

المجلس
الاقتصادي
والاجتماعي
والبيئي



المملكة المغربية
Royaume du Maroc

ⵎⴰⵔ ⵏ ⵓⵎⵎⴰⵔ ⵏ ⵓⵙⵏⵓⵙ ⵏ ⵓⵙⵏⵓⵙ ⵏ ⵓⵙⵏⵓⵙ
CONSEIL ECONOMIQUE, SOCIAL ET ENVIRONNEMENTAL

Opinion

Economic, Social and Environmental Council

**The Cloud , a necessity that needs to be
addressed urgently for successful digital
transformation**

Own-initiative n° 71/2023

Opinion

Economic, Social and Environmental Council

The Cloud, a necessity that needs to be addressed urgently for successful digital transformation

Committee Chair : Ahmed Abaddi

Rapporteur for the topic : Abdallah Deguig

Permanent Expert : Mohamed Amine Charar

Own-initiative n° 71/2023

In line with the provisions of Article (6) of Organic Law n°128-12, the CESE (Economic, Social and Environmental Council) has decided to deliver an own-initiative Opinion on the issue of the Cloud.

The Council's Board entrusted the Standing Committee for the Knowledge and Information Society with the task of preparing this Opinion.

The General Assembly of the CESE at its 149th regular session (31 August 2023) unanimously adopted the Opinion, with the theme "The Cloud – a necessity that needs to be addressed urgently for successful digital transformation". The Opinion was developed through a participatory process involving a large debate among all the constituent members of the Council and based on the findings of a series of interviews with a host of key stakeholders .

Executive Summary

This Opinion supplements an earlier study by the Council (2021) titled “Towards a responsible and inclusive digital transformation”. A key recommendation of that study was that “national and regional sovereign data centers should be established to enable the State and Moroccan businesses to host their strategic assets (data and applications)”. In the present Opinion, the Council focuses on the factors favoring the adoption and use in Morocco of Cloud computing solutions. The aim is to accelerate our country’s digital transformation, while ensuring the sovereignty of sensitive and vital data. Today’s Opinion was unanimously adopted by the Council’s General Assembly of 31 August 2023.

The Cloud is a key pillar of the digital transformation technology ecosystem. An essential part of digital transformation, the Cloud allows the data to be stored securely offsite at a remote location, guarantees rapid access to shared digital infrastructures and services, and therefore enabling economies of scale of up to 20%. By offering services such as intelligent mobility, remote surveillance, automatic access to services and streaming, the Cloud system is a beneficial step for successful organization of world-class events such as the FIFA World Cup; something to which our country aspires.

Yet, despite this huge potential, Morocco has its myriad of actors (public and private) still lagging in the adoption of Cloud-based solutions. In 2020, the outsourcing rate for IT resources was just 14%, compared with 35% in Western Europe and 51% in Asia-Pacific.

Furthermore, despite the existence of several national players offering hosting services and Cloud-based solutions, digital adoption by national institutions is to a large extent still confined to basic services (hosting, Infrastructure as a Service, frequent applications), without covering the full range of high added-value Cloud-based applications and services (*software as a Service*).

Several factors may explain this situation:

- **Morocco’s national market is restricted due to a poorly deployed Cloud** environment: organizations still opt for management methods that favor the direct ownership and management of infrastructures and applications in-house, obscuring the pooling, resilience and scalability benefit of using the Cloud.
- **Connectivity costs are relatively high:** cloud players need affordably priced high-quality connectivity to have access to large bandwidths for both customer access and replicability between their sites to ensure geographical redundancy. However, the cost of Internet service is up to 4 times more expensive in Morocco than in Europe.
- **Lack of qualified human resources:** the Cloud sector, like the rest of the IT market, suffers a shortage of human resources, exacerbated by intense international competition, particularly for highly specialized skills.

- **Classification of big data** based on level of sensitivity, as provided for by Moroccan Law no. 05-20 on cybersecurity and its implementing decree, is slow. This classification remains essential for choosing the most appropriate Cloud-based infrastructure.

From this diagnosis and based on international experiences, the CESE calls for the Cloud to be given prior attention in the digital transition strategy currently being finalized by the Ministry for Digital Transition and Administrative Reform. To achieve this, it is recommended that a “Cloud-first” action plan be developed as a matter of urgency to harness the Cloud to drive accelerated digital transformation and ensure data sovereignty.

This task could be entrusted to a commission gathering the stakeholders concerned and steered by the Ministry Attached to the Head of Government in Charge of the Digital Transition and Administrative Reform, with the close collaboration of key public and private sector stakeholders to provide the necessary expertise and roll out the action plan identified nationwide. The ADD (Digital Development Agency) could be tasked with the implementation of this plan.

The overriding ambition is to position our country at the forefront of Cloud technology regionwide as a continental “*data embassy*”, offering advanced Cloud services with the involvement of national stakeholders.

Here are a few recommendations thereto pertaining:

- **Encourage the establishment of global and/or international Cloud players (hyperscalers) in Morocco**, particularly through (i) the introduction of a range of incentives (telecoms service charges, data privacy, cybersecurity, renewable energies, land, etc.); (ii) the development of competitive optical fiber offerings tailored to the needs of these players. To this end, the ANRT (National Agency of Telecommunication Regulation) should provide for regulatory levers aimed at diversifying the offering, guaranteeing quality of service and reducing costs.
- **Put in place a sovereign Cloud-based solution (public or private)** for vital and sensitive applications and data.

Prioritize the use of the Cloud for all new government projects and support administrations in migrating their existing systems to the *Cloud*.

- **Support VSEs/SMEs wishing to adopt the Cloud**, while offering financial incentives to user companies.
- **Develop local Cloud computing skills.**

Promote a national ecosystem of start-ups that can take advantage of Cloud technology (*IaaS, PaaS and SaaS*).

Introduction

Digital transformation has brought a clear shift in our social interaction patterns, affecting our ways of learning, our production processes, our means of entertainment, and presenting novel ways to serve customers and solve their problems.

