DIGITAL ECONOMY

Development of the cloud computing industry: impacts and transformations in progress

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1 The “cloud computing” industry

Introduction

“Cloud computing” is a term that encompasses the evolution of several aspects related to information technologies, telecommunication networks and advances in microprocessors, the most significant being *virtualisation or hardware abstraction*. Virtualisation software enables running an application concurrently on several remote machines, and the concurrent sharing of system hardware resources (CPU, RAM, network adapters, etc.) by different applications and operating systems. Thus, by making the hardware independent of the software it runs, ***it provides ubiquitous, on-demand access to a shared set of configurable computing resources.***

This transformation in the use of hardware resources allows the provision of technology through the internet in **service mode,** similarly to how power and telephony are supplied. The analogy with power plants is highly illustrative in understanding the cloud concept: in response to the production of electricity in and of itself, which requires an enormous investment to meet a generally irregular demand, public power stations aggregate the needs of different clients and optimise the use of their facilities. Thus, faced with the need to acquire computer systems for in-house use, those systems can be accessed through a simple internet connection.

The NIST (National Institute of Standards and Technology) defines three cloud service models as a function of the technology layer provided and, therefore, of the diverse type of control the end user has on the technology infrastructure:

- **IaaS (Infrastructure as a Service)**: The provision of hardware systems, such as access to servers, computing power, storage systems, communication devices, etc. The user has total control over operating systems, applications, databases, etc., that run on the supplied hardware. One example of this model is the services provided by Amazon and Microsoft Azure, which can be used to run algorithms and batch processes, which require high computing power.
- **PaaS (Platform as a Service):** This model provides a development environment in which programmers can create, test and/or run their applications. In addition to languages, libraries and other programming tools, the required run-time IaaS infrastructure is also provided. The end user has control over their applications and, in many cases, over the environment setup. An example of this type of service is Google App Engine, which allows creating and storing webpages on Google infrastructure.
- **SaaS (Software as a Service):** Also in service mode, enables offering end user applications that are stored and run on a provider-controlled physical and application infrastructure. The technology used to provide the service (CPU, RAM, operating system, databases, etc.) is completely transparent to the user, who only has access to an application interface for information processing. Examples of this service model are the most popular cloud services among final consumers, e-mail services such as Gmail, Dropbox, Instagram, social networks, Apple's iCloud, etc., but also full sales management and client marketing suites such as Salesforce.

Access to cloud services is provided through an API (Application Programming Interface). SaaS services can also be accessed through Web browsers or applications developed for mobile platforms: tablets, smartphones, etc.

Furthermore, and depending on how cloud services are rendered, we find different types of implementation models:

- **Public Cloud**: Refers to the provision of services available to any user with internet access. Public cloud services are generally offered by technology companies from their own premises, and the provider's infrastructure is shared by all users.
- **Private Cloud:** The cloud infrastructure is provided for exclusive use by a single user (or organisation) comprising multiple consumers. The cloud infrastructure may be owned and managed by the organisation itself, third parties or a combination of both and may be located inside or outside the user's infrastructure.
- **Hybrid Cloud:** Attempts to combine the client's own resources with others consumed through the public cloud.

The offering of cloud services

The cloud's ability to provide service mode technology has enabled the emergence of a new sector made up of public cloud companies that offer IaaS, PaaS or SaaS types of services (or the three types at the same time).

The market is dominated by a few, mostly US, technology companies. They are characterised by **operating globally**, providing **an identical service to all their clients**, whether end users or public or private organisations. Generally, they are owners of large data processing centres that house the technological infrastructure which ultimately renders the service. Consequently, the acquisition of large volumes of the equipment required to provide their services allows them to benefit from large economies of scale. As can be observed on Table 1, the prices of network and storage devices can be cheaper at a very large data processing centres.

