
</table>

Usage, emissions, cost per pound of meat

**Sources:** CB Insights, Water Footprint Network, Business Insider, Forbes, Food Climate Research Network (FCRN), Quartz
Livestock:
• Supports 1.3 billion people
• 40% of global value of agricultural output
Cloud Services

Top-Down Data Acquisition System → IoT

Satellite & UAV Earth Observation

GIS and other datasets
Data Rescue

Data Management
Analytics/Models

Big Data

Platforms

Machine Learning/AI

Crowdsourcing

Web Portals/Apps/e-books

Stakeholder Alerts

Operational Control Rooms

Manual Monitoring

Automated Monitoring

Bottom-up Data Acquisition System → IoT
Data → Information → Knowledge → Wisdom to make Decisions
Flood Coping Actions
(stakeholder actions to minimize loss of life / livelihood)

Dissemination
(Stakeholder Channels – DSS, Bulletins, SMS, Radio, TV, Social Media, Portals, Apps, Podcasts, phone, emails, …)

Flood Early Warning & Recommendations

Products & Services
(Formats, Frequency, Messaging, Customization, Media)

Weather Forecasts

Hydrologic Forecasts

Flood Inundation Forecasts

Models
(Season to nowcasting; statistical/ hydrologic systems/ hydrodynamic, …)

Surveys
(detailed Digital Elevation Model, Soils, Water Infrastructure Status)

“Top-Down” Data
(from remote sensing/ earth observation products)

“Bottom-up” Data
(from field gauges, manual reporting, crowdsourcing)

Data Value Chain: Coping with Floods
Basin Planning
Envisioning the Future

Point A: Current Situation

Strategy

Point B: Future Vision

Support Program

Institutions

Information

Investments
Analytical & Stakeholder Tracks to Multi-sectoral Spatial Planning...
Big Data – on the ground...

Wisdom of the Crowd

In-Situ Sensors: Now when a tree falls in a forest, you can actually hear it!
Competitions

Water Appathon
Water Hackathon
Data Jams
X-Prize
Internships
E-books, Designs, Products, Processes...
Benefits of using emerging technology

- Cheaper, faster, better, ...
- More participatory, information-based decisions
- Do things not possible before, smaller world...

Risks of using emerging technology

- Traditional jobs becoming obsolete
- Changes in decision making
- Privacy, Cybersecurity, Accelerated pace of change...
Towards a Mashreq Platform
A new world of “Disruptive Technology”

“Disrupt” decision making

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- Mobile money, Fintech
- Maker movement/ DIY/ Tech Incubators/OLC
- Sharing economy, Mobile learning
“Top-Down” Data Acquisition System

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Manual Monitoring
Automated Monitoring

“Bottom-up” Data Acquisition System → IoT

Satellite & UAV Earth Observation

Data source: NOAA, 2006
Click on stream to delinate its watershed.
Disrupt or Be Disrupted!

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