



Cloud Strategy and Its Impact on Bahrain's Economy

ECONOMIC IMPACT STUDY

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In collaboration with:





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Economic Impact Study

Sponsored by: AWS and Bahrain Economic Development Board

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Executive Summary

\$1.2B* expected to be contributed by Cloud Spending to Bahrain's GDP by 2026

2.3% of GDP expected to be contributed by cloud and its associated supply chain

9,300+ Jobs**

Expected to be created, supported and retained by Bahrain's spending on cloud procurements by 2026

\$6.7 Return

For every dollar invested in cloud spending

Economic Impact of iGA's Spending on Cloud Procurement



\$156.0 million

Expected to be contributed by cloud spending to Bahrain's GDP in 2022

\$21.0 million

Total spending on cloud procurements in Bahrain in 2022

933 Jobs**

Expected to be created, supported, and retained in the economy in 2022

Source: IDC Economic Impact Study, 2022

* These revenues are forecast to generate due to direct, indirect, and induced impact of cloud and its supply chain ecosystems

** Additional jobs represent both technical and non-technical (unskilled) jobs created, supported, and retained by the cloud and its ecosystems

Technology adoption has fast-forwarded the realization of the Kingdom of Bahrain's Vision 2030 in the last five years. Cloud has had a pivotal role in achieving the country's short- and long-term visions, which revolve around financial sustainability and economic diversification. Bahrain's Cloud First Policy, the first of its kind in the region, launched by the Information & eGovernment Authority (iGA) in 2017, has vastly accelerated cloud adoption and digital transformation. According to IDC, spending on public cloud services in Bahrain is expected to grow by 14.9 times between the base year of 2018 and 2026 — making it one of the fastest among countries in the Middle East and Africa (MEA) region.

Various digital transformation (DX) initiatives led by the government and businesses will continue to drive utilization of and spending in cloud solutions. The availability of Amazon Web Services (AWS) in-country



datacenters and accelerated adoption of cloud services are expected to contribute \$1.2 billion revenue to Bahrain's GDP by 2026, according to IDC's Economic Impact study.

Moreover, the economy also is expected to create over 9,300 jobs, driven by cloud in Bahrain, representing 0.8% of 1.17 million, the country's total estimated employment in 2026.

Investments made by the public sector, spearheaded by the Information & eGovernment Authority (iGA), have already contributed strongly to the country's GDP, employment creation, and overall economic development. This IDC White Paper highlights important aspects of a national cloud strategy and its impact on Bahrain's economy. It also gives a detailed view of the country's successful cloud journey and the unparalleled economic benefits gained from its transformation into a digital economy and the enablement of innovation.

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Overview of Bahrain's Economy

The government of Bahrain has been focused on various modernization initiatives in pursuit of the long-term development plans outlined in its Vision 2030 and Economic Recovery Plan 2022-2026. The country is progressing towards a future-ready technology ecosystem, striving to diversify its economy, and increasingly investing in emerging and disruptive technologies such as cloud, artificial intelligence (AI), machine learning (ML), blockchain, and the Internet of Things (IoT).

According to the MEA Business Group, Bahrain's GDP growth is one of the fastest in the MEA, and the country has a forward-looking strategy for its long-term digital transformation. Growing investment in technology is one of the key focus areas as part of the Kingdom's Economic Recovery Plan. The government has launched its national "Cloud First Policy" and is driving public-private partnerships in the technology space, fostering investments in small and medium-sized enterprises (SMEs) and fintech firms. These initiatives encourage the adoption of cloud and other emerging technologies across both public and private sectors.

The adoption of emerging technologies is accelerated by forward-looking strategies and roadmaps created by government authorities such as iGA and the Bahrain Economic Development Board (Bahrain EDB). iGA has been playing a key role in the overall utilization of cloud and other emerging technologies, creating an amicable environment for both technology providers and end users to thrive and prosper. Bahrain EDB has been seeking to boost direct investments in various key priority sectors including, financial services manufacturing, logistics, ICT and tourism. At the same time, Tamkeen, Bahrain's labor fund, aims to foster the development and growth of enterprises and enhance the productivity and training of the national workforce through

investments and various support programs and initiatives. Government authorities like Bahrain EDB and Tamkeen are central to the development of Bahrain's economy and local employment opportunities.

Government authorities in Bahrain have continued to reform their policies and introduce new strategies aimed at supporting cloudification in the country. These efforts include the establishment of the Cloud Transformation Program (CTP), the Cloud First Policy, and the National Cyber Security Council (NCSC), as well as revamping of the public sector's procurement strategy. These initiatives have helped facilitate the adoption of digital technologies in Bahrain and enabled organizations across both the public and private sectors to pursue their DX ambitions. Such government efforts have boosted the country's overall technological

Bahrain Factsheet*

Key Economic Indicators

- **Total Population:** 1.49 million (2021, IMF)
- **GDP (Nominal):** \$38.9 billion (2021, IMF)
- **GDP Growth:** 11.9% (2021); 13.6% (2022 forecast)
- **Total Workforce:** 1.01 million (2021, IMF)
- **Total Employment:** 0.99 million (2021, IMF)
- **Country Ratings:** **B2** by Moody's (Apr 2022); **B+** by Fitch (Dec 2022); **B+** by S&P (Nov 2022) [**overall stable outlooks**]

Bahrain in Global Rankings

- **Digital Quality of Life (DQL) 2022:** Ranks 29th out of 117 on Electronic Infrastructure and 34th on Internet Quality
- **World Digital Competitiveness Ranking 2022 by IMD:** Ranks 23rd out of 63 countries (across Europe, Middle East & Africa, Asia-Pacific and the Americas) on Technology. Some of the strong areas where Bahrain has ranked better on the global ranking are below:
 - ✓ 4th on Internet users (number of internet users per 1000 people)
 - ✓ 6th on Investment in Telecommunications (Percentage of GDP)
 - ✓ 10th on Mobile Broadband subscribers (4G & 5G market, % of mobile market)
 - ✓ 11th on Cyber security (falls within IT Integration, indicates it is being adequately addressed by corporations)
- **Global Innovation Index (GII) 2021:** Ranks 27th out of 132 for Institutions (political, regulatory, and business environments) and 32nd for Infrastructure (ICT, ecological sustainability, and general infrastructure)

progress and will continue to position Bahrain highly on global ranking for ICT infrastructure (e.g., network readiness, regulatory landscape, technology adoption) and business environment (e.g., e-government, digital services, in-country digital skills and knowledge).

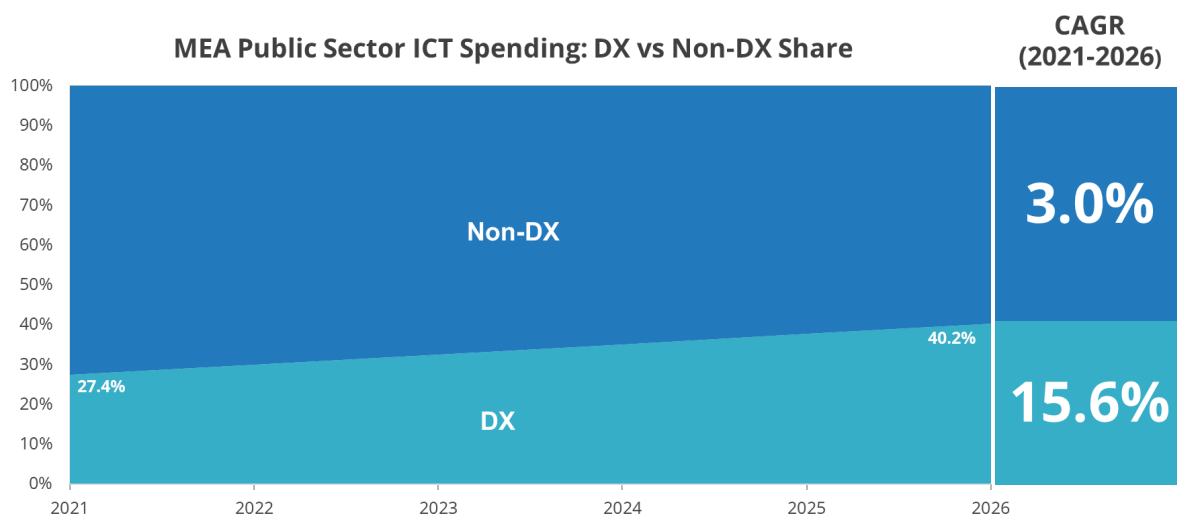
***Bahrain Factsheet Sources:** Moody's [Apr 2022](#); Fitch [Dec 2022](#); S&P [Nov 2022](#); [Digital Quality of Life \(DQL\)](#); [Digital Competitiveness Ranking by IMD](#); and [Global Innovation Index \(GII\)](#).