The scope and scale of the digital revolution is such that digital solutions will soon permeate across all industries and environments. As a result, digital technology is identified as the key area for transforming our development model and a pillar of the nation's economy and growth. Harnessing the Cloud is **instrumental for digital transformation efforts as it enables the data¹** of government departments, companies and citizens to be stored securely offsite at a remote location.

The Cloud computing paradigm offers rapid access to shared digital infrastructure and services, thus delivering economies of scale of up to 20%². The Cloud also guarantees greater resilience, availability and security for outsourced processes.

Definition of the Cloud

Cloud computing is the delivery of IT services and software tools online, rather than on a personal computer or local server, from a network of remote computers (or server farms) hosted on the Internet.

The Cloud refers to the efficient, shared use of remote digital resources by different users with different needs. Cloud customers are thus freed from management efforts and the constraints of acquiring equipment and software thanks to a highly secure, robust environment that is available on demand³. Moreover, customers can benefit from the state-of-the-art skills that they would otherwise have difficulty recruiting in-house.

There are several specific Cloud models, such as *edge computing*⁴ and sector Clouds (industry Cloud platforms)⁵, which address specific user needs.

1 The best-known examples of the Cloud are Amazon Web Services (AWS), Google Drive, Microsoft Azure and Microsoft Office 365.

2 The Cloud can help IT organizations save from 10-20% of their annual IT budget (Cloud Economies: Making the Business Case for Cloud, 2014).

3 Characteristics of the Cloud according to the American National Institute of Standards and Technology (NIST): on-demand self-service, extended accessibility, pooling of resources: which are shared between customers on a dynamic basis: rapid variation in capacity and measurement of the service provided.

4 The Edge Cloud model brings IT resources closer to users, reducing latency and improving performance.

5 The sector Cloud (industry Cloud) offers IT resources specially adapted to regulated sectors such as healthcare or finance meeting particular needs in terms of data, confidentiality and performance.

The Cloud enables organizations to accelerate the pace of digital innovation, improve their productivity⁶ and increase their revenues⁷.

Furthermore, and owing to the services it offers, particularly in the areas of Cloud-based smart mobility services, remote surveillance, automatic access to services and streaming, the Cloud is an essential prerequisite for successful organization of major international events such as the FIFA World Cup. It is therefore in our country's interest to leverage the Cloud in its bid to host the 2026 FIFA tournament.

Although the Cloud is an important pillar in the acceleration of digital transformation, it must be said that our country does not yet have a clear vision in this area.

The present Opinion supplements an earlier study by the Council (2021) titled "Towards a responsible and inclusive digital transformation". A key recommendation of that study was that "national and regional sovereign data centers should be established to enable the State and Moroccan businesses to host their strategic assets (data and applications)".

In this Opinion, the Council focuses on the factors favoring the adoption and use in Morocco of Cloud computing solutions. The aim is to accelerate our country's digital transformation, while ensuring the sovereignty of sensitive and vital data.

The strategic challenges of the Cloud are manifold

Data sovereignty and security

According to the World Economic Forum (WEF), digital sovereignty refers to the ability to control one's digital destiny (data, hardware, software)⁸. The issue of digital sovereignty has emerged as a key concern for policymakers, given that considerable power is now centralized in a small number of technology players, most of them American, known as GAMMA (Google, Amazon, Meta, Microsoft, Apple) and Chinese, known as BATX (Baidu, Alibaba, Tencent, Xiaomi)⁹.

Hyperscale Cloud Providers (hyperscalers)

The largest providers of infrastructure services and platforms in the Cloud are known as "hyperscalers". The four players that dominate the global market with almost 70% are Amazon (AWS), Microsoft (Azure), Google (Google Cloud) and Alibaba (AliCloud)¹⁰.

Hyperscale Cloud providers are characterized by their expertise, their international presence, the scalability of their resources and the diversity of their services. As a result, their Cloud-based solutions address several market segments: SMEs, large enterprises, multinationals, and governments.

6 "Cloud adoption linked to stringer firm performance", MIT Management, June 2022.

7 A study estimates that a 1% increase in Cloud adoption by organizations in Morocco would bring a 0.05% increase in GDP. The Contribution of Cloud to Economic Growth in the Middles East and North Africa, TELECOM ADVISORY SERVICES LLC, May 2023 (https://www.teleadvs.com/wp-content/uploads/MENA_0502023.pdf)

8 <https://www.weforum.org/agenda/2021/03/europe-digital-sovereignty/>

9 The Internet giants are constantly collecting user data (thousands of data points) without users really being aware of it.

10 According to Statista (2023), the top four Cloud players are: Amazon (32%), Microsoft (22%), Google (11%) and Alibaba (4%).

Digital sovereignty rests on two pillars: 1) data sovereignty and 2) technological sovereignty¹¹. The first pillar concerns the geographical location where data is hosted and processed, the people who can access and manipulate this data, and the applicable laws in this case. The second pillar relates to the technological aspect, which consists of controlling the software and hardware. Clearly, given the mechanisms and resources that need to be deployed to ultimately achieve digital sovereignty, it cannot be approached from a binary “all or nothing” perspective.

The laws and regulations governing access to and protection of data, to which organizations and companies are subject, are closely linked to the geographical location where their data is hosted (data residency)¹². Information systems and sensitive data in sectors of vital importance (security, foreign affairs, finance, telecommunications, banking, health, etc.) must comply with data residency legislation¹³.

In addition, it should be noted that some countries establish extraterritorial jurisdictions. These jurisdictions apply to all national service providers and give them the right to supervise data hosted in other countries by these same providers. For example, the US CLOUD Act¹⁴ theoretically allows access to sensitive data belonging to a national agency if it is hosted by a US Cloud service provider.

There is therefore a crucial issue at stake for our country: sensitive data and applications (secrets protected by law, data for the fulfilment of essential State missions) must be located on national soil and administered by Cloud operators subject to Moroccan regulations, so that national laws on cybersecurity and the protection of personal data prevail.

