Cloud computing in Latin America
Current situation and policy proposals

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Economic Commission for Latin America and the Caribbean (ECLAC)

Content

Introduction

Cloud computing is not a stand-alone technology, but rather a mix of a large set of various technologies. Although based upon previous trajectories, recent progress in virtualization, storage, connectivity and processing have come together to create a new ecosystem. The result is a new paradigm extremely attractive from an economic perspective due to its capability to combine cost saving with increased flexibility to manage the ICT needs of firms. The main characteristics of cloud computing are as follows:

- *High degree of abstraction of the user from the physical and technological characteristics of hardware* and other related ICT infrastructure.

- *Easily adaptable*: its use and cost can be adjusted to demand changes without specific contracts or penalties.

- *Multitenancy:* cloud architecture allows firms to access ICT infrastructure while ensuring privacy and security.

- *Pay-per-use:* user cost varies based on actual consumption.

The three main cloud computing services are software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS). Moreover, Gartner identified a fourth type, referred to as business process as a service (BPaaS), which includes business process outsourcing (BPO) based in the cloud and geared toward multiple users. Some of the most significant benefits of moving the management of business processes to the cloud are:

- *Cost reduction*: users do not need to purchase or maintain servers to run their business.

- *Use of the pay-as-you-go model.*

- *Increased mobility*: technological solutions can be used from any location or device, which allows for faster firm growth and diversification.

- • *Scalability*: firms can expand without incurring increased infrastructure costs.

I. Cloud computing in Latin America

In most Latin American countries, there is scarce public information on cloud adoption and, when available, it is seldom organized and often the result of third party estimates.

The *public* cloud is the model of cloud computing with the greatest presence in the region, thus we must study its dynamics to evaluate the economic impact of its adoption. Other cloud models (private, community and hybrid) carry less weight.

World revenue derived from public cloud services would total 200 billion dollars in 2016, 75% of which consists of BPaaS, including cloud advertizing. Most revenue would be generated in Western Europe and North America (table 1). However, other areas, such as Latin America, continental China and Asia-Pacific would present the highest growth rates. The share of Latin America in public cloud services is about 5% of the world total, less than its share of global GDP. Nevertheless, its projected annual growth rate, approximately 26%, would imply that such services will be adopted at a faster rate than in Europe or Asia-Pacific. As in the rest of world, SaaS and BPaaS, including cloud advertizing, are the most demanded cloud services.

Information on data center workloads in the cloud at the regional level reaffirms the expected dynamism of cloud computing in Latin America (table 2). This variable would grow from 0.7 million in 2011 to 7.2 million by 2016, with a CAGR of 60%.

Brazil is the country in Latin America with the greatest revenues from cloud services (figure 1). Those revenues are expected to increase significantly between 2012 and 2016, as is also expected for Mexico and Argentina. However, the most dynamic countries, among those analyzed in Latin America, would be Colombia and Chile, where figures are expected to triple within the same time frame.

TABLE 1
PUBLIC CLOUD REVENUE BY REGIONS, 2011, 2014 AND 2016
(In billion dollars and percentages)

| Region	2011	2014 (estimate)	2016 (estimate)	CAGR 2011-2016 (percentages)
Latin America	**2.4**	**4.7**	**7.6**	**26.4**
Argentina	0.2	0.4	0.6	28.5
Brazil	1.4	2.7	4.4	25.0
Mexico	0.6	1.1	1.8	26.0
Other	0.2	0.5	0.8	26.0
Eastern Europe	0.4	0.7	1.1	22.2
Asia – Pacific, emergent	0.4	0.9	1.5	31.8
Eurasia	0.6	1.4	2.0	25.9
China, continental	3.0	7.1	11.2	30.0
Asia – Pacific, developed	8.9	14.0	17.5	14.3
North Africa and Middle East	0.3	0.6	0.9	21.5
North America	50.8	89.8	125.4	19.1
Sub-Saharan Africa	0.2	0.3	0.5	19.6
Western Europe	24.3	34.1	42.5	11.8

Source: Gartner.

TABLE 2
DATA CENTER WORKLOADS IN THE CLOUD, 2011, 2014 AND 2016
(In million units and percentages)

| Region	2011	2014 (estimate)	2016 (estimate)	CAGR 2011-2016 (porcentajes)
Latin America	**0.7**	**3.3**	**7.2**	**60**
Asia – Pacific	6.7	23.2	40.6	43
Central and Eastern Europe	0.7	2.5	5.0	50
Middle East and Africa	0.3	1.5	4.2	73
North America	8.1	21.0	29.7	30
Western Europe	4.9	16.2	25.4	39

Source: Cisco Systems.