Table 1
Economies of scale in 2006 for medium-sized DPCs (1,000 servers) versus very large DPCs (50,000 servers)

Technology	Cost at a medium-sized DPC	Cost at a very large DPC	Ratio
Network	USD95 per Mbit/sec/month	USD13 per Mbit/sec/month	7.1
Storage	USD2.20 per GB/month	USD0.4 per GB/month	5.7
Administration	140 servers/administrator	>1,000 servers/administrator	7.1

Source: Armbrust et al. (2009)

Moreover, the fact that their production is focussed on a small range of services without major differences allows them to **industrialise their processes**, which also cuts technological infrastructure administration and maintenance expenses.

Thus, by way of their clients' aggregate demand, an industrialisation of their processes and an excellent optimisation of their installed technology base, new cloud services providers can offer highly competitive prices and capture large market shares.

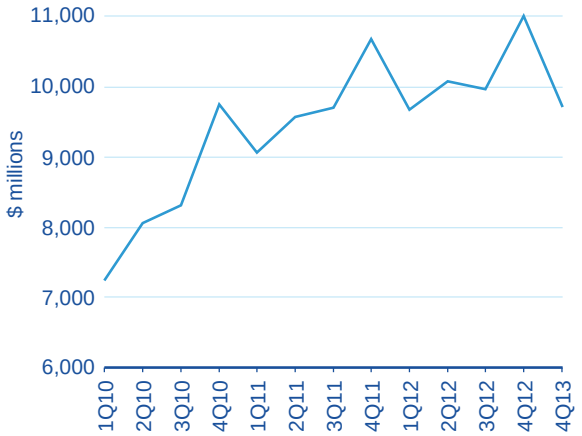
The low costs offered by the technological giants (cloud services providers) are precisely what have also favoured the emergence of new and innovative digital services provided by third party companies. These companies offer SaaS services to their end clients (consumers) by subcontracting the most basic cloud services (IaaS and/or PaaS), thus becoming cloud services providers and clients at the same time.

It is also common for cloud services providers to subcontract from third-party data processing centres, to expand their technological architecture and to be capable of meeting an exponentially growing demand,

particularly in developed regions. Interconnections through large global communication networks allow the DPCs to be located at any geographical point on the planet, provided they have an appropriate connection.

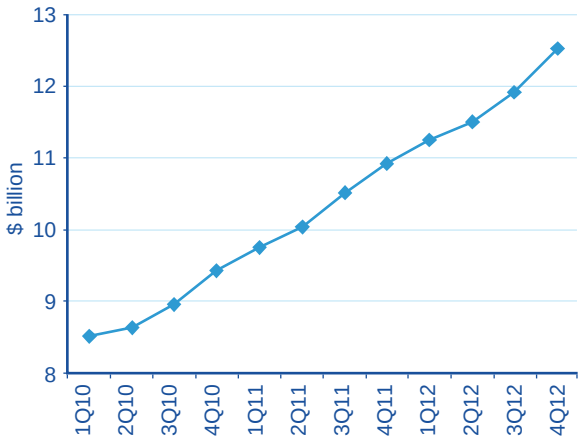
One indicator of how global cloud adoption is progressing consists in observing the sales evolution of the IT components required to create the infrastructure for said services. According to Synergy Research (2013a) data, revenues in this market over the last three years grew at rates of 3% (including computing and storage systems, network infrastructure and cloud software licenses) (see Figure 1).

Figure 1
Worldwide revenues of Cloud infrastructure equipment



Source: Synergy Research Group

Figure 2
Worldwide revenues of Cloud infrastructure services



Source: Synergy Research Group

From the perspective of the revenues of the companies that offer cloud infrastructure services (including hosting services at data processing centres for those relating to IaaS and PaaS), according to the Synergy Research (2013b) report, the annual growth rate in this sector's revenues has ranged from 13% to 17% since 2010, reaching a total of 57.2 billion dollars (a total increase of 33%).

