Saving More Lives in Morocco with the COVID-19 Real-Time Monitoring System

Ministry of Health, Kingdom of Morocco
Morocco’s Ministry of Health was founded in 1982, and the minister of health is Professor Khalid Aït Taleb. The Ministry runs the country’s national institutes and laboratories, basic healthcare network, and hospital network. The Moroccan healthcare system has four layers, the first being primary healthcare. This includes clinics, health centers and local hospitals for public healthcare, and infirmaries and medical offices for private healthcare. The second layer includes provincial and prefectural hospitals for public health, and specialized clinics and offices for private health. The third layer includes hospitals in all major cities, and the fourth includes university hospitals.

When the COVID-19 pandemic struck, the Ministry of Health needed to get a clear picture quickly of the evolving situation, such as total confirmed cases, critical cases, the outcome of cases (recovery or death), and the growth factor of daily new cases across the different layers of the Moroccan healthcare system, including local hospitals, provincial hospitals, and university hospitals. The Ministry provided daily public updates on the COVID-19 situation on prime-time TV at 6:00 p.m. The biggest challenge was the urgent need for one source of truth and real-time data to properly monitor, assess, and communicate the situation.
Saving Lives with the COVID-19 Real-Time Monitoring System
Ministry of Health, Kingdom of Morocco

"In terms of results, we can use this project as something to be proud of. It demonstrates that we have succeeded in this crisis."

Dr. Ahmed Rguig, Director of the Centre of Moroccan Epidemiology, Ministry of Health

**Challenge**
Morocco’s health system lacked a digital system to manage COVID-19 patient, treatment, and test data at scale. Information collection was siloed and relied on paper forms, which delayed tracking of cases, impeded distribution of tests and medicine, and inhibited oversight and crisis management by public health authorities.

**Solution**
We built a solution with ALGO Consulting Group, the COVID-19 Real-Time Monitoring system, in just two weeks. It uses SAP HANA® for data collection and analysis and the SAP® Analytics Cloud solution and SAP Digital Boardroom to give health decision-makers, up to the minister of health, a real-time overview of the situation.

**Outcome**
One country-wide real-time source of truth enables quick and fact-based decision-making at many levels and effective communication to the public by the authorities. Test capacity has increased because many more labs are now able to submit their tests, and the stock of drugs across hospitals can be managed more efficiently and made available to those who need them.

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<table>
<thead>
<tr>
<th>100x</th>
<th>2</th>
<th>4x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase in laboratory test capacity, from 100 to 10,000 COVID-19 tests per day</td>
<td>Weeks implementation time, from initial discussions to go-live</td>
<td>Faster provision of data by hospitals and laboratories</td>
</tr>
</tbody>
</table>
Participating Partner Information

ALGO Consulting Group

It was immediately clear to ALGO, the first partner in Africa to be certified for SAP Analytics Cloud and with an SAP-qualified partner-packaged solution in the transport sector, that digital technology was needed to help manage the pandemic. So, at a very early stage, ALGO proposed to the Ministry of Health to build an innovative solution enabling country-wide monitoring of the pandemic in real time. As a result of this success, ALGO has developed a new packaged solution called QPP “Epidemic Real-Time Monitoring”.

“Because of our analytics expertise and our quick response right at the beginning of the pandemic, we could help our country adopt its first-ever digital tracking system in response to the coronavirus outbreak.”

Naoual Hammane, SAP Director, ALGO Consulting Group

“ALGO was able to respond instantly to our requests so we could respond to our leaders, the people of Morocco, and the media with fact-based information.”

Dr. Ahmed Rguig, Director of the Centre of Moroccan Epidemiology, Ministry of Health
**Business Challenges and Objectives**

- **Weak health system**: In many low- and middle-income countries such as Morocco, health information systems are weak and underfunded, making handling a pandemic like COVID-19 even more difficult.
- **Siloed data and manual processes**: Data from public hospitals and laboratories was manually collected in siloes, with only a few large labs able to do testing because of time-consuming and cumbersome administration and reporting.
- **Delayed identification**: High-risk areas, spreaders, and asymptomatic patients could not be identified early, which meant they could fuel the exponential growth of positive COVID-19 cases.
- **There was a lack of efficient control of the stock** of drugs used for COVID-19 treatment.