FIGURE 1
CLOUD COMPUTING REVENUE IN LATIN AMERICA, 2012 AND 2016
(In millions of dollars)
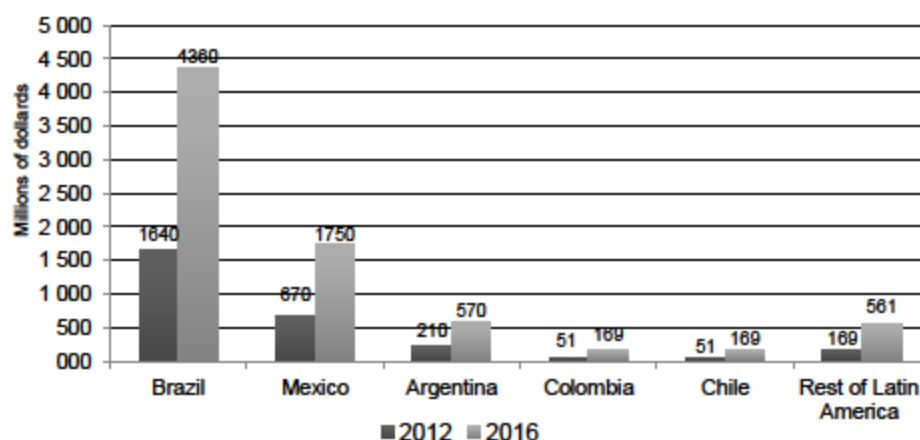
Source: Gartner.

Cloud computing is a global priority: 34% of ICT budgets were allocated to this technology in 2012. This share represents a significant increase compared to 2010. In Latin America in 2012, 46% of ICT budgets were also allocated to cloud computing, well above the global and other regional averages (figure 2).

FIGURE 2
ICT BUDGETS ALLOCATED TO CLOUD COMPUTING, 2010 AND 2012
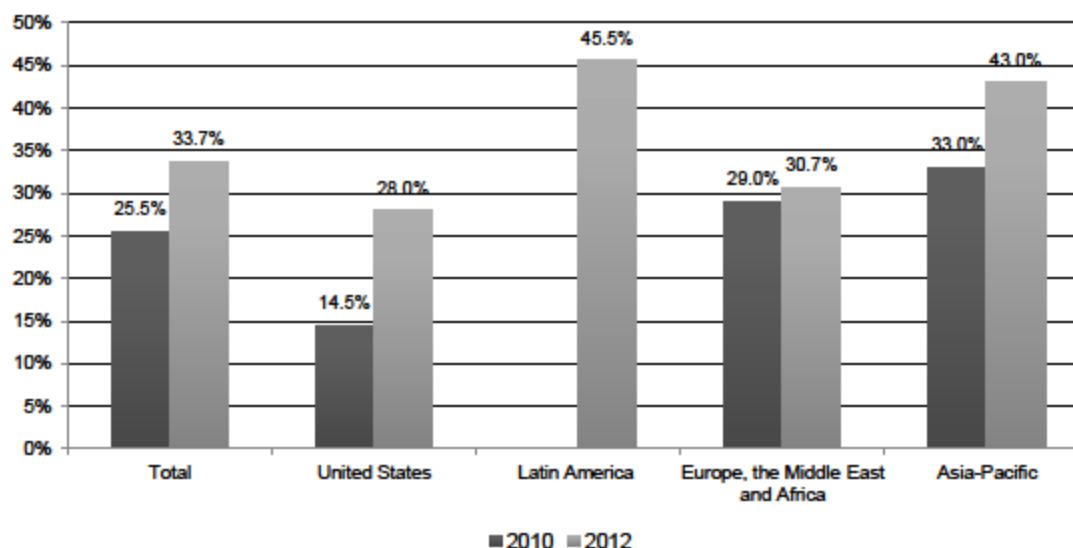
Source: *VMware Cloud Adoption Study 2012*, May 2012, VMware, Inc.

As for the European Union, the potential impact of massive cloud computing diffusion on the creation of new firms in Latin America has also been estimated, particularly for SMEs. A large reduction of ICT fixed costs for the installation of new firms reduces barriers to entry and increases the number of firms in the market, which would have positive impacts on job creation. A recent analysis focusing on Brazil and Argentina shows strong effects on both SME and job creation (table 3).

TABLE 3
CLOUD COMPUTING IMPACT ON FIRM AND JOB CREATION

	In 5 years		In 10 years	
	Firms	Employment	Firms	Employment
Argentina	24 700	117 300	30 300	128 900
Brazil	202 100	861 000	402 650	945 000

Source: F. Etro and A. Colciago, Cloud computing, structural change and job creation in SMEs, ECLAC, 2013.