The same Synergy Research report reveals that the worldwide IaaS and PaaS services market grew at an annualised rate of over 55%, exceeding the USD2bn dollar mark over the first four months of 2013.

Cloud sector demand

The demand for cloud services by public and/or private organisations is spurred by the ancillary benefits the technology provides in meeting sales and in-house production targets:

- **Ease of access**. An internet connection is the only requirement for cloud services, which can be accessed from any device and location.
- **Reduced entry costs.** The outsourcing of cloud services obviates the need to make an initial investment in computer systems, thus cutting acquisition and start-up overheads. Consequently, initial investment capital resources are shifted to operating expenses adjusted for real consumption, thus turning overheads into short- and medium-term variables.
- **Scalability and elasticity:** A cloud service automatically provides more or less resources as a function of demand, which leads to greater **flexibility along the entire production process and reduces time to market.** Moreover, the service's versatility can prevent unscheduled downtime from intensive use of resources, increasing service quality and improving client experience.

- **Improved efficiency of IT resources**: At traditional data processing centres (DPCs), IT systems are usually scaled for optimum process demand response during peak (maximum throughput) hours, while a high percentage of resources remains idle during trough hours. Cloud technology allows hardware resources to be shared by several processes or applications, which means that the efficiency of the installed base can be maximised by the optimised use of in-house resources.

New companies, SMEs and start-ups are those which benefit most from cloud services contracting. As we have seen, the initial investment in technology to deploy new services is minimised. This favours innovation and facilitates the creation of new internet businesses at hitherto unimaginable speeds, given that it simplifies accessing the technology in the absence of powerful IT systems.

According to a McKinsey (2014) report, the SME cloud market share could generate up to USD28bn in 2015, which would account for 40% to 50% of the market total.

Nevertheless, large companies are faced with the challenge of defining their cloud adoption strategy, given that many already have their own data processing centres and technology infrastructures, which have entailed major investments, and which support their day to day business. Over the years, they have had to adapt their systems to changes and modifications due to business requirements, but also (depending on the sector) to legal requirements. Consequently, they maintain large computing centres designed around services, building service-dedicated silos that are isolated from each other and, in many cases, underutilised. IT budgets have risen year after year to accommodate the inclusion of new services (new silos) and the maintenance of those in existence. IT expenditure thus make the traditional business model unsustainable, especially when compared with that of the younger companies, which benefit from the onset from the technology cost-cutting that adoption of the cloud entails.

On another note, cloud migration also entails an organisational change in IT departments, which must secure the required skills to administer the new public, private or hybrid cloud systems. Although cloud migration involves investing in the costs derived from the re-engineering of processes, systems and applications, and from the reorganisation of technology departments, large companies are cognisant of the long-term benefits that migration can provide, not only in terms of cost reductions but also, and especially, with respect to gains in productivity, efficiency and agility.

Conceptually, it seems clear that the cloud will gain market share over the coming years. This is evidenced by the results of several worldwide surveys of corporate executives conducted by the major technology consulting companies, which reveal a growing interest in adopting public, private or hybrid cloud solutions as a vehicle to transform in-house processes or as a business strategy facilitator. For example, based on interviews held with 1,656 CIOs of organisations in 70 countries and 20 industries, IBM (2013) concluded that there has been a very significant rise in the number of organisations that see the cloud as a critical technology for their organisations, from 30% in 2009 to 64% in 2013.

With respect to the adoption of private cloud implementation models, the results of a survey of 2,306 IT executives in Canada, the US and Europe, conducted by Forrester Research (2013) in the summer of 2013, reveal that 55% of the executives surveyed included private cloud creation in their strategies, while 33% had already adopted an initiative in this regard. Other examples along these lines were presented by Computerworld (2014), which revealed that 42% of the executives surveyed expressed an intention to increase their investment in cloud technology over the next 12 months. Moreover, IDC (2012) found that organisations then currently using the cloud expected to spend 53.7% of their IT budget on cloud applications and platforms over the next 24 months.