Digital Transformation Driving Innovation in the Region

As the world is embracing the digital era, organizations are investing in digital technologies and advanced solutions to drive innovation and thrive. Governments and public-sector organizations in the wider MEA region have been at the forefront of digitization and modernization, with a view to improving their citizen experience. The COVID-19 pandemic accelerated the adoption of such digital solutions, as organizations from both the public and private sectors were forced to make flexibility, speed, and scalability their top priorities while ensuring business continuity.

According to the IDC Digital Transformation Spending Guide released in October 2022 which represents overall spending on procuring digital solutions across the ICT domain, public-sector spending related to DX technologies in the MEA region has recorded impressive growth, with an expected five-year compound annual growth rate (CAGR) of 15.6% from 2021 to 2026. In the post-pandemic environment, both public and private sector organizations are increasingly investing in digital technologies as they look to build digital-first enterprises that will be resilient in the face of market disruptions.

Figure 1: DX-Related ICT Spending in the MEA Public Sector



Source: IDC DX Spending Guide, Oct 2022

Cloud Is the Foundation for DX Strategy

Cloud has become the foundation technology for many organizations across the globe that are undergoing digital transformation. When the shortcomings of legacy infrastructure were revealed in the newly distributed, location-agnostic world, it triggered an accelerated move toward a modern IT environment that can securely scale to meet the needs of digital businesses in the new era. A cloud-first strategy, which many forward-looking governments in the Middle East and Africa were pursuing even before the pandemic, thus became a necessity in the new normal. Today cloud is the optimal choice for improving digital infrastructure, modernizing applications, and providing a platform for creating new products and services. Indeed, IDC's

research indicates that the rate of spending growth on opex-based IT consumption models such as cloud is much bigger than the rate of spending growth on traditional infrastructure (e.g., servers, storage, network equipment).¹²³

State of Public Cloud Services Adoption in MEA

Public cloud spending in the MEA region is witnessing exponential growth, which is catalyzed by the need for digitization and modernization initiatives among governmental public organizations within the region. Another key driver of cloud uptake is increasing investments by hyperscalers within in-country datacenters.

According to the IDC Semiannual Public Cloud Services* Tracker, the eight-year CAGR for cloud adoption in the MEA region (between 2018 and 2026) is 27.6%. During this period, Bahrain reflects strong CAGR at 40.2%. The growth in Bahrain's cloud spending is mainly driven by the huge spike in 2019, when iGA invested significantly to procure various cloud solutions from AWS for Bahrain's governmental entities. iGA's public cloud spending grew from \$0.35 million in 2018 to \$8.5 million in 2019.



Bahrain's public cloud spending reflects strong CAGR of **40.2%** during the 2018-2026.

***Public cloud services:** Public cloud services are shared among unrelated enterprises and/or customers, open to a largely unrestricted universe of potential users, and designed for a market, not a single enterprise. IDC captures the overall spending on procuring SaaS, PaaS, and IaaS cloud services across all industries across the region within its Public Cloud Services Tracker.



In 2021, Bahrain's public cloud services spending accounted for **4.6%** of total IT spending in the country. This figure is forecast to reach **12.4%** by 2026.

According to IDC's Semiannual Public Cloud Services Tracker, Bahrain's public cloud services* market, which includes infrastructure as a service (IaaS), software as a service (SaaS), and platform as a service (PaaS), is expected to reach a value of \$123.6 million in 2026. IaaS is expected to grow the fastest, with a CAGR of 48.2% for the 2018-2026 period, followed by PaaS at 43.6% and SaaS at 31.7%.

Despite the small base value measured in 2018, one of the major factors for Bahrain's cloud adoption growth, was the government's aggressive cloud-first strategy. The major spike in the country's cloud spending in 2019 reflects substantial spending from iGA to procure and implement AWS cloud solutions. The government of Bahrain has fueled cloud growth in the country, persistent towards transforming the country into a digital economy, and setting up a successful adoption roadmap for other countries in the region to follow.

Challenges for Cloud Adoption

When Bahrain's government started evaluating the use of cloud to digitize the country's economy, it faced many challenges. Some of the main ones are below:

¹ [IDC Semiannual Public Cloud Services Tracker](#)

² [IDC Quarterly Enterprise Infrastructure Tracker](#)

³ [IDC Quarterly Storage Software and Cloud Services Tracker](#)

Lack of Cloud-Friendly Regulations

In the 2016-2017 period, there were no cloud regulations or guidelines for organizations in Bahrain to buy or sell cloud solutions. Data classification was limited to what can stay on-premises and what can reside in the cloud, which was not particularly useful for cloud migration. When iGA conducted its first workshop for the various governmental ministries in 2017, the key concern that emerged was whether certain data or a given workload was allowed to be hosted on public cloud. To address this challenge, iGA worked with other government entities to refine the regulations and update data classification laws. They introduced a Cloud First Policy and new data classification guidelines. Instead of mandating the data residency requirements, the Cloud First Policy emphasized defining the level of control and security, irrespective of where the data is stored. iGA knew that cloud's benefits are best realized when there are no data residency restrictions placed on data. The Policy states that restrictions around data residency "undermine the economies of scale and security benefits to be gained from shared computing infrastructure."⁴ This allowed iGA to prepare a foundation for the ministries' cloud journey and helped them to accelerate cloud adoption within the country where the ministries did not have to wait for the launch of the AWS Bahrain Region and was able to host its data outside of Bahrain.

Traditional Procurement Cycle

Government entities in Bahrain were traditionally used to capital expenditure-oriented budgets and had little experience with an operational expenditure model. IDC's interview with iGA revealed that the Ministry of Finance and National Economy (MoFNE) initially found it difficult to deploy a model in which they do not "own" any "hardware" and are paying only for "what they consume." It was thus a challenge to allocate a budget for such services, because there was no prior consumption rate to base an estimate on. In addition, members of finance and accounting departments in other government entities were unlikely to be familiar with the concept of cloud. To address such obstacles, iGA worked with MoFNE to completely revamp the procurement cycle and with the Bahrain Tender Board to establish a new approach to procurement. This approach optimized procurement through unifying and consolidating cloud purchases under one agreement.

IT Skills and Competence

The cloud market was still nascent in Bahrain prior to 2017, however it was difficult to find IT professionals with specialized cloud skills or experience. The country's overall ecosystem was still evolving, and know-how was universally limited. Without the requisite IT skills, organizations could not deploy cloud solutions to notable effect, much less think of moving critical workloads to a cloud environment. This was an early roadblock and significant inhibitor to cloud uptake in the country. iGA mandated cloud professional certifications for all IT professionals in the government to address the cloud skill shortage. In parallel, Tamkeen established a program to fund Bahraini IT professionals to upskill their capabilities on the cloud technology with AWS. According to AWS, almost 2,500 employees from the public sector were trained during the 2018-2022 period. In addition, Bahrain is home to two AWS Cloud Innovation Centers, located in the University of Bahrain (UoB) and at Bahrain Polytechnic (BP).

⁴ Source: [Bahrain Cloud First Policy, June 2017](#)

Lack of Cloud-Ready Infrastructure or Ecosystem to Support Cloud Journey

Cloud computing requires robust network availability, as well as a vast ecosystem of partners such as systems integrators, value added resellers (VARs) and managed cloud service providers. To support the government's forward-looking strategy to digitize its economy and leverage the full benefits of cloud, Bahrain needed a robust ecosystem of cloud consultants, cloud migration service providers, implementation partners, and other skilled professionals. In an effort to enhance the country's infrastructure, the Telecom Regulatory Authority (TRA) introduced Bahrain's fourth National Telecommunication Plan (NTP) in 2016, which aimed at launching secure and high-speed broadband services and developing wireless infrastructure, as well as increasing international connectivity.