- The Ministry needed to establish one source of truth for COVID-19 data with real-time monitoring of KPIs, such as confirmed cases, active cases, recoveries, deaths, mortality rate, growth factor, and stock of drugs by hospital and region.
- It also wanted to provide an intuitive application to manage patients and medicine and match both to optimize the prescription process and increase treatment effectiveness along with high transparency.
- It set out to quickly launch a cost-efficient real-time management reporting and monitoring system that can be intuitively used by different actors in the health system, is available on many devices, and can transform COVID-19 steering meetings to intelligent meetings – to help teams make hard decisions much more quickly and accurately.
ALGO knew that with SAP HANA serving as a central data layer, its existing SAP-qualified partner-packaged solution for the transport sector could be adapted to monitor COVID-19 data in real time across the country. In just two weeks, the solution was delivered to the Ministry of Health involving the following components:

- Web application developed with React JavaScript for data entry by hospitals (patient information) and laboratory agents (positive or negative results of the COVID-19 test) as well as subsequent validation using simple workflows
- SQL Server Integration Services for extraction, transformation, and load to collect raw data from third-party sources, such as patient data
- SAP HANA to store raw data at the most granular level and calculate KPIs, with data refreshed every 10 minutes as per the requirement of the Ministry of Health
- SAP Analytics Cloud for real-time, role-specific dashboards using a live data connection with SAP HANA. Authorizations are handled in SAP Analytics Cloud, which is accessed through desktops and mobile devices. SAP Digital Boardroom has been installed as a control center at the office of the minister of health (with data refreshed every 10 minutes) to help the minister take hard decisions much more quickly and efficiently.

The data and solution are hosted in a customer-dedicated cloud on Microsoft Azure.

Due to the urgency of the situation, ALGO and the Ministry of Health worked day and night over two weeks to get the system up and running. To promote quick adoption, ALGO developed training videos that got users up to speed just four hours after go-live.
Benefits and Outcomes

**Business or Social**
- Provided one source of truth for quick and informed decision-making, enabling better crisis management and helping save more lives in Morocco
- Allowed production of tests to be scaled significantly, helping the government deliver tests to where they are needed most
- Enabled better management of the stock of medicines used to treat COVID-19 and the targeted allocation of medicine

**IT**
- Developed a cost-efficient system in the cloud, requiring no hardware
- Used virtual teams to develop the system in just two weeks without face-to-face meetings, with requirements gathered in the morning, developed during the day, and tested at night
- Created how-to videos to enable 400 users to learn about and use the solution only four hours after go-live and enabled the minister of health to use SAP Digital Boardroom in just 30 minutes
- Provided an export dashboard to create PDFs used for presentations in meetings

**Human Empowerment**
- Helped senior health officials to make more-informed decisions regarding the pandemic
- Helped the Ministry of Health communicate effectively with multiple stakeholders using trustworthy and solid information
- Provided the minister of health and other officials with the information needed at their fingertips – whereas previously they had to make calls to receive information
- Expanded use of the dashboard to two other government ministers
Architecture

Visualization

<table>
<thead>
<tr>
<th>Source data (third-party)</th>
<th>Excel, SQL Server ...</th>
</tr>
</thead>
</table>

Access

<table>
<thead>
<tr>
<th>Modeling and KPI calculations</th>
<th>SAP HANA®</th>
</tr>
</thead>
</table>

Access

<table>
<thead>
<tr>
<th>SQL Server Integration Services</th>
<th>CORS (live connection)</th>
</tr>
</thead>
</table>

SAP® Analytics Cloud

SAP Digital Boardroom
Architecture

COVID-19 management

**Hospital agent**
- Receive suspect patient
- Fill in Web form with patient information
- Take samples from patient
- Send samples to laboratory

**Laboratory agent**
- Receive sample results
- Test received samples
- Send result (positive or negative)

**Regional doctors**
- Each regional doctor visualizes specific dashboard to which they have access
- Confirm or disapprove

**Epidemiology Center**
- Access and visualize COVID-19 dashboards updated for all 12 regions of Morocco
- Data updated automatically in system

**Ministry of Health**
- Visualize updated dashboards in SAP® Digital Boardroom
Management of medicine stock (procurement)

**Procurement division**
- Initiating available stock of medicine
- Procurement of quantities of medicine
- Medicine stock reduced by quantities sent

**Regional division/university hospital/military procurement division**
- Receipt of quantities of medicine
- Procurement of quantities of medicine
- Confirm
- Yes
- No
- No change

**Hospital or provincial pharmacy**
- Receipt of quantities of medicine
- Procurement of quantities of medicine
- Confirm
- Yes
- No
- No change

**Department of Pharmacy and Medicines**
- Entry of actual quantities received
- Medicine stock replenished by quantities actually received
- Medicine stock reduced by quantities sent
- Medicine stock updated automatically in system