On the final consumer side, the cloud helps to provide consumers with higher-quality services at a cheaper price. The options to store information and run software in the cloud will enable consumers to use smaller,

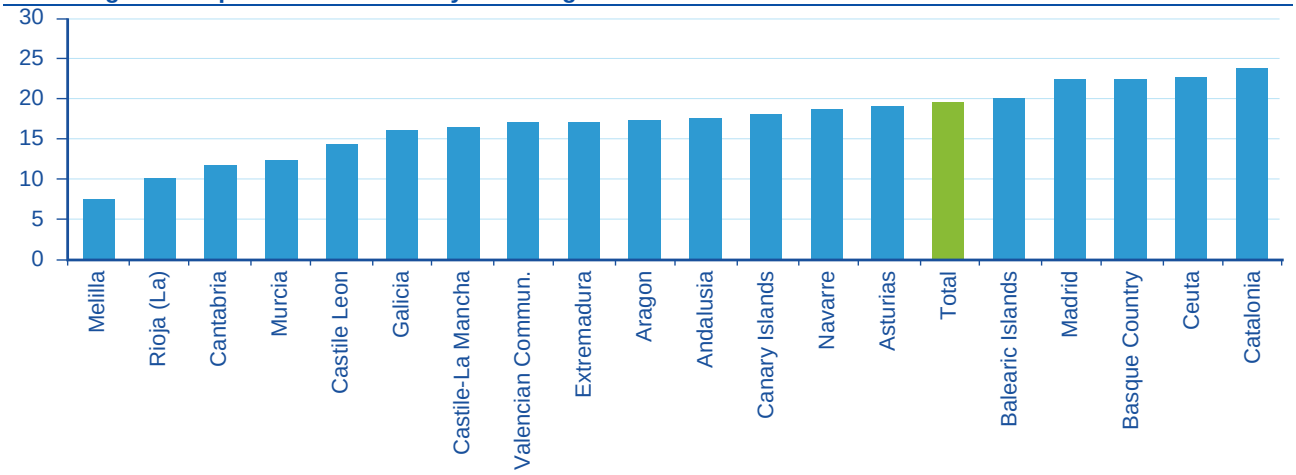
more portable and more versatile technological devices, which will give them access to a new range of innovative digital services beyond those commonly known, such as document storage and e-mail access.

Cloud demand in Spain

In relatively recent times, cloud services started spreading among companies. European Union (2008, 2010) documents and statistics that describe the status of the ICT sector make no mention of the cloud. Not until 2012 did the European Commission (2012) highlight the importance of the cloud for the EU economy and the measures that would be taken to foster its development.

In the case of Spain, and notwithstanding the relative novelty of this type of services, close to 20% of companies are already using the cloud. By Autonomous Community, Catalonia (24%), Ceuta (23%), the Basque Country (23%), Madrid (23%) and the Balearic Islands (20.5%) make the greatest use of these services, with less use made to date by Melilla (8%), La Rioja (10%) and Cantabria (12%) (see Figure 3).

Figure 3
Percentage of companies that state they are using the cloud



Source: INE (National Statistics Institute 2013)

Regarding cloud usage, 83% of the companies used it for storage, 51% for back-up and 48% for software in the cloud. Only 20% used it as a complete platform.

Of the companies that indicated they did not use the cloud, it is surprising that close to 61% stated they did not do so because “it was not necessary for business development”, while 53% stated that the reason was that “they were not highly aware of this type of technology”. One conclusion from the latter might be that the lack of extensive knowledge of the possibilities the cloud offers could lead companies to think that this technology provides no value to their type of business. Other reasons given by Spanish companies for not using the cloud were high costs (32%) and problems with the security and confidentiality of corporate data (39%).

As companies become more aware of this type of technology, we can expect a greater percentage of them to start using it, and for this type of service to become more widespread and standardised over the medium and long term. The speed at which this will happen will determine greater or lesser use in terms of improving efficiency, company productivity and the economy.