Negative Perceptions of Cloud

IDC's interview with iGA executives revealed that one of the biggest challenges was overcoming the perception of cloud as less secure or more expensive than traditional IT infrastructure. Government leaders from iGA and later Bahrain's National Cyber Security Centre (NCSC) worked with business leaders from various companies and sectors to overcome the perception bias by launching national cloud awareness campaigns. Several trainings and bootcamps were also organized to educate potential users in the public and private sectors about the advantageous security aspects of cloud, as well as its ability to provide long-term cost savings.

Bahrain's Cloud Journey

Cloud has proved to be a game-changer for Bahrain's economy. As the first country in the MEA region to adopt a nation-wide 'Cloud First' policy in 2017, Bahrain compels government entities to adopt cloud environments in place of on-premises infrastructure. This has led to an increased uptake of public cloud services across public and private sector organizations of all sizes. Cloud is leveraged to improve agility, reduce IT system costs, and integrate enhanced business functionalities and add-ons into applications and IT platforms.

The cloud reform in the country has enabled government entities to not only modernize their IT systems and reduce IT-related costs but also improve the accessibility, security, and resiliency of various government services. For example, iGA transformed its business line offerings to the cloud, launching several government-to-government, government-to-consumer, and government-to-business services. Many new technologies rely on cloud deployment to achieve their full potential. Cloud and other emerging technologies such as AI, IoT, and data analytics have been critical for realizing the government's long-term Vision 2030, as well as driving economic growth, financial stability, and sustainable development — three focus areas defined under the government's short-term action plan. The use of cloud has spurred innovation and enhanced agility among public sector organizations and improved services for citizens and businesses alike.

The Evolution of Cloud in the Kingdom of Bahrain

Bringing Global Hyperscaler AWS to Bahrain

The absence of any Tier 4 datacenter or hyperscaler in MEA was an inhibitor to cloud services adoption in the region, especially in highly regulated sectors such as government and financial services. Attracting a global hyperscaler became a key priority, which would require showcasing future opportunities in this important sector. As such, Bahrain EDB presented AWS with an opportunity to not only serve the Bahraini market, but also to tap into the entire MEA region from Bahrain.

“Bahrain EDB was able to persuade AWS of Bahrain’s commitment to providing a conducive business environment and infrastructure for cloud-related investments. Bahrain EDB continues to act as a partner to AWS as it expands and grows its cloud-based services in the entire region.” — H.E. Khalid Humaidan, Chief Executive, Bahrain Economic Development Board (Bahrain EDB)

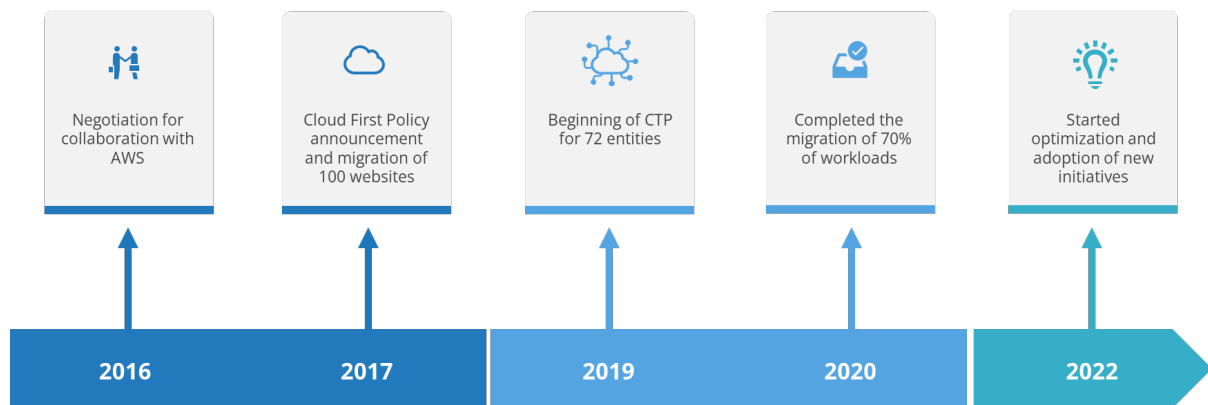
AWS carried out an intensive evaluation process of various potential jurisdictions before making its first ever datacenter investment within the MEA region. Bahrain EDB acted as the main interface between AWS and the numerous stakeholders involved in Bahrain, designing, and populating a suitable task for the project. Bahrain EDB ensured that AWS was provided with all necessary government support, including hosting AWS’s onsite due diligence visits and guiding thorough business case investigations. Bahrain EDB acted as a primary facilitator and conduit for information, as well as a partner for AWS in negotiations with the government. Bahrain EDB also advocated for regulatory reform, provided input for upskilling programs, assisted in negotiations with third-party partners and customers, obtained relevant permits and visas, and provided other necessary assistance. It is clear then that Bahrain EDB played a central role in attracting and setting up the first regional AWS Cloud Region in Bahrain, which became active in July 2019.

Establishment of Cloud Transformation Program (CTP) and Launch of Cloud First Policy

After the partnership with AWS was formed in early 2016, iGA launched its Cloud First Policy in 2017, which encouraged local organizations to explore cloud opportunities. During the same year, iGA successfully migrated almost 100 websites from 49 entities to the AWS cloud.

iGA also established the Cloud Transformation Program (CTP) in 2017. This program sought to prepare the basic infrastructure, skills, policies, and frameworks required to facilitate the migration of government services to the cloud. The CTP included an assessment of the existing regulations and evaluation of what was needed to support the cloud-based modernization initiatives in the country. The launch of Cloud First Policy was one of iGA’s initial strategic moves. The CTP team prepared all the necessary components that are required for the cloud migration. The team consisted of 20 IT professionals from iGA departments such as infrastructure, security, database, development, and core IT personnel who worked with AWS. In addition, the team recruited professionals from AWS partners to support the program. By December 2021, the CTP team had migrated 70% of the government services workloads to AWS cloud. CTP is currently working with the government entities to refactor the remaining workloads to make them cloud ready. For 2023 and beyond, CTP is exploring the option of the SaaS approach for some business applications, such as e-procurement for tendering purposes.

Figure 2: Timeline for Cloud Transformation Program (CTP)



Source: iGA, 2022

Government Strategy to Overcome Challenges

Complete Revamp of Procurement Strategy

To address the challenges related to organizations' traditional procurement cycles, iGA centralized the entire process. First, it conducted a thorough consumption forecast analysis for all 72 government entities that were expected to move their infrastructure to the cloud. Based on the resulting estimates, the government approved a centralized budget to be distributed among all 72 entities. If an entity's consumption behavior increases, it can request additional budget from the central amount. If a government entity uses less budget than estimated, that can compensate for the entities that require more. This flexibility enabled iGA to overcome procurement challenges and resolve the problem of budget allocations during 2017-2018. Cloud migrations at this time were not complex, as it was a learning phase for most users. By 2019, the procurement strategy was ready for more full-fledged cloud migrations.

Assessment of Current Regulations and Necessary Changes

The iGA and CTP team had a lot of work to do in the area of data classification, prior to the deployment of a hyperscale datacenter in Bahrain. Laws regarding data protection were brought up to date (to their current form) for offering cloud computing services to foreign parties, and providing foreign parties sovereignty over their data when hosted in Bahrain. Instead of defining what workloads should stay on-premises or move to cloud, iGA evaluated the "level of control" required to host any sensitive data, internal data or public, either on-premises, on cloud or on hybrid cloud. For every data classification, iGA aimed to define the level of control irrespective of the environment. Sensitive data hosted outside the entity had to ensure the required level of control, as defined by the entity.

The Central Bank of Bahrain (CBB) overhauled its regulations regarding data residency and the use of cloud to host bank data. The new regulations allowed financial institutions to host data with third-party providers like AWS.

“Instead of defining what workloads should stay on-premises or move to cloud, iGA evaluated the 'level of control' required to host any sensitive data, internal data or public, either on-premises, on cloud or on hybrid cloud. For every data classification, iGA aimed to define the level of control irrespective of the environment.” — **Khalid Almutawah, Vice CE Operations and Governance, iGA**

Establishment of National Cyber Security Center (NCSC)

In October 2020, iGA announced the establishment of the National Cyber Security Center (NCSC) to overlook and define a unified cybersecurity framework. Prior to this, no single government entity was responsible for the whole country's cybersecurity issues. The NCSC aims to create cybersecurity laws and implement security regulations at the national level, governing to establish trust in the digital economy.