However, exclusive data localization, except for data classified as sensitive, is no longer required in some countries¹⁵. Instead, it makes sense to reinforce security measures such as encryption, anonymization, third-party security audits and compliance with applicable security standards¹⁶. Regardless of the location of the data, a “zero trust” approach should be adopted, consisting of reducing the “implicit trust” placed in the perimeter security model on the users and activities carried out via the entity’s equipment¹⁷.

Definition of “zero trust”

The “zero trust” approach to security is based on the notion that no element of the network can be considered reliable by default, be it terminals, users, or processes. The underlying principle of zero trust is never to place implicit trust, but rather to rely on constant vigilance and ongoing verification mechanisms.

11 <https://atos.net/en/lp/digital-sovereignty-cybersecurity-magazine/what-is-sovereignty-and-why-it-does-matter>.

12 For example: the EU GDPR (General Data Protection Regulation).

13 In Morocco, Law 05-20 stipulates that sensitive data must be in Morocco.

14 It stands for Clarifying Lawful Overseas Use of Data.

15 A case in point is the Qatar Cloud Policy Framework.

16 These standards may include CSA STAR, ISO 22301 (Business continuity management systems), ISO/IEC 27001 (Information security management), ISO/IEC 27701 (Privacy information management), ISO/IEC 27017 (Cloud security), ISO/IEC 27018 (Cloud privacy), ISO/IEC 27035 (Incident reporting), Service Organization Controls Report

“SOC” 1 and 2, Payment Card Industry Data Security Standard (“PCI DSS”) for financial services.

17 <https://www.ssi.gouv.fr/agence/publication/le-modele-zero-trust/>

Resource pooling, economic growth and digital transformation

The main economic challenge of the Cloud is pooling. It is not viable for each public authority or business to have its own IT infrastructure or its own Cloud, given the real operating costs this entails. Hence the importance of investing in shared national Cloud infrastructures to achieve economies of scale¹⁸ that can sometimes be as high as 20%.

The development of the Cloud is accelerating digital transformation, stimulating job creation in a variety of sectors. More specifically, for every job created in the IT sector, an average of 4.3 jobs are created across all sectors of activity¹⁹. The Cloud is a hyper-automated technical infrastructure that does not directly employ large numbers of people.²⁰ On the other hand, this infrastructure is a lever for numerous indirect developments with significant positive spin-offs.

The global Cloud computing market size stood at over USD 405.65 billion in 2021. The market is anticipated to surge from USD 480.04 billion in 2022 to USD 1,712.44 billion by 2029²¹. The global Cloud computing market growth is driven by expanding digital transformation across businesses, rising internet and mobile device (smart phone) adoption worldwide.

The development of the digital infrastructure and ecosystem is likely to generate significant positive economic spin-offs²² and could thus contribute to the ambitious objective of doubling GDP per capita by 2035, as recommended in the vision of reform set out in Morocco's New Development Model (NMD). To elevate Morocco to the status of a digital nation, turn it into a genuine regional hub and boost its economic activity, it is essential to accelerate the development of robust digital infrastructures and foster the emergence of major local cloud-based solution providers.

Developing the use of the Cloud will substantially help the Kingdom to catch up in terms of the digitization of public services²³.

Big data as a springboard for innovation

In general, the acceleration of technological disruptions and the massive use of Big Data, blockchain, the Internet of Things (IoT) and Artificial Intelligence (AI), which are essential to the digitalization of businesses and the transformation of cities into smart cities, should boost demand for Cloud services.

1. These new technologies have become essential in all sectors and in all areas. The gamut of Cloud-based solutions on offer today is quite vast (Fintech, HealthTech, EdTech, AgriTech,

18 The Cloud can help IT organizations save from 10-20% of their annual IT budget (Cloud Economies: Making the Business Case for Cloud, 2014).

19 World Bank MENA Economic Monitor, April 2018.

20 To illustrate this point, Google's data centers in Europe employ some 1,900 persons in ICT, along with 2,400 in local construction and 700 in the green energy industry (Oxford Economics).

21 Source: fortune business Insight <https://www.fortunebusinessinsights.com/Cloud-computing-market-102697>

22 The World Bank's report "The Upside of Digital for the Middle East and North Africa" indicates that "fully digitalizing the economy in the MENA region could increase GDP per capital by at least 46% over 30 years."

23 Morocco's EGD (E-Government Development Index) score, in the UN's E-Government Survey 2022, ranked the country 101st globally among 193 countries. The country has fallen 19 places since 2014 (82nd).

Mobility, R&D, etc.) and the adoption of these innovations, in conjunction with the deployment of Cloud solutions, will enable businesses and administrations to offer greater new services. The development of these services is based on the phenomenal amount of data generated every day by users and systems: by 2025, it is predicted that 200 zettabytes (or 1021 bytes) of data will be stored worldwide, mainly in the Cloud²⁴.

The challenge of sustainability

Globally, the major players in the Cloud computing market are moving towards green data centers to reduce their carbon footprint, given that they consume approximately 1% of the world's electricity²⁵. This means using green electricity from renewable sources to power and cool their facilities. In this way, our country will be able to position itself as a "green" Cloud investment destination, by capitalizing on its strengths in terms of sustainable energies, particularly solar and wind power.

By migrating their infrastructures from an on-premises environment to the Cloud, public authorities and businesses can reduce their energy consumption²⁶ by up to 65%, thanks to the ongoing innovations deployed by Cloud providers and the benefits of pooling their resources²⁷.

Morocco lags in the adoption of Cloud computing

Timid adoption of the Cloud by public authorities and businesses

By 2020, outsourced IT capacity in Morocco, in the form of Cloud computing or hosting in third-party data centers, will account for around 14% of the country's total IT capacity²⁸. This rate remains low compared with that observed in 2018 in different regions of the world: 51% in Asia Pacific, 42% in Russia and 35% in Western Europe.

Although outsourcing is less widespread in Morocco than in other countries, its rate is growing rapidly, at more than 40% per year between 2018 and 2020²⁹:

24 For example, the ChatGPT platform has been "fed" with a large amount of data and uses the Microsoft Azure Cloud to offer its services.