2. Cloud market contribution to the economy

The cloud stands as an IT breakthrough similar to what was seen in the past in other areas of the economy, such as the transportation sector. In the past, producers each took their own products to the local market for sale. This hindered the growth of industry, by limiting potential demand to a local market that precluded the use of economies of scale. The initial development of the railways, subsequently road transportation and, above all, the boom in freight forwarders with huge cargo ships carrying shared containers fostered market globalisation, which enabled any merchandise from any company, no matter how small, to be shipped to any part of the world quickly, safely and, especially, cheaply (Lorenzi and Bourles, 1995). As with all technological shocks, the cloud will cause changes in companies and consumers and, therefore, in the overall economy.

The labour market

All shocks of a technological nature cause a process of construction/destruction in the economy. As the new technology prevails over time, companies reorganise as a function of the new requirements. As a general rule, a positive technology shock will tend to improve the productivity and efficiency of the production process. The cloud could be seen as yet another case of those already experienced in history in other sectors. Specifically, the effects that might be observed in the labour market might centre on two clearly distinct segments:

The direct effect of the move toward the Cloud

Companies that transition to cloud-based IT operations will witness a transformation of the organisational structure of their IT departments, particularly large companies. The progressive outsourcing of these services will probably lead to a lower required number of company in-house systems administrators, while employment will rise at companies that render cloud services. This transformation is also quite likely to lead companies to demand other analytical profiles, different from those of the systems administrator. The outcome of the creation/destruction process of employment in the sector will ultimately depend on the interaction of these market forces.

The effect on employment in the overall economy

According to the Etro (2011) study, the reduction of entry costs entailed by the adoption of public cloud services is an incentive for new companies and entrepreneurs to start new businesses in any sector, given the reduced risk of suffering a loss from the initial investment. There are cloud services today that enable a company to administer its entire accounting and human resources management, as well as solutions and platforms to manage order logistics or cloud CRMs to track sales and client marketing. In this regard, the European Commission (2011) analysed the potential economic benefits that the widespread adoption of the cloud would entail, and concluded that around 80% of organisations could cut their costs by between 10% and 20%.

Furthermore, the reduction of barriers to entry derived from this reduction in initial installation overhead will increase competition in each market, which will entail a tendency to reduce sales margins and increase production going forward. In this regard, Etro (2011) concluded that company creation and, consequently, employment rises in step with the rise in cloud adoption. According to this study, the greatest impact would occur in the global wholesale and retail sales sectors (around 160,000 new companies in the EU over the medium term resulting from a speedy adoption of the cloud), and in real estate and other business and financial activities (over 150,000 new SMEs in the EU). The study thus estimates that cloud introduction would reduce unemployment in Europe by between 0.1% and 0.3% in the short term, and from 0.05% to 0.2% in the medium to long term.

In more absolute terms, but in line with the results of the Etro (2011) analysis, the European Commission (2012) foresees that, with an appropriate strategy, the cloud has the potential to generate 2.5 million jobs in Europe by 2020.

Higher productivity and contribution to GDP

According to Etro (2009), using a dynamic general equilibrium model, the reduction of barriers to entry arising from the widespread adoption of the cloud could raise the EU GDP growth rate by 0.1% (if cloud adoption is slow) to 0.3% (if it is speedy).

Effects on prices

The rise in the number of new companies that would benefit from lower entry costs (capex) and lower operating costs (opex) due to the improved efficiency of cloud services would increase market competition and reduce the sales margins of both existing and newly-created companies. A contribution to the containment of inflation could be expected as a result.