Despite the potential advantages, an index elaborated by Pyramid Research shows that many countries in the region are not prepared to operate business services in the cloud (figure 3). Even Argentina, the highest ranked country in the region, barely surpasses half the maximum score attainable (4.1 of 7).

FIGURE 3
INDEX OF READINESS FOR BUSINESS SERVICES IN THE CLOUD, 2013
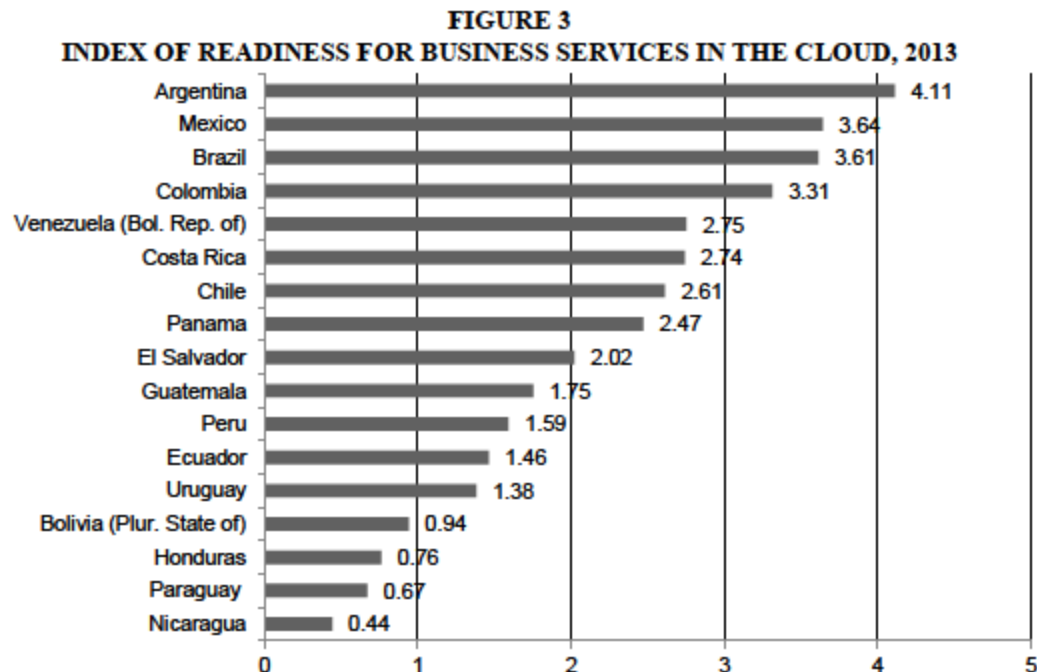
Source: Pyramid Research.

Brazil, as reflected by its National Software and IT Service Plan, has shown great interest in cloud computing development, based on the implementation of the following points:

- Incentives to attract large regional data centers.

- Support for the creation or modernization of personal data protection and privacy law.

- Development of standards and interoperability solutions in the cloud for government use, recognizing technological neutrality and supplier independence.

- Large investments in research, development and innovation of cloud services (IaaS, SaaS) to produce *hardware* y *software* technologies that increase process efficiency, and guarantee security and environmental sustainability.

- A program to strengthen human resource capabilities in technical areas required by cloud computing, e.g. virtualization, storage, analytics, security and new architectures.

- Regulatory harmonization of the international transfer of data to allow secure movement of personal data through the net.

Although cloud penetration in Colombia is relatively low (only one fourth of large firms operate in the cloud), Frost & Sullivan found that more than 75% of the firms interviewed invested in cloud services in 2011 and 2012.

From a different perspective, the Instituto Mexicano para la Competitividad (IMCO) estimated that the Mexican government could save up to 1,7% of GDP if all its entities (departments, agencies, etc.) move their operations to the cloud. The lack of standards and the complexity of domestic and international privacy issues pose challenges to both the public and private sectors in Mexico, as well as in other countries.

Although cloud computing is a relatively new topic in Costa Rica, firms are increasingly using its services, with SaaS being the most used service (57%), followed by IaaS (25%) and PaaS (18%).

Lastly, regarding cloud service providers, the Latin American situation is similar to the rest of the world where 85% of the market is controlled by US-based corporations, particularly Google, Amazon and Microsoft. Table 4 demonstrates the dominance of US providers in the region; only one European firm (SAP) ranks among the 9 service providers preferred by Latin American firms.