25 <https://www.iea.org/reports/data-centres-and-data-transmission-networks>

26 <https://www.accenture.com/fr-fr/insights/strategy/green-behind-Cloud>

27 The load rate of a local server does not exceed 30%: according to the document "Federal Cloud Computing Strategy" (commonly referred to as "Cloud Smart"), Vivek Kundra U.S. Chief Information Officer, 2011.

28 Two interviews conducted with Morocco's Digital Development Agency (Agence de Développement du Digital) and Morocco's telecommunication operator "Maroc Telecom", respectively in March 2023 and June 2023.

29 Interview conducted in June 2023 with Morocco's leading telecom operator (Maroc Telecom).

Year	On-premise capacity (MW)	On-premise percentage (%)	Outsourced capacity (MW)	Outsourcing percentage (%)	Total capacity (MW)
2014	50	96%	2	4%	52
2018	72	91%	7	9%	79
2019	78	89%	10	11%	88
2020	84	86%	14	14%	98

This low adoption rate is due to a predominant culture and management methods favoring the direct ownership and management of infrastructures and applications in-house (on premise), thus obscuring the effects of pooling, resilience and scalability offered by the Cloud.

This trend, whether the result of deliberate choices or standard management practices, could also highlight certain bottlenecks or obstacles that need to be addressed if the country is to reap the full benefits of the Cloud.

It should also be noted that a large part of the Moroccan Cloud is outsourced to foreign suppliers operating infrastructures outside the country.

In the absence of a national vision of information systems governance centered on the national Cloud, our country is exposed to several risks, starting with the dependence of our businesses and administrations on international Cloud infrastructures³⁰.

In 2020, the national IT outsourcing market was made up of the following three segments³¹:

- The first relates to data center hosting requirements. According to estimates, it has a volume of 3.2 MW³² with an estimated market value of MAD 110 million.
- The second segment deals with the needs of vital and regulated activities, encompassing data of a sensitive or strategic nature. Its IT load is estimated at 0.6 MW, representing a market worth 30 million dirhams.
- The third segment concerns the public Cloud deployed by non-regulated companies and use cases that are sensitive to price variations. This segment accounts for almost 70% of the data outsourced in Morocco. The main players, in order of importance, are AWS, followed by Microsoft and OVH³³. Its volume is estimated at 10 MW, with sales of 200 million dirhams.

³⁰ To illustrate this point, a disastrous fire (March 2021) destroyed a foreign provider's data center on the Strasbourg site revealed that several national platforms offering services to citizens are hosted outside of the Kingdom.

³¹ Interview with INWI (one of Morocco's telecom operators), June 2023.

³² The term "MW" in the context of a data center refers to its total electrical power consumption, which is the equivalent of 1 million watts.

³³ Interview with N+One, April 2023.

A national Cloud offering confined to basic services

Several national providers with data center facilities offer hosting and Cloud-based services³⁴.

It should be emphasized that the national Cloud offering is to a large extent still confined to very basic services (hosting, Infrastructure as a Service and a few examples of frequent applications), without covering the full range of high added-value applications and services (Software as a Service). However, some national Cloud operators do offer value-added services, such as Disaster Recovery as a Service (DRaaS), Backup as a Service (BaaS) and Security as a Service (firewall and DDoS)³⁵.

Main types of Cloud computing services

Three main types of Cloud computing services³⁶ stand out:

- **IaaS** (Infrastructure-as-a-Service): shared access to basic resources (computing, storage, or communication).
- **PaaS** (Platform-as-a-Service): access to a development platform that enables users to write and test IT applications; this mode is primarily intended for developers and programmers (AWS Lambda, Microsoft Azure, Google App Engine, Red Hat OpenShift, etc.).
- **SaaS** (Software-as-a-Service): a complete, operational application that users can access without having to manage the underlying infrastructure (Office 365 or Google Workspace).

The expansion and diversity of these solutions will continue to depend primarily on the increasing pace of digitization of our services for citizens/users, and on a positive shift in the trend towards outsourcing.

According to the stakeholders interviewed for the purposes of this Opinion, the prices of the services offered by national Cloud operators are relatively high. These are generally organizations with a need for “data residency” or sovereignty that resort to them: public and private organizations (infrastructure of vital importance) subject to Law no. 05-20. Some of these organizations are also turning to the creation of their own private Clouds, given that they are obliged to host their sensitive data on national territory.

SMEs or organizations that do not have this “data residency” requirement generally use international Cloud solutions.

³⁴ These include: Inwi, Maroc Telecom, Maroc Data center, N+ One, Atlas Cloud Services (OCP) and Orange-Maroc.

³⁵ Interview with Moroccan Cloud solutions companies, April and June 2023.

³⁶ There are other Cloud service models including FaaS (Functions as a Service). Because the category list of Cloud computing models is endless, the “X-as-a-Service” term is used. It stands for “anything as a service”.

Several factors may explain the slow development of Cloud in Morocco

A limited national market

The culture of Cloud adoption is still lacking, and organizations prefer to keep their information assets on premises (on premise) for better control. Moreover, they are not yet convinced of the benefits of the Cloud in terms of IT cost savings³⁷.

On a national level, the lag in the adoption of national Cloud services obstructs the development of a national market of sufficient size to significantly reduce the production costs of Cloud infrastructures.

Limited access to international market

Despite good Internet connectivity to Europe via several undersea cables, the European market is difficult to address in terms of the Cloud, given the EU's GDPR/RGPD (General Data Protection Regulation) personal data protection rules. It should be noted that the CNDP (French for: National Commission for the Supervision of Personal Data Protection) is currently working on revising Law no. 09-08 on the protection of individuals regarding the processing of personal data, with a view to harmonizing it with the EU's GDPR/RGPD³⁸.

The interconnection with Africa is clearly weak and insufficiently diversified. Our country has only one direct submarine cable with Africa³⁹. This makes it impossible to address the African Cloud market effectively. Bilateral agreements on the free circulation of data with African countries are still lacking, particularly with the countries of West Africa.