Improvement in energy efficiency

Another potential effect of widespread cloud use could be an improvement in the economy's energy efficiency. A higher share of ICTs in a company's total capital is associated with greater sustainability of production in energy-intensive industries. Thus, it is estimated that a single percentage point of a rise in the share of ICT capital would increase sustainable efficiency from 0.8 to 2.6 percentage points, depending on the sector (European Commission, 2010). Moreover, improved efficiency in the energy sector itself may substantially contribute to a reduction of carbon emissions. ICTs account for 2% of carbon emissions in Europe, of which 1.75% is due to the use of intrinsic ICT products and services, and 0.25% to their production (Etro, 2009).

3. Challenges for cloud deployment

While the cloud could entail major benefits for the economy, greater deployment will depend on the interaction displayed by the technology's offering, company demand and the evolution of the regulatory framework that covers this market. Below, we mention some specific factors to be taken into account

Progress toward greater standardisation and certification

One of the factors that prevents organisations from adopting public cloud solutions is the dependence entailed by the choice of provider. Once the company has been selected, there are certain barriers for the service to continue adapting in step with the company, or to change providers if the company is dissatisfied with the service received, or if it finds a more economically attractive offering. This scenario, which was seen in the past in the development of other innovations, ***is the result of the initial status of standards development in the cloud industry***. However, some initiatives are being developed in Europe and the United States. For example, "*EU Procure Secure: A guide to monitoring of security service levels in cloud contracts*," (ENISA 2012), of April 2012, is a compendium of recommendations in the way of security controls intended to be used as a guide in government cloud services contracting. For its part, the US Government issued FedRAMP (Federal Risk Assessment Program) in February 2012. As opposed to the European initiative, FedRAMP includes not only recommendations but also a certification programme that cloud companies would have to adopt to offer their services to the government. While these initiatives are oriented toward government, they are the first step toward more widespread acceptance.

The mass acceptance of international standards and certification schemes would allow the cloud industry to develop as other service sectors have done. In fact, since technology services have started to be offered in service mode, particularly with respect to the cloud's most basic levels (IaaS), those services could in theory be construed as utilities, given that they become a part of public infrastructure, such as gas, water, electricity and telecommunications. In this regard, the cloud sector has a way to go to reach an appropriate level of maturity that will enable it to become a market that works like those mentioned, because it will first have to face the same challenges and opportunities other sectors have already experienced: existence of monopolies, interoperability and portability.

Data control and management

The delegation to third parties of the maintenance of technology infrastructure in which client business processes are performed means that companies must develop good risk analysis for data and application management, to prevent an eventual loss of in-house control.

It is important to note that not all models of cloud implementation offer the same degree of dependence. For example, IaaS-level services and some PaaS service modes provide the option for control over data, applications and, ultimately, the business processes to remain in client hands.

Privacy of information

Worth noting is the concern over the security and privacy of information, given the potential for third-party access to confidential information and especially after the recent news that some governments may require cloud providers to grant them access to all the information they manage, transmit or store, regardless of the owner. The subcontracting chains that some cloud services providers create, to continuously rescale their resources as a function of market conditions, may in some cases prevent knowing where the data is stored, data which could be located in regions that do not require protection levels comparable to those required in the European Economic Area. In this regard, private cloud solutions may help mitigate the associated risks. In fact, according to the global KPMG (2013) survey, one third of 674 executives of large companies in

different sectors and regions throughout the world admitted having chosen private solutions, due to concerns over protection of their information.

At any rate, the development of the cloud market is strongly influenced by the development of privacy regulations. In this regard, the differences in regulations throughout the world, each with different approaches, entail a significant increase in complexity and compliance costs.

In the case of Europe, the publication of the new privacy regulation is expected to facilitate the development and homogenisation of cloud services throughout the continent. The drive of mechanisms that are included in the text's current drafting, such as the creation of privacy seals, might allow cloud services companies to provide guarantees for the security and control of processed information, regardless of the region where their servers are located. However, as these measures only affect the Member States, there will still be differences with other regulations that will continue to delay cloud development within a global context. Therefore, only through international collaboration will it be possible to tap fully the potential benefits the cloud can provide to the global economy. In this regard, regulators should promote more mechanisms like the “Model Contract Clauses,” which facilitate rendering cloud services from third-party countries when the provider furnishes sufficient guarantees for the security and control of the information processed in said places.