The NCSC represented the government's comprehensive plan to drastically improve the country's cybersecurity landscape. It also established National Cloud Security Standards and worked closely with sector regulators to develop cloud security and cybersecurity regulations for each sector, which could then implement their own security policies. The NCSC also published security templates that became a standard for ensuring critical infrastructure security, enabling organizations to implement cybersecurity policies within their own operations.

NCSC has also made significant investments in upskilling the Bahraini workforce in such areas as security and compliance. In fact, the government has undertaken an initiative to provide cybersecurity training for at least 20,000 citizens by 2026. The NCSC and iGA organized multiple security workshops and awareness programs in collaboration with AWS and other key technology providers for technical and non-technical team members. Tamkeen, Bahrain's labor fund responsible for skills development and training, launched a cyber academy in collaboration with the SANS Institute. This has further bolstered the NCSC's efforts in establishing Bahrain as one of the most advanced countries in the region from a cloud security standpoint.

“In addition to overhauling the security regulations and implementing cloud policies, our most important investment is in human capital. The government had already initiated a number of upskilling programs, and NCSC worked very closely with AWS to conduct security workshops and develop best practices for cloud security and compliance.” — **Shaikh Abdulla Mohamed Abdulwahab Al Khalifa, Deputy CEO for Cyber Operations at NCSC**

Attracting Foreign Investment

As an investment promotion agency, the role of Bahrain EBD is to attract direct investment in Bahrain's economy. Bahrain EDB has identified priority sectors viable for investment including, financial services, manufacturing, logistics, ICT and tourism. Among these, ICT is considered a key enabler for driving digitisation

across all the other sectors. At the heart of the country's ICT strategy, part of the Kingdom's wider Economic Recovery Plan, is the development of datacenters and cloud service providers. For example, manufacturing organizations need to have industry 4.0 (AI, IoT, big data analytics, cyber security, etc.) solutions and skills to maximize efficiency and be competitive. Banks today are hiring more coders than bankers. Tourism relies on digital passports, digital border control, digital immigration, and other ICT innovations to ensure a frictionless experience.

To make AWS Bahrain a reality, Bahrain EDB worked closely with key stakeholders to fulfil AWS's requirements, one of which was establishing the Cloud First Policy. The entry of AWS was a game-changer in many respects. By deploying the right resources towards this specific goal, Bahrain concurrently advanced its overall digitization strategy more rapidly.

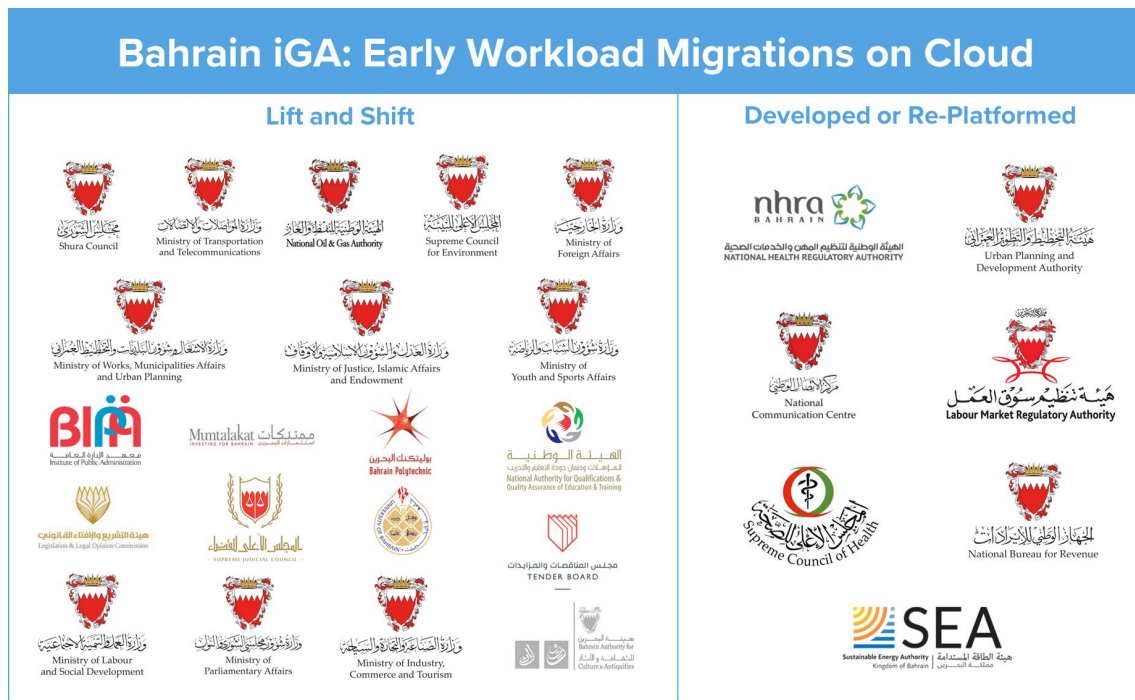
Promoting Cloud Adoption to Drive Business Expansion

Mumtalakat Holding Company, Bahrain's sovereign wealth fund that invests in and nurtures local, regional, and international businesses, plays a key role in the country's overall cloud development. Some of the companies under its umbrella, such as Aluminium Bahrain (ALBA), the National Bank of Bahrain (NBB), Gulf Air, Bahrain Airport Company (BAC), and Batelco have already made significant strides in their cloud journey by migrating their workloads to AWS. Batelco formed subsidiaries (Beyon Cyber, Beyon Connect and Beyon Money) to focus on cybersecurity, connectivity, and digital banking — one of the many success stories where cloud has empowered public and private sector organizations to form new entities, expand business coverage, and enter new geographies with their solutions and offerings.

Benefits and Achievements of Cloud Implementations

The cloud migration project started as proof of concept (PoC) in 2017. During the initial stages in 2017 and 2018, the government entities' workload migration was minimal, mainly involving basic workloads like websites. This stage was implemented using internal resources at iGA. After the actual contract was signed in 2019, the major migration began for systems and services, and external resources were brought on board for implementation.

Figure 3: Entities that have completely transitioned to cloud computing



Source: iGA, 2022

Since the announcement of Bahrain's Cloud First Policy in 2017, 72 government entities have started using cloud services. According to iGA, almost 70% of workloads have been migrated to the cloud as of 2022, and the remaining workloads are planned to be redeveloped to make them ready for cloud migration.

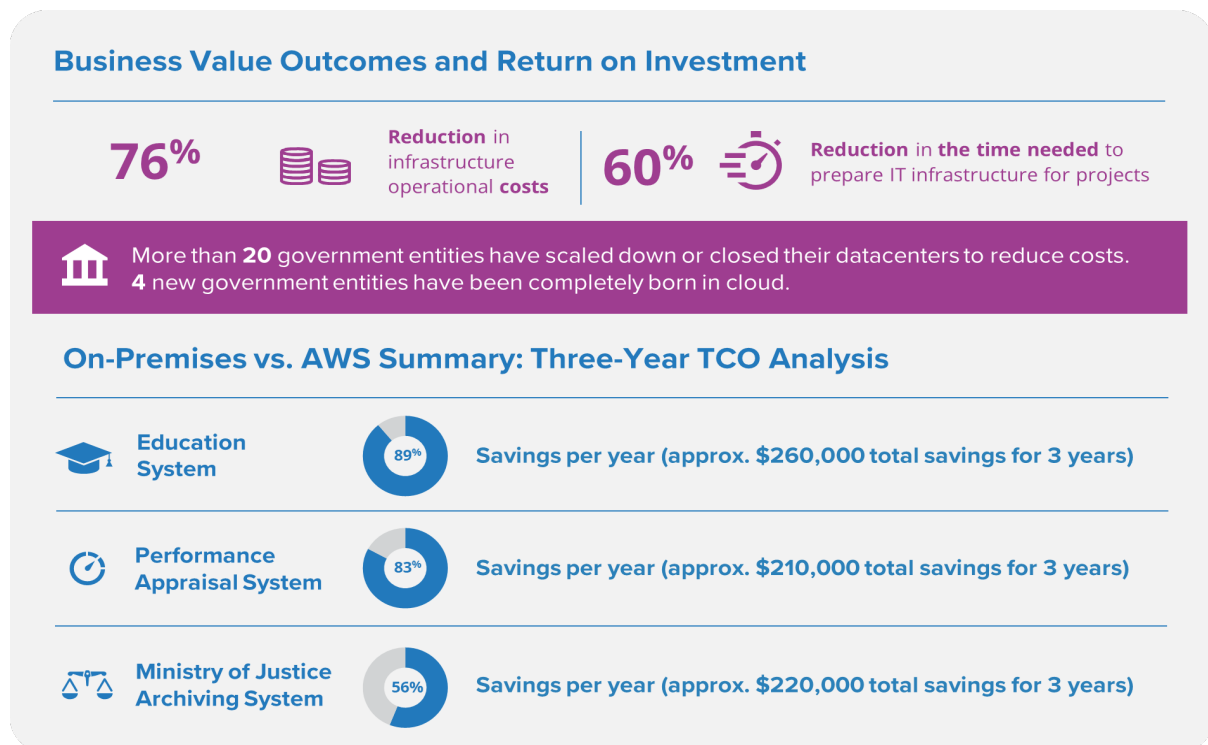
Below are some examples of government workloads that are currently running on cloud:

- **National Bureau of Revenue:** VAT taxation system, running on SAP + Hanan environment
- **Ministry of Justice:** Court Cases Management System, running on Oracle DB and applications
- **Information & Government Authority:** Bahrain National Portal (Bahrain.bh) that provides more than 500 eservices to citizens, running on IBM WebSphere and DB2 technology
- **Electricity and Water Authority (EWA):** CRM systems that manage billing for households and commercial customers
- **Electricity & Water Authority (EWA):** Smart Meter Management System built on third-party solution using IoT technology to capture, consolidate, and analyze data for better decision making
- **National Health Regulatory Authority (NHRA):** Munshaat and Mehan for medical facilities application and professional applications for licensing
- **University of Bahrain:** Student information system
- **Polytechnic Bahrain:** Student information system
- **Health Council:** Health insurance management system for all insured people in Bahrain
- **Ministry of Education:** Edunet system to provide elearning for more than 140,000 students
- **Ministry of Industry and Commerce:** Sijilat System to manage the lifecycle of Commercial Registration services
- **Benayat:** The National Building Permits that consolidate the requirements of more than 7 government departments

Cloud Benefits Achieved by the Information & eGovernment Authority

Bahrain's government has achieved many benefits since transitioning to the cloud. A total of 1,385 government services and 570 e-services have been integrated on the cloud, reducing complexity for a better user experience, and saving time and costs. Some of the key business benefits, such as return on investment (ROI) are illustrated in the figure below.

Figure 4: Business Value Achieved and Three-Year TCO Analysis



Note: Savings per year by moving infrastructure (server, storage, network, and IT labor) to AWS Cloud. Based on three-year TCO (AWS cost includes business level support).

Source: Business Value Outcome and ROI analysis conducted and shared by iGA and EDB, 2022

Analysis of Cloud's Economic Impact in Bahrain

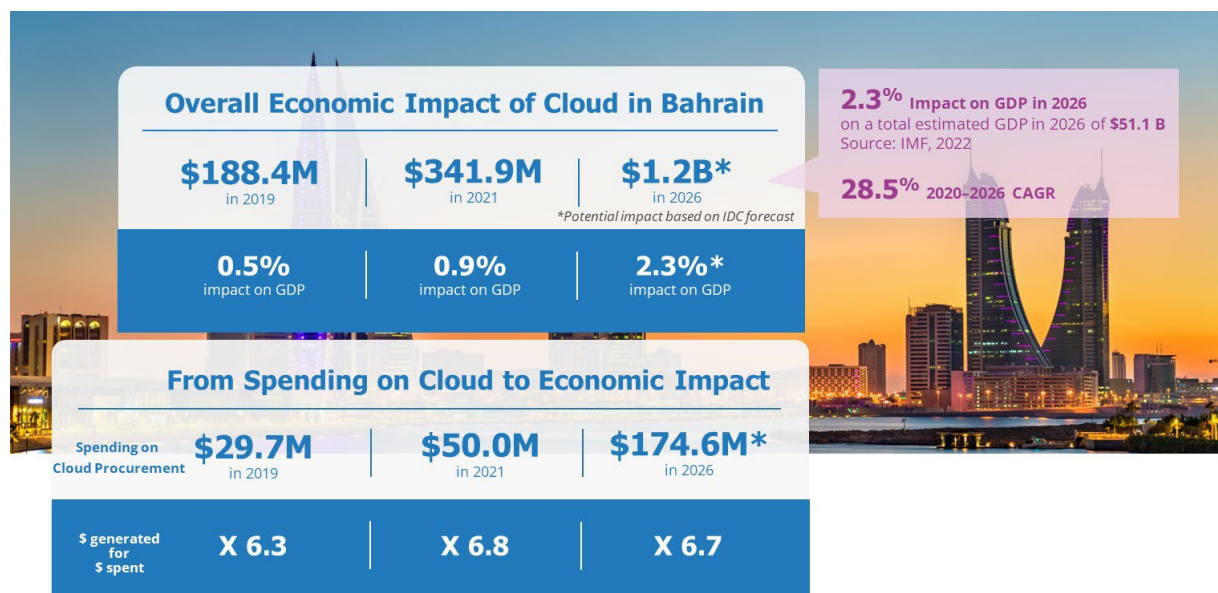
As the cloud market in Bahrain matures, organizations' appetite for cloud solutions is growing. Beyond public cloud, demand for multi-cloud and hybrid cloud systems is also growing, as organizations seek additional benefits. The SaaS delivery model allows organizations to deploy new applications efficiently and affordably and to standardize and update existing versions. This capability improves productivity by enabling users to access applications from any location or device. The IaaS model enables organizations to scale their compute and storage needs on demand, thus improving performance and agility. Additionally, PaaS offerings allow organizations to develop and deploy solutions quickly and reduce overheads.

IDC has used an Economic Impact Analysis (EIA) leveraging the Input/Output framework to analyze the economic impact of cloud services in Bahrain. For a detailed overview of the model, please refer to the Methodology section.

Total Economic Impact of Cloud Services in Bahrain

According to IDC's economic impact analysis, cloud and its supply chain contributed almost \$341.9 million to Bahrain's GDP in 2021. This is almost 6.8 times larger than the initial \$50.0 million that was spent on procuring cloud services in that same year. Cloud spending included both public and private sector spending on IaaS-, PaaS-, and SaaS-based solutions, as well as investments in cloud support and training, project services, and managed cloud services. The study forecast that, by 2026, cloud and its supply chain will add almost \$1.2 billion to Bahrain's GDP based on total spending of \$174.6 million on procuring and implementing cloud services. This impact refers to the provision of cloud in each year and its impact on the supply chain of the cloud providers, especially those who are benefitting from cloud usage (such as end users adopting cloud) and those providing inputs for the cloud provision (cloud service providers and channel partners). These benefits will in turn impact the whole supply chain, resulting in benefits for Bahrain's overall economy. The benefits will also be reflected in terms of more efficient services delivered to customers and increased production to support cloud provision. In 2021, spending on public cloud technology in Bahrain accounted for almost 0.9% of the country's GDP. This figure is expected to reach 2.3% by 2026.

Figure 5: Total Economic Impact of Cloud



Source: IDC Economic Impact Study, 2022

* Potential impact based on IDC Forecast

Other key findings from the EIA are summarized below:

- For every dollar that was spent on procuring cloud services in 2021, 6.8 additional dollars were generated for the overall Bahraini economy. This was a combination of the direct, indirect, and induced impact of the overall cloud supply chain on the country, with indirect impacts accounting for over 50% of the additional revenue. While the direct impacts were generated among the direct clients and providers of public cloud services (i.e., end-user spending on cloud services that generated request of inputs in the supply chain), the indirect impacts were those generated across the whole supply chain and end-user universe. These effects were not directly caused by cloud providers selling their services but were rather the indirect benefits of direct spending on cloud services (i.e., relating to the "providers of providers" or "customers of customers" — business-to-

business purchases in the supply chain that stemmed from the initial industry input purchases/provisions). This is explained further in the Methodology section of this report.