Connectivity costs are quite high

To develop their activities, Cloud providers need affordably priced high-quality connectivity (based on fiber optic cables). This will enable them to have access to large bandwidths for both customer access and replicability between their sites to ensure geographical redundancy⁴⁰.

The Cloud companies whom the CESE has interviewed for the purposes of the present Opinion are of the view that the cost of connectivity in Morocco is high⁴¹: the cost of Internet connections is up to 4 times more expensive in Morocco than in Europe⁴². The cost of telecommunications can even exceed the cost of the Cloud service⁴³ for some Cloud solutions.

³⁷ Interview with AUSIM (Association of Information Systems Users in Morocco), April 2023.

³⁸ Interview with Morocco's CNDP (National Commission for the Supervision of Personal Data Protection), March 2023.

³⁹ Maroc Telecom West Africa (<https://www.submarinecablemap.com/>)

⁴⁰ It is possible for a Cloud operator to connect their data center sites via their own fiber optic cables, provided they obtain the necessary authorizations (source: ANRT "Morocco's Telecommunications Regulatory Authority).

⁴¹ Workshop with N+One, Atlas Cloud Services and Maroc Data Center, April 2023.

⁴² Workshop with N+One, Atlas Cloud Services and Maroc Data Center, April 2023.

⁴³ Workshop with N+One, Atlas Cloud Services and Maroc Data Center, April 2023.

Lack of qualified human resources

The Cloud sector, like the rest of the IT market, faces a shortage of human resources, exacerbated by intense international competition, particularly for highly specialized skills. This situation is taking away from the sector's ability to keep pace with its fast-moving atmosphere.

To develop the Cloud in our country, it is crucial to focus on developing human resources. In Morocco, several institutions already offer certification training in cloud computing⁴⁴. However, more initial training programs need to be put in place to support the migration to the Cloud and enable the necessary job profiles in cloud computing to be hired.

In addition to initial training, the range of in-service training for staff (users and development teams), both in the public and private sectors, will have to include modules relating to the adoption of the Cloud, such as the international certifications⁴⁵.

The process for big data classification is slow

Data classification is a prerequisite for deploying the most appropriate Cloud (public or private Cloud).

Main forms of Cloud-based services

The **public cloud and the private cloud** are the two main forms of cloud-based services.

A **public cloud** consists of shared infrastructure and resources provided by an external service provider.

A **private cloud** consists of **dedicated infrastructure and resources** belonging to the cloud user entity. It can be hosted within this entity or by an external service provider, if access is restricted to the entity's own users.

In its report on open data published in 2013, the CESE recommended that data should be classified so that it could be grouped according to its level of sensitivity, its owners and the various levels of authorized access could be determined, and it should be made easier to share.

It was in 2020 that Article 5 of Law no. 05-20 on cybersecurity required data to be classified according to its level of sensitivity, integrity, and availability. Its implementing decree, published in 2021, defined four levels of sensitivity ("top secret", "secret", "confidential" and "restricted distribution").

44 For example: Specialized Digital Infrastructure Technician Diploma (major in Cloud computing) from Moroccan Office of Professional Training (OFPPT); professional degree network and Cloud computing (Ain Chock Science College); Bachelor of Science in Cloud and Mobile Software Design and Development (Al-Akhwayn University); MS from INPT (National Institute of Posts and Telecommunications) in Web Technologies and Cloud Infrastructure Development.

45 A case in point is Amazon Web Services certification, Microsoft Azure certification, Google Cloud certification, etc.

The need in Morocco to adopt a Cloud plan of action as part of its in-progress digital transition strategy

From this diagnosis and based on international experiences⁴⁶, the CESE calls for the Cloud to be given prior attention in the digital transition strategy currently being finalized by the Ministry for Digital Transition and Administrative Reform.

To achieve this, it is recommended that a “Cloud-first” action plan be urgently developed to harness the Cloud toward accelerated digital transformation and to ensure data sovereignty.

Morocco may need to establish a special commission with all relevant stakeholders to deliver to this task. The commission shall be steered by the Ministry attached to the Head of Government in Charge of Digital Transition and Administrative Reform, with the close collaboration of key public and private sector stakeholders to provide the required expertise and roll out the action plan identified nationally⁴⁷. The ADD (Digital Development Agency) could be tasked with implementing this plan.

The overarching ambition is to position our country as a leading regional player in Cloud services. The goal is to establish ourselves as a continental “data embassy”, offering advanced Cloud services while ensuring that national players are involved.

A series of recommendations have been put forward to this end.

Reinforcing the national Cloud offering

1. **Encourage the entry, into the Moroccan technology space, of global and/or international Cloud players (hyperscalers)**, such as through:
 - Introducing incentive measures on aspects relating to their areas of activity (telecoms service tariffs, data privacy, cybersecurity, renewable energies, land, etc.).
 - Developing competitive fiber-optic solutions tailored to the needs of these operators. To this end, the ANRT should provide regulatory levers aimed at diversifying the solutions offered, guaranteeing quality of service and reducing costs.

⁴⁶ Annex 3: International benchmarking.

⁴⁷ Sitting in this commission should be the Department of Economy and Finance; the Department of Investment, Convergence and Evaluation of Public Policies; the Department of Energy Transition and Sustainable Development; the National Defense Administration; the General Directorate of Information Systems Security (for French DGSSI); the Department of the Interior; the Digital Development Agency (for French ADD); the National Telecommunications Regulatory Agency (for French: ANRT); the National Commission for the Supervision of Personal Data Protection (for French: CNDP); the CGEM (French for: Morocco’s Business Confederation); Moroccan Federation of Information Technology, Telecommunications and Offshoring (formerly known as the Association of Computer Equipment and Office Automation Professionals “APEBI”); AUSIM (Association of Information Systems Users in Morocco) and all relevant entities from the public and private sectors.

How to facilitate the entry, into the Moroccan space, of Cloud hyperscalers?