**Ministry of Health**
- Access and visualize updated dashboards for medicine stock management at various levels
- Access and visualize dashboards in SAP® Digital Boardroom

**End**
# Deployment

## Deployment status
Live

## Date
March 2020

## Number of users
- 400 users entering patient data/laboratory results; 50 users accessing dashboards in SAP Analytics Cloud; 1 installation of SAP Digital Boardroom for the Health Minister and his team

## SAP technologies used:

<table>
<thead>
<tr>
<th>SAP product</th>
<th>Deployment status (live or proof of concept [POC])</th>
<th>Contribution to project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  SAP Analytics Cloud</td>
<td>Live</td>
<td>Real-time monitoring of COVID-19 KPIs and stock of drugs through intuitive, role-specific dashboards and live connection with SAP HANA</td>
</tr>
<tr>
<td>2  SAP Digital Boardroom</td>
<td>Live</td>
<td>Control center for real-time monitoring of COVID-19 installed in the office of the minister of health</td>
</tr>
<tr>
<td>3  SAP HANA</td>
<td>Live</td>
<td>In-memory platform with advanced data processing, serving as one source of truth</td>
</tr>
</tbody>
</table>

If you have used one or more of the services or support offerings from SAP Services and Support during the implementation or deployment phase, please indicate which one(s) below with an **X**

- SAP MaxAttention™
- SAP ActiveAttention™
- SAP Advanced Deployment
- SAP Value Assurance
- SAP Model Company
- SAP Innovation Services
- SAP Innovative Business Solutions
- Others:
### Advanced Technologies (1 of 2)

The following **advanced technologies** were part of the project.

<table>
<thead>
<tr>
<th>Technology or use case</th>
<th>Product used*</th>
<th>Contribution to project and how product used integrates with SAP products</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Machine learning or artificial intelligence</td>
<td>Robotic process automation, conversational AI, AI-based knowledge graph</td>
<td></td>
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<tr>
<td>2 Blockchain</td>
<td></td>
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<tr>
<td>3 Internet of Things</td>
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<tr>
<td>4 Intelligent data management</td>
<td>Multi-cloud, data virtualization and governance, smart data tiering, persistent memory, data privacy</td>
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<tr>
<td>5 Advanced and augmented analytics</td>
<td>• Real-time and streaming analytics, spatial analytics</td>
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<td></td>
<td>• Natural language query and generation</td>
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<td></td>
<td>• AutoML to identify trends, patterns, outliers</td>
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<tr>
<td></td>
<td>• Predictive analytics (time series analysis and forecasting, regression, classification)</td>
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*If this is not an SAP product, explain how it integrates with SAP products.
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<tr>
<td>6 Data and analytics solutions in the cloud</td>
<td>SAP Analytics Cloud, SAP Digital Boardroom, SAP HANA</td>
<td>Solution deployed in the cloud to provide transparency about the pandemic in near-real time to public health actors and officials using role-specific dashboards and a central source of validated data</td>
</tr>
<tr>
<td>7 Advanced cloud integration</td>
<td>• API economy (monetization and API marketplaces)</td>
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<td></td>
<td>• AI-based or crowdsourced integration</td>
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<td></td>
<td>• High throughput, low-latency digital integration hub</td>
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<tr>
<td>8 Industry cloud platform</td>
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<td>9 3D printing</td>
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SAP Digital Boardroom installed in the office of the minister of health for real-time monitoring of COVID-19 data and drug stocks – pictured during the first meeting with the minister of health on how to use SAP Digital Boardroom (for COVID-19 cases)

On Moroccan TV, the health minister and his team using SAP Digital Boardroom to provide an overview of the pandemic situation
Additional Information

- Article: “SAP Partner ALGO Helps Save Lives in Morocco’s Lockdown”

- Video: “COVID-19 Real-Time Monitoring by SAP Partner, ALGO in Morocco”
  https://www.youtube.com/watch?v=_wctJi8PWX0&feature=youtu.be

  https://www.sap.com/assetdetail/2020/08/7a1f7d7e-ab7d-0010-87a3-c30de2ff8ff.html

- Podcast: “RESET: For a Positive Future” (episode 2, Morocco)
  https://lnkd.in/gVhnQtH

- Epidemic Real-Time Monitoring (SAP-qualified partner-packaged solution based on COVID-19 project):
  http://newalgosite.azurewebsites.net/algo-sap-qualified-package-epidemic-real-time-monitoring/