- The impact of cloud in Bahrain is expected to reach 2.3% of GDP in 2026, at which time the country's total GDP is forecast to reach \$51.1 billion. IDC expects a peak in impacts in 2023, as the benefits reach the wider economy, thanks to Bahrain's Cloud First policy, which has been creating new opportunities within the public sector and beyond. These benefits will remain high through the forecast period, although they will likely level out.
- The 2020-2026 CAGR of the overall impacts (total spending on public cloud services) is nearly 28.5%. As Bahrain's cloud market will not be fully mature by 2026, IDC expects the impact of cloud on the country's GDP to continue growing beyond the current forecast period before normalizing.

Total Employment Impact of Cloud Spending in Bahrain

As a result of continuous spending on cloud services in Bahrain, demand for cloud skills, as well as the use of emerging technologies like AI, ML, IoT, analytics, and automation, also increased. These skills and technologies will be used to support ongoing transformation initiatives. The government is also collaborating with private sector organizations to develop the ICT skill sets that will be required in the future. Uptake of cloud services will create demand for cloud architects, software developers, cybersecurity experts and employees that are skilled in vendor management, IT governance, and data privacy. Extensive cloud uptake may also require the retraining of employees to fulfill new technology-support roles. Furthermore, cloud services are giving rise to new professions.

Innovations and the rising use of public and private cloud services will further drive economic diversification in Bahrain and support the establishment of new companies. This will create additional job opportunities, for technical, non-technical, and unskilled roles to support the growing cloud ecosystem, but jobs will also be generated as secondary effects, not directly related to cloud activity, and supported by the wider health and resilience of Bahrain's economy.

Figure 6: Total Employment Impact of Cloud Spending in Bahrain



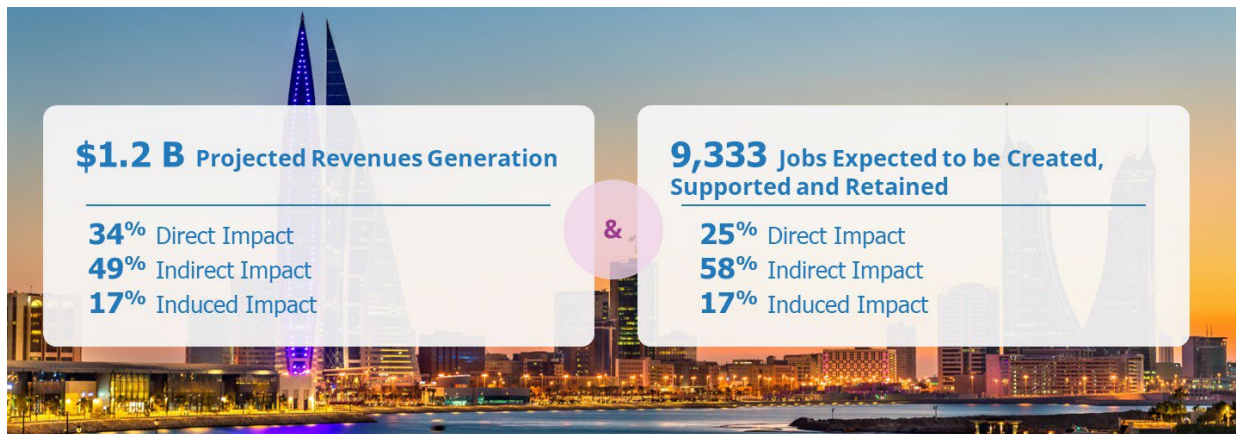
Source: IDC Economic Impact Study, 2022

* Forecast figure, jobs represent all types of jobs expected to be created, supported, and retained, and not only ICT or digital jobs in the economy.

The overall spending on cloud and cloud-based services produced an impact of 0.1% on the overall employment in Bahrain in 2019. By 2026, cloud's impact is expected to add 9,333 jobs to the economy, which represents around 0.8% of the country's total estimated employment. These are not ICT or technical jobs, but all types of jobs combined, including skilled and unskilled, which are being generated, supported, and retained as result of cloud spending in the country.

In the figure below, the impact of cloud and its related supply chain on additional revenue and jobs in the country are analyzed at different levels — namely direct, indirect, and induced impact.

Figure 7: Forecast of Direct, Indirect, and Induced Impacts of Cloud in Bahrain by 2026



Source: IDC Economic Impact Study, 2022

Study results of the overall economic impact of cloud on Bahrain's economy yielded direct, indirect, and induced impacts which are summarized below:

- **Direct Impact:** This is generated by changes in production along the supply chain of the cloud provider. Direct impact of cloud spending is almost 34% of total revenue generated in the country, whereas its contribution to employment is 25%.
- **Indirect Impact:** These are the largest impacts on the economy, as they include all the effects on the entire supply chain, in terms of both revenue and employment. By 2026, nearly 60% of jobs generated in the economy will stem from the overall cloud supply chain.
- **Induced Impact:** These represent a secondary effect of cloud. While they may be small compared to the other two impacts, they tend to increase, showing how the benefits of cloud eventually "ripple" across the whole economy.

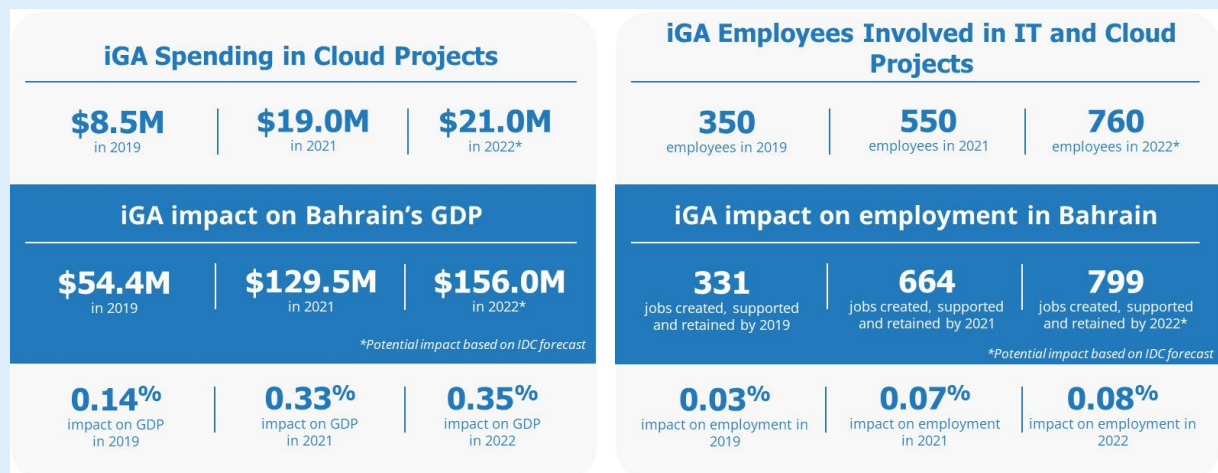
Economic Impact of iGA's Cloud Strategy

Bahrain's iGA has played a key role in driving the overall cloud initiative in the country, with authority to make cloud spending decisions for all government and public sector entities.

iGA's almost \$21 million of spending to procure cloud services had an estimated impact of nearly \$156.0 million on Bahrain's GDP in 2022, reflecting approximately 0.35% of the country's total GDP. The country's impact of total cloud spending was almost 1.0% of total GDP, whereas iGA's cloud spending alone has

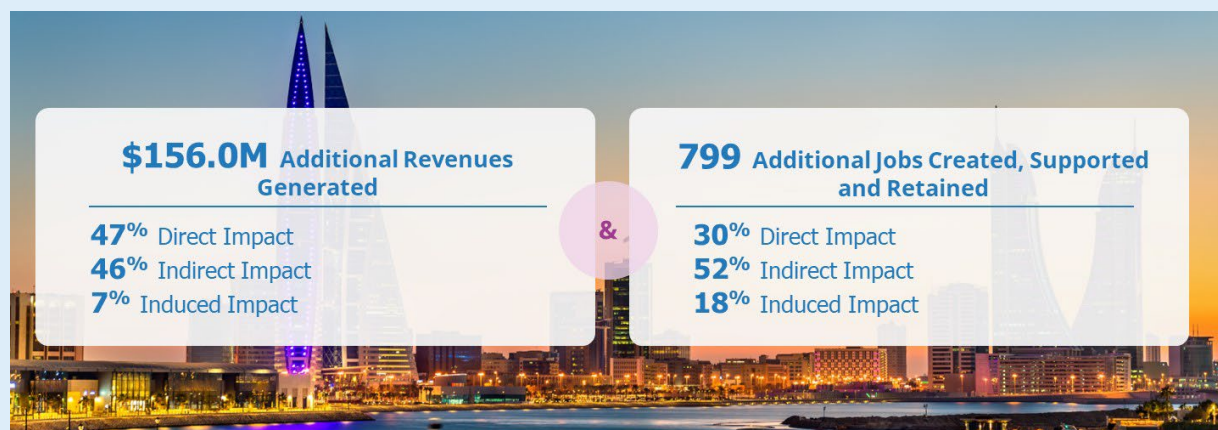
contributed almost 0.35% of total GDP. This is remarkable for any country where the government and public sector contributes so heavily to its GDP.