It has been shown that building a hyperscale cloud computing infrastructure has the potential to significantly increase the size of the information technology (IT) market. In Morocco's case, attracting hyperscale cloud providers or engaging hyperscale challengers⁴⁸ could serve as an essential catalyst for the growth of digital services exports, along the lines of the successes achieved in the automotive sector with the Renault group and in the aerospace sector with Safran.

Generally, hyperscalers operate in countries with a high GDP or a proactive digital development policy. Currently, in Africa, only South Africa has several campuses of hyperscale cloud providers on its land. However, Kenya was another African country where Amazon had announced its global expansion⁴⁹.

The minimum size a hyperscale region spans would be roughly equivalent to half of Morocco's total computing capacity. It is therefore imperative to adopt a regional perspective to seize the opportunity to host hyperscale cloud providers (hyperscalers).

The following factors have been assessed as main criteria for the entry, into the Moroccan space, of hyperscale Cloud providers:

- **The market:** Morocco should commit to providing realistic market size forecasts regarding demand (public, private, regional) for cloud computing, while offering tax incentives, are key market-related factors⁵⁰.
- **Data privacy:** Morocco may need to develop a cloud-specific regulatory framework, such as regards data confidentiality. The aim is to help increase the Moroccan data center market's growth potential.
- **Connectivity:** a reliable, low-latency national fiber optic infrastructure, a diversity of international submarine cables and accelerated deployment of Internet Exchange Points (IXPs) are essential.
- **Renewable energies:** hyperscale cloud providers are constantly striving for carbon neutrality, which is why it is so important to provide them with renewable energy sources such as solar, wind and hydro power.
- **Land:** the availability of suitable land for the construction of data centers, which require several hectares for each site.

It is therefore necessary to consider specific support measures for hyperscalers, like the targeted offers developed in the offshoring sector a few years ago. Synergies and partnerships between public and private players may prove necessary to create the framework and infrastructure needed to meet the demand of one or more hyperscalers.

48 Apart from the top 3 (Amazon, Microsoft and Google), there are also Alibaba, IBM, Oracle, Tencent, Huawei, etc.

49 <https://dev.to/aws-builders/aws-plans-to-launch-local-zones-in-nairobi-johannesburg-what-does-it-mean-3bg8>

50 Based on the interview (March 2023) with the Digital Development Agency (ADD), the data center market size and the clarity of the legal framework are major criteria for hyperscale cloud providers to .

There are several possible solutions for building a hyperscale computing infrastructure, thus enabling our country to ensure data sovereignty by providing government with the means to prevent unvetted access by foreign contractors through data disclosure orders for data stored within an overseas jurisdiction that has conflicting privacy laws:

Put in place a national institution to partner with hyperscale cloud provider(s) to deliver cloud options and solutions to ensure the interests of both parties, while maintaining control over access to the data.

- Create a zone dedicated to sovereign needs: this zone within the hyperscale region could be set up through data processing agreements with hyperscale cloud entities to guarantee data sovereignty, while providing solutions to optimize data security solutions with the supervision of a national data protection entity.
- Whatever the scenario, it is essential to consider certain fundamental principles for the smooth adoption of the Cloud:
- Avoid relying on a single Cloud provider: this helps prevent the cloud user from being exposed to the “lock-in” phenomenon.
- Explore hybrid and multi-Cloud patterns to diversify solutions and maximize flexibility.
- Favor open-source technologies: particularly for sensitive applications and for the continuity of public services.

2. **Put in place a sovereign Cloud-based solution** (public or private)⁵¹ for vital and sensitive applications and data operated by a Moroccan-law-governed entity or by a hyperscale cloud provider based in Morocco, using technological solutions that ensure compliance with data sovereignty requirements.
3. **Introduce specifications to be complied with by Cloud service providers** depending on the type of information processed and create a “trusted Cloud provider” label to be awarded by the DGSSI (Morocco’s General Directorate for Information Systems Security).
4. **Set up a centralized “marketplace”** enabling government bodies to meet their needs in terms of cloud resources and services offered by “trusted Cloud providers” in accordance with predefined SLAs (service level agreements).
5. **Encourage, wherever possible, the use of green energy and promote decarbonized data centers on both a national and territorial scales** (edge data centers) in locations that are suitable in terms of climatic conditions⁵² and proximity to renewable energy sources, while putting in place the necessary transmission infrastructures (fiber optic cables).

⁵¹ The sovereign Cloud is an infrastructure that is physically located and operated within the national borders of a country and complies with local regulations, standards and laws. It is generally used to store and manage sensitive and vital data. Physical access to the data is limited to the national territory.

⁵² The town of Dakhla could serve as a location thanks to its assets (geographical position, favorable climate, renewable energy potential and availability of land).

Towards an efficient adoption of the Cloud by public and private sectors

6. **Prioritize the use of the Cloud for all new government information systems** projects on a national scale and support administrations in migrating their existing systems to the Cloud.
7. **Encourage and sensitize the private sector to invest in and adopt the Cloud.** This role should be played by the relevant government authorities and by professional associations such as APEBI and AUSIM.
8. **Support VSEs/SMEs wishing to adopt the Cloud,** while offering financial incentives to Cloud-using companies.

Developing an innovative Cloud ecosystem (public and private)

9. **Develop local skills in Cloud professions,** by combining the efforts of universities, vocational training and digital service providers.
10. **Promote a national ecosystem of start-ups that can take advantage of Cloud technology (IaaS, PaaS and SaaS),** while integrating academic, economic and industrial systems in research and development in the field of Cloud and data.

Establishing a regulatory framework for cloud computing

11. **Adapt public procurement procedures for the acquisition of cloud** solutions by public administrations, given that these involve recurring costs (subscriptions) on demand.
12. **Strengthen the regulatory framework for the protection of personal data to keep pace with the rapid adoption of the cloud. This can be achieved by:**

Revising the law on the protection of personal data to bring it into line with the EU General Data Protection Regulation (GDPR).