TABLE 4
PREFERRED CLOUD COMPUTING PROVIDERS IN LATIN AMERICA, 2010

Firm	Headquarters
IBM	Armonk, NY
Microsoft	Redmond, WA
Google	Mountain View, CA
HP	Palo Alto, CA
Salesforce	San Francisco, CA
Oracle	Redwood, CA
Unisys	Blue Bell, PA
Amazon	Seattle, WA
SAP	Walldorf, Baden-Württemberg

Source: Frost & Sullivan.
Note: Providers listed in order of preference of interviewed firms.

II. Obstacles

The expansion of cloud computing in Latin America faces several constraints:

- *Limited access to and low quality of broadband internet*. Fixed or mobile broadband penetration is very low in some countries, such as Honduras, Nicaragua, Paraguay, Guatemala and the Plurinational State of Bolivia. Countries with higher penetration rates (e.g., Chile, Brazil and Uruguay) have better chances to successfully migrate services to the cloud. Even in cases where the adoption of cloud computing services is viable from a technological standpoint, its diffusion may be hindered by uncertainty in the legal framework or inadequate regulation systems.

- *Weak legal and regulatory frameworks*. These frameworks are frequently absent in many countries, and, in the few cases where they do exist, are clearly insufficient. As for regulation, according to the Business Software Alliance, Mexico and Argentina present above average qualifications (similar to those of India and Turkey) in a group of 12 countries analyzed, while Brazil ranks 9th within the same group. A particularly troubling aspect is the minimal attention paid to fiscal norms, from both the provider and user perspectives. Server location among different countries may eventually have strong fiscal consequences which have not yet been perceived by cloud users and providers.

- *Incomplete service level agreements* (SLA). As long as service providers do not offer SLAs which duly include considerations about security and portability, many firms would be reluctant to fully migrate to the cloud. The main points SLAs should cover are service adaptability, system security and latency, service reliability, data security (including backups), compliance with existing laws (e.g., governing data protection), data migration and standardization, and technical support to customers.

- *Limited privacy and security*. Security is the main concern faced by many firms considering cloud migration, and it is related to the following risk areas: i) external data storage, ii) dependency upon public internet, iii) multi-tenancy, and iv) lack of integration with internal security systems. With regard to law, policies and rules on personal data protection in the cloud, many countries in the region have standards with are on par with those put in place in Europe; although not perfect and with room for improvement, they are able to provide adequate protection.

In accordance with the priorities outlined by the World Economic Forum for the expansion of cloud computing, industry and governments should:

- Explore and facilitate reaping the benefits presented by this technology.

- Advance in the understanding and management of the related risks.

- Promote service transparency.

- Clarify and improve accountability of all stakeholders.

- Ensure data portability.

- Facilitate interoperability among platforms and services (standard APIs).

- Accelerate the modernization and harmonization of regulatory frameworks.

- Provide sufficient network access and capacity.

To seize the opportunities offered by cloud computing, governments and industry must face two key political, legal and regulatory challenges: protection of users' interests and promotion of access and investment in networks. In the first field, they should i) protect privacy and stored data, fostering transparency of security practices, ii) prevent conflicts over privacy and data security, iii) protect free speech, iv) ensure data portability, and v) guarantee users' security in the cloud. In the second, they must: i) ensure that the communication infrastructure is cloud ready, ii) foster innovation in services through the protection of intellectual property rights, and iii) adequately manage government procurement policies.

III. Recommendations

Based on these considerations, we propose the following recommendations for the promotion of cloud computing in Latin America.

Given that one of the main problems is access to reliable structured information on cloud computing development and adoption, **we suggest the creation of a regional information center** which enables governments, firms and users access to such information.

To the extent that a uniform and adequate regulatory framework is necessary to promote cloud computing dissemination, **we propose a high level regional dialogue** aimed at reaching and implementing multilateral agreements on the following issues:

- Incentives for fixed and mobile broadband deployment, as well as to attract large regional data centers.
- Regulation modernization and harmonization, including SLAs and cloud network standards.
- Creation or update of legal frameworks for personal data protection and privacy, paying attention to data security.
- Harmonization of international data transfer regulations in order to facilitate secure personal data transfers between countries.
- Ensure interoperability between cloud solutions for government use, recognizing technological neutrality and the independence of suppliers.
- Alternatives to promote government services in the cloud as a drive for cloud computing expansion.

Lastly, **regarding trade-offs among privacy and security**, a prevalent topic since mid-2013, **two approaches may be explored:**

- *A multilateral agreement.* This alternative would imply that governments seek a agreement in the form of a treaty or similar legal instrument. Although this option will require diplomatic leadership and significant resources, it offers the best hope for coherently facing governments' security concerns, and guaranteeing that firm and user interests are properly taken into account on a global scale.

- *Bilateral commitments.* This less ambitious option implies that governments independently undertake consensus building on procedures for the prevention or the resolution of privacy-security conflicts.