Figure 8: Economic Impact of iGA's Spending on Cloud Services on GDP and Employment



Source: IDC Economic Impact Study, 2022

Similarly, iGA's cloud spending is estimated to generate 799 additional jobs (not necessarily ICT jobs, but overall jobs, including non-technical and unskilled) in 2022, which represents around 0.08% of the total estimated employment of 1.02 million (ILO estimates) for that year.

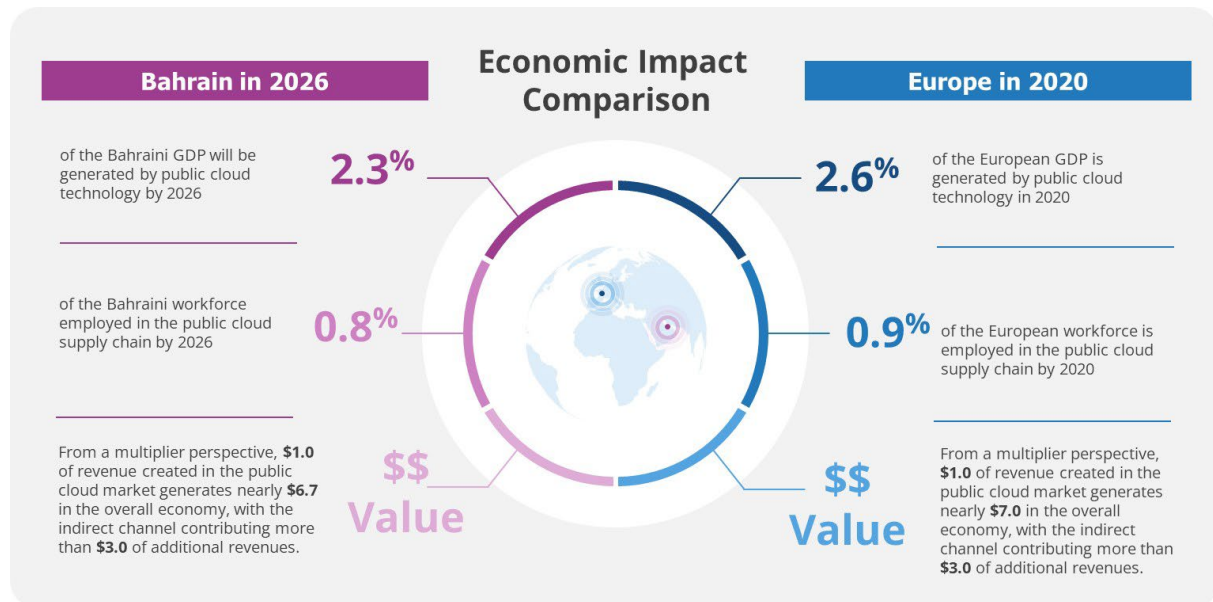


This impressive economic impact is mainly driven by the early spending on IaaS, followed by SaaS and PaaS spending, which delivers its benefits in the early years of the cloud spending. As iGA's spending in the area of IaaS matures, their future spending within SaaS and PaaS solutions, as well as support and training, project and managed cloud services will maintain high growth. **Direct impacts** are the second largest portion of its economic impacts in terms of job creation; in terms of additional revenue generation in the economy, these impacts are the most significant. **Indirect impacts** are the second largest impacts on the additional revenue in the economy, showing the importance for the government and public sector to deliver services to citizens and businesses. These benefits are seen also on the employment side, where the whole public sector generates the largest share of employees as an indirect impact (almost 52%), in all industries that the public sector serves whereas direct impact (30%) and induced impact (18%) are smaller.

A Comparative View of Cloud Impact on Bahrain and Europe

IDC conducted a similar EIA in 2021 to evaluate the impact of public cloud and its related supply chain on the European economy in an aggregated model. When comparing the economic output of Bahrain with Europe, we find that early adoption of cloud in Europe yielded similar results.

Figure 9: Economic Impact Analysis: Bahrain vs. Europe



Source: IDC Economic Impact Analysis (Bahrain study 2022; Europe study 2021)

In general, European spending in cloud services began prior to 2016, while Bahrain's major cloud spending did not start before 2019. Nevertheless, impacts in terms of GDP contribution, revenue, and employment are similar.

IDC Opinion

Cloud technology plays a central role in the Kingdom of Bahrain's current innovation and digital transformation initiatives. Government entities, particularly iGA and Bahrain EDB, have spearheaded the cloud initiative and made several changes in the country's infrastructure, introduced new regulations, encouraged foreign investments and worked towards building in-country cloud skills and expertise. Since the inception of the government's Cloud First Policy, numerous government entities have already migrated their workloads to the cloud and have realized benefits such as improved performance and reduced costs.

Bahrain's cloud strategy has strongly impacted its economy in terms of GDP contribution, additional employment opportunities, and operational benefits for organizations across business sectors. Ongoing investments by global and local cloud and technology providers, both in Bahrain and the wider Gulf Cooperation Council (GCC) region, will further accelerate cloud uptake while creating additional opportunities in the public and private sectors. As the cloud market in the region matures, new ecosystem players to support cloud migration, operation, and management will emerge.

Entities in Bahrain's government and public sector are aiming beyond infrastructure digitization and continuing to invest in cloud-based solutions (e.g., SaaS and PaaS) in a citizen-centric approach towards modernization. The use of data analytics, application modernization (using DevOps, microservices),

intelligent security, and advanced technologies embedded with AI and machine learning will further fuel the growth of cloud in the country.

Bahrain has now conceptualized a cloud security framework, enacted flexible regulations, revamped the national procurement strategy, inculcated skilled cloud architects and consultants, and is in the process of establishing a mature cloud-ready infrastructure and ecosystem. Along with supportive leadership driven by a long-term vision, Bahrain has positioned itself as a regional cloud and datacenter hub in the Middle East and North Africa region.

Methodology

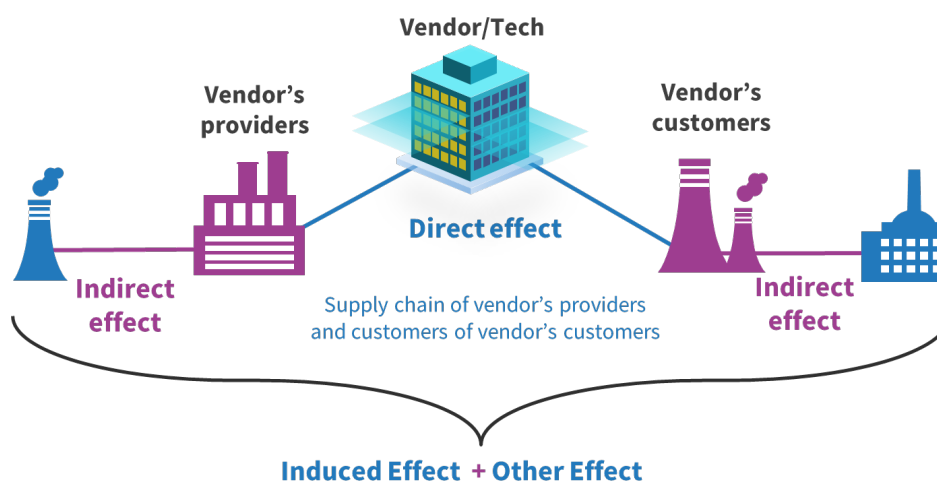
IDC developed an Economic Impact Analysis (EIA) leveraging Input/Output (I/O) methodology to analyze the economic impact of cloud services in Bahrain.