Implementing the data classification project as provided for in Law no.05-20 and its implementing decree.

Establishing a specific legal framework to enable better classification and processing of data from certain specific sectors such as health and finance.

Annexes

Annex 1: List of members of Standing Committee of Knowledge and Information Society

Chair	Ahmed Abbadi
Rapporteur for the topic	Abdallah Deguig
Members	Abdelaziz Adnane Nabil Hikmet Ayouch Ahmed Bahanniss Mustafa Benhamza Tahar Benjelloun Mohammed Benkaddour Latifa Benwakrim Amine Mounir Alaoui Laila Berbich Ali Bouzaachane Albert Sasson Lahcen Hansali Armand Hatchuel Abdelaziz Iouy Mustapha Khlafa Meriem Bensalah Chaqroun Saâd Sefrioui Mohamed Wakrim Hajbouha Zoubeir Othman Benjelloun Idriss Ilali Jamaa El Moatassim
Council's Permanent Expert	Mohamed Amine Charar
Council's Permanent Translation Experts	Adel Gaiz Nadia Ourhiati

Annex 2: List of Institutions and Stakeholders Interviewed

Government Department	<ul style="list-style-type: none"> • Ministry of Digital Transition and Administrative Reform
National and public-sector institutions	<ul style="list-style-type: none"> • Digital Development Agency (ADD) • National Telecommunications Regulatory Agency (ANRT) • High Commission for Planning (HCP) • Mohammed VI Polytechnic University (UM6P) – Digital Innovation Centre of Excellence • National Control Commission for the Protection of Personal Data (CNDP)
Trade associations and organisations	<ul style="list-style-type: none"> • Moroccan Federation of Information Technology, Telecommunications and Offshoring (formerly known as the Association of Computer Equipment and Office Automation Professionals “APEBI”) • Association of Information Systems Users in Morocco (AUSIM)
International businesses	<ul style="list-style-type: none"> • Huawei • G42 Group • Microsoft
National businesses	<ul style="list-style-type: none"> • N+One • Atlas Cloud Services • Maroc Data center • Maroc Telecom • Orange Maroc • Inwi
National and international experts	<ul style="list-style-type: none"> • Abderahman Mounir, CEO of Orunix, Morocco • Louis Naugès, CEO of Dhasel Innovation and Chief Strategy Officer of Wizy.io, France • Ali Salhi, Chief Technical Officer of LOOP, Google Cloud Certified Fellow, USA • Zouheir Lakhdissi, CEO of Dial Technologies, Morocco • Karim Regragui, Managing Director of PMP Strategy Africa Middle East, Morocco

Annex 3: International benchmarking

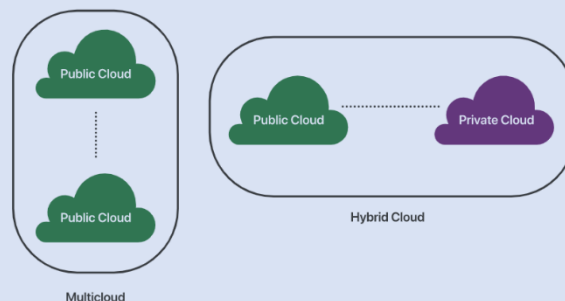
One thing has become clear: the world countries have endeavored each to develop strategies tailored to their own context, but all have a common objective: namely, to promote Cloud adoption.

The US and the UK’s “Cloud-First” Policy

The “Federal Cloud Computing Strategy”⁵³, published in 2011 by the US government, introduced a “Cloud first” approach that requires federal agencies to evaluate Cloud options before making new investments in IT infrastructure. This strategy aims to optimize the costs of acquiring and maintaining IT infrastructure and to improve the agility of the various federal agencies, by reducing the time taken to deliver citizen Cloud services. The “Cloud first” policy has had a significant impact on the rate of adoption of Cloud services, with around half of US government organizations actively using these services in 2018⁵⁴. The Cloud Smart strategy published in 2018 defined the pillars of successful Cloud adoption as: workforce, security and procurement⁵⁵. The Cloud Smart strategy also recognizes that a mixed approach (hybrid Cloud combining private and public Cloud) could be effective and efficient in improving services and delivery.

Public Cloud, private Cloud, multi-Cloud and hybrid Cloud

1. The most common Cloud computing solution is the public Cloud, in which all the hardware, software and infrastructure belong to the Cloud service provider (Amazon, Microsoft, Google, etc.).
1. A private Cloud, on the other hand, is a service that is entirely controlled by a single organization, for its own needs, and is not shared with other entities.
1. Hybrid Cloud includes two or more types of Cloud environments (public or private).
1. Multi-Cloud refers to several Clouds of the same type (public or private) from different suppliers.



Source: Cloudflare

53 “Federal Cloud Computing Strategy”, Vivek Kundra U.S. Chief Information Officer, 2011.

54 <https://www.gartner.com/smarterwithgartner/understanding-Cloud-adoption-in-government>

55 <https://Cloud.cio.gov/strategy/>

In 2013, the UK also introduced a “Cloud first” policy to drive government adoption of the Cloud (or G-Cloud). To this end, the UK government set up a marketplace linking government bodies with national and international Cloud service providers. This approach has led to a significant increase in the proportion of government departments that have adopted the Cloud⁵⁶.

The GAIA-X initiative to strengthen Europe’s digital sovereignty

Being aware that they are lagging the world’s powerful Cloud players, mainly American and Chinese, European countries have resolutely embarked on a strategy for catching up. In 2020, the French President acknowledged that the battle for the Cloud had been lost by Europeans and that it was necessary to relaunch it.

The countries of Europe have signed up to the GAIA-X Cloud plan, launched in 2020 by 22 German and French players with a view to strengthening European digital sovereignty. The GAIA-X initiative currently counts over 300 members, most of them Europeans. Its members also include American and Chinese players.

The “Cloud at the center” policy of the French State’s drive toward digital transformation

France has unveiled its “national Cloud strategy” for 2021, adopting the “Cloud at the center” doctrine. This strategy mobilizes public-private-European funding worth €1.8 billion over 4 years. Guided by the “Cloud at the center” doctrine, France is making the Cloud the default hosting and delivery mode for the State’s digital services. Government departments can choose to host their services in the State’s two internal Clouds (operated by the Directorate General of Public Finance and the Ministry of the Interior) or opt for a Cloud offered by the private sector, if it meets rigorous security criteria.⁵⁷ This is why the “trusted Cloud” (SecNumCloud label) was launched.

In addition to national Cloud players, some French players have joined forces with international players to set up trusted Clouds⁵⁸. The shareholding structure of these projects and the fact that the data centers are in France means that the country is “immune” to the constraints imposed by extraterritorial legislation such as the US CLOUD Act. For example, Thales has set up S3NS, a French company wholly owned by Thales, in partnership with Google Cloud, with the aim of meeting regulatory requirements in terms of sovereignty⁵⁹.

SecNumCloud-certified Cloud services cover both IaaS infrastructure (OVH, Cloud Temple, Outscale, Worldline) and SaaS software (Oodrive)⁶⁰. The French government has also launched a call for projects on “Cloud-based collaborative office suites”, with the aim of developing national solutions⁶¹. But with the budget allocated (€23 million) spread over three projects, it seems difficult to compete with Microsoft 365 and Google Workspace and offer a viable alternative to these two American giants.

56 In 2010, only 38% of the UK public sector had officially adopted at least one Cloud service. By 2017, this had more than doubled to 88%.

57 <https://www.numerique.gouv.fr/services/Cloud/doctrine/>

58 For example: Thalès partnership with Google Cloud and the “Blue” partnership between Orange, Microsoft and Capgemini.

59 https://www.thalesgroup.com/en/group/press_release/thales-introduces-s3ns-partnership-google-cloud-and-unveils-its-offering-first

60 <https://www.ssi.gouv.fr/uploads/liste-produits-et-services-qualifies.pdf>

61 - <https://www.bpifrance.fr/nos-appels-a-projets-concours/appel-a-projets-developpement-de-suites-bureautiques-Cloud-de-travail-collaboratif>

South Africa: attraction of Cloud hyperscalers and government Cloud

South Africa is undisputedly the top leader in Cloud computing on the continent. It is the only country so far to have succeeded in attracting hyperscale cloud providers such as Amazon, Microsoft, Oracle and Huawei. In addition to its level of economic development and the degree of its digital transformation, South Africa has a major advantage: it is one of the countries with the most connectivity via undersea cables on the continent.

Also significant, the country has the largest data center operator in Africa (Teraco Data Environment) which covers 7 locations and offers a capacity of more than 110 MW.

As far as the public sector is concerned, the South African government, through the State Information Technology Agency, launched the implementation of a government Cloud in 2018 by partnering with Huawei as well as IBM.

The Cloud and artificial intelligence at the heart of development strategies in the Gulf States

The Kingdom of Bahrain was among the first countries in the MENA region to adopt a Cloud first policy in 2017. This favorable climate for the Cloud led Amazon Web Services (AWS) to choose the Kingdom as the location (in 2019) for its first data centers in the region. Bahrain's "Cloud First" policy has proved extremely beneficial, given the many advantages it has brought. It has enabled the migration to the Cloud of more than 70% of the operations and systems of 72 government entities (birth in the Cloud for new entities), and the complete migration of 32 public and private organizations in 2021. The Cloud first policy has also resulted in a 60% reduction in the time needed to prepare the technical infrastructure for projects, and a 60-80% reduction in operational expenditure⁶².

As part of its national AI strategy, the United Arab Emirates (U.A.E.) aims to improve the competitiveness of priority sectors of the economy thanks to the gains brought about by AI. According to some studies, AI could contribute up to 14% of the UAE's GDP by 2030. To achieve these ambitions, the UAE has launched Group 42 (G42), an artificial intelligence and Cloud company focused on developing government services: health, finance, oil and gas, aviation and hospitality. G42 has one of the largest data centers in the region, with a capacity of over 300MW. Through the IIAI institute, G42 is actively involved in scientific research in the field of artificial intelligence in partnership with Emirati and international universities.

Saudi Arabia's Vision 2030 also aims to accelerate the country's digital transformation. The country has adopted a "Cloud first" policy aimed at encouraging government bodies to opt for the government Cloud (G-Cloud) instead of developing their own Cloud (private Cloud) paradigms. As far as the public Cloud is concerned, Saudi operators (STC, ARAMCO) have joined forces with leading international players⁶³.

62 - <https://www.bna.bh/en/iGACEOBahraingovernmenthassuccessfullyadoptedCloudFirstpolicy.aspx?cms=q8FmFJgiscL2fwlzON1%2BDs-za1Y%2Fkue9jMtMR3lk55ms%3D#:~:text=AI%20Qaed%2said%20that%20the,to%20further%20improve%20government%20processes.>

63 - Like Alibaba Cloud and Google Cloud.

Initiatives to set up government data centers in certain West African countries

In Senegal, as part of the “Smart Senegal” programme, the State’s information agency (ADIE) has set up a data center in Diamniadio, which, according to official guidelines⁶⁴, will host all the data and platforms of all the State’s structures.

For its part, Cape Verde (or Cabo Verde) has a cloud national data center (NOSI) that provides cloud-based information services⁶⁵ across many business disciplines (social security, electronic elections, budget management, distance learning and healthcare, etc.) not only for the government, enterprises and institutions of Cape Verde, but also the surrounding countries.

64 - Website of Senegal’s state information agency (ADIE).

65 - Cape Verde is ranked 4th in Africa in terms of the development of ICT services according to the ICT Development Index (IDI), 2017.

Conseil Economique, Social et Environnemental

1, angle rues Al Michmich et Addalbout, Secteur 10, Groupe 5
Hay Riad , 10 100 - Rabat - Maroc

Tél. : +212 (0) 538 01 03 00 Fax +212 (0) 538 01 03 50

Email : contact@cese.ma