The Input-Output (I/O) methodology was founded by Wassily Leontief in 1966 and quantifies "the mutual interrelationships among the various sectors of a complex economic system". Input-output analysis is a method of systematically quantifying the mutual interrelationships among the various sectors of the economy. In so far, input-output analysis is concerned with the description and analysis of the production structure of an economy.

This method is based on national input-output tables that describe the flow of goods and services between all sectors of an economy over a period of time. These tables provide information on all inputs used in production: labor, capital, land, and intermediates, which are the intermediate inputs in production. The structure of each sector's production process is represented by a defined vector of structural coefficients that describes in quantitative terms the relationship between the inputs it absorbs and the output it produces. The objective is to calculate the output levels for the individual sectors (endogenous variables) for the given final demand (exogenous variables).

The EIA evaluates four different types of impact: direct, indirect, induced, and other. These are explained in detail below.

Figure 10: Overview of Economic Impact Model



Source: IDC 2022

The I/O methodology allows the calculation of three different type of impacts:

- **Direct Impact:** This is the effect on the direct supply chain (direct backward) and on the direct customer line (direct forward) of the cloud provider. This is the effect that is driven by the increased spending on cloud services.
- **Indirect Impact:** This is the indirect effect on the supply chain (indirect backward) as well as the customer line (indirect forward) of the cloud provider: indeed, the supply chain of the cloud provider has, in turn, its own supply chain, and customers have their own customers, which are impacted by the change in spending on cloud services.
- **Induced impact:** The induced effects are secondary effects, not directly related to the cloud provision or to the specific supply chain. These effects are generated in the economy from economic stimulus coming from increased households' income. The wealth is spread across the sectors and the activities, with a ripple effect in terms of jobs and revenues.

Model Perimeters: the cloud technologies and assumptions

To assess the economic impact of public cloud in Bahrain, it is necessary to clearly define public cloud technology, thus defining what is the scope of our analysis. With this methodology, IDC aimed at assessing the impact of spending on the consumption of public cloud by both the private and public sector, from 2018 to 2026. From cloud spending perspective, IDC is accounting for the dollar spent on procuring cloud solutions and cloud related services, and not looking at the cloud investment.

The perimeter of IDC model includes spending on Public Cloud IaaS, PaaS, SaaS as well as Cloud related IT Services such as Support and Training, Project Oriented and Managed Services. Definitions can also be the more detailed ones.

Detailed Cloud coverage in the model

Infrastructure as a service: IDC defines public cloud IaaS as the aggregate of compute, raw storage capacity, and the associated networking capability, delivered through a cloud deployment model.

Platform as a service: The PaaS market includes all revenues from IT capabilities in the application development and deployment primary software market when they are composed and delivered as a cloud service. PaaS provides integrated services organized around application development and life-cycle management.

Software as a service: SaaS applications services are based on a service composition and delivery model made up of a utility computing environment in which unrelated customers share a common application and infrastructure that is managed by an independent software vendor (ISV) or a third-party service provider. The code or IP of the service is typically owned by the SaaS ISV. There are many emerging models for providers of this software code (ISVs) to leverage third-party infrastructure, business services, and other providers as hosting, selling, fulfillment, or support partners.

Support and Training, Project and Managed services related investments are further classified under three separate services markets, as follows:

Support and Training: Support and training Services include hardware support Services, software support services and IT education and training services within the IDC taxonomy.

Project Oriented Services: Project oriented services market tracks activities related to project implementation and deployment for a customer by a service provider. The project-oriented services market

is further classified into IT consulting, custom application development, network consulting and integration and systems integration.

Managed Services: Managed services track all activities related to managing the customers IT (cloud environment in this case) environment including infrastructure, platform and applications. It further includes IT Outsourcing, network and endpoint outsourcing and application management, hosting infrastructure services, and hosted application management.

Excluded from the model are all capital investments and the economic impact of building and maintaining the datacenters. When we look at cloud investment view, we think of multi-million-dollar investment to procure land (for DC build-out), resources, datacenter components (such as servers, storages, networking equipment), and human resources both technical and non-technical. It also includes investments in creating a partner ecosystem. All these investments are very different which are excluded, as the current IDC model looks only at cloud spending.

The inputs that IDC used in order to evaluate the spending in cloud in Bahrain were mainly in two ways:

1. **IDC tracker and spending guide forecast data** for public cloud services and cloud related IT services market for Bahrain. This captures the spending by both public and private sector spending on cloud to procure these solutions and services across all company segments and industries.
2. **iGA's actual cloud spending (on IaaS, PaaS, SaaS and cloud related services) from 2017 until 2022.** iGA invested significantly to procure various cloud solutions from AWS for Bahrain governmental entities. iGA, which procures the cloud and related services for all the government entities in Bahrain, shared its direct feedback in terms of dollars spent from 2017 till 2022. This was reflected in the IDC's cloud tracker and spending guide forecast.
3. **IDIs with key government and public entities:** IDC analyst conducted almost 9 in-depth-interviews (IDI) with key government and public entities to gauge the usage of cloud as well as understand the cloud evolution from regulatory, and market perspective.

Assumptions on multipliers

Since it is commonly assumed that the impact estimates derived from I/O analysis represent activity within a single year, economic impact assessment is mostly used as a one-shot assessment. I/O multipliers can however be assumed stable during a certain period after the initial calculation of the I/O table (typically up to 6 years), unless the region's economy has changed significantly. In a systems approach perspective, one can thus yield interesting results in terms of comparisons of scenario impacts (the different scenarios will make the components of the assessment vary), if one works with re initialization of the impact assessment each year.

For this reason, some changes were applied to multipliers and impacts in order to reflect the innovation of this specific technology as well as the impact it can have over the years on the economy.

- IaaS assumed to be most impactful at the beginning of the period and to slowly fade its potential at the end of the period, in favor of SaaS and PaaS, which instead become more impactful after a couple of years after the initial investment. Services will increase from the beginning, especially for indirect and induced impacts.
- Overall impacts on the economy assumed to be higher in the first years after the initial spending is made (i.e. 2022 is the year where the overall impact is higher), slowly fading along the period. In

order to do so, a “smoother by year” was applied, so that direct impacts have been smoothed from 2023, indirect impact have not been adjusted, and induced impacts are instead accelerated along the period, as we assumed they tend to increase, showing how the benefits of cloud eventually “ripple” across the whole economy.

About AWS

In 2006, Amazon Web Services (AWS) began offering IT infrastructure services to businesses as web services — now commonly known as cloud computing. Today, AWS provides a highly reliable, scalable, low-cost infrastructure platform in the cloud that powers thousands of public sector agencies in most countries around the world. With AWS, customers find a complete set of highly available services that are designed to work together to build sophisticated scalable applications. More than 200 services that range from compute, storage, networking, database, analytics, application services, deployment, management, developer, mobile, Internet of Things (IoT), Artificial Intelligence (AI), security, hybrid and enterprise applications are available.

AWS Middle East (Bahrain) region launched in 2019, with three Availability Zones. Having three Availability Zones enables Middle East organizations to meet business continuity and disaster recovery requirements and build highly available, fault-tolerant, and scalable applications as well. Developers, startups, and enterprises, as well as government, education, and non-profit organizations use AWS services to run applications and leverage advanced technologies such as artificial intelligence, advance analytics, database, and serverless to drive innovation across the Middle East.

About Bahrain Economic Development Board

The Bahrain Economic Development Board (Bahrain EDB) is an investment promotion agency with overall responsibility for attracting investment into the Kingdom and supporting initiatives that enhance the investment climate.

Bahrain EDB works with the government and both current and prospective investors, in order to ensure that Bahrain’s investment climate is attractive, to communicate the key strengths, and to identify where opportunities exist for further economic growth through investment.

Bahrain EDB focuses on several economic sectors that capitalise on Bahrain’s competitive advantages and provide significant investment opportunities. These sectors include financial services, manufacturing, logistics, ICT and tourism. For more information on the Bahrain EDB visit www.bahrainedb.com

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications, and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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