Scalability versus tailor-made services

The economies of scale sought by cloud providers promote the industrialisation of their processes, to thus offer an identical product at the lowest possible cost to all clients, perhaps without completely meeting the intrinsic requirements of a particular sector or client typology. Thus, for example, cloud e-mail services offered to an end user at times are no different from those offered to a large company. This situation, however, clashes with the needs of some strongly-regulated industries that are faced with providers that might not meet their requirements.

Aware of this situation, cloud providers seem to detect the business opportunity that large companies with special regulations might offer. Thus, according to the KPMG (2013) survey, the large providers are starting to create regulatory compliance schemes that will allow them to adapt to the demands of global clients, which can represent a large source of revenues.

4. Cloud adoption in the banking sector

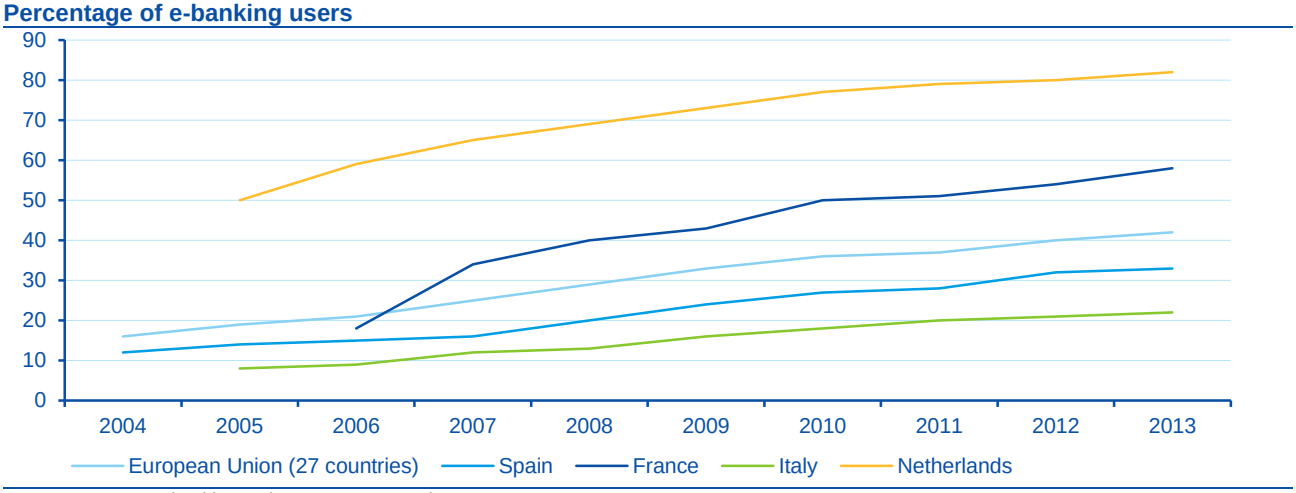
The technology used for information processing is one of banking's most important assets. Given that they do not deal with tangible goods but rather accounting entries, virtually all banking processes and services rely on information systems. Thus, in the 1970s, the financial sector had to acquire a massive number of data processing centres (DPCs) to support its activities. The DPCs have had to adapt their infrastructure to the constant technological changes to accommodate the new processes of digitisation, communication with regulators, back office and, of course, transactions and new client methods of banking through different channels. This is why the DPCs feature both 1970s mainframes (transactional platforms equipped with high-security systems on which core banking services are conducted, and which are prepared to efficiently manage large volumes of information) and the distributed systems that arose around Web communications at the end of the 1990s. Furthermore, banking has had to add new and diverse systems from the mergers the sector has experienced, which required the creation of bridges to enable interconnection with the rest of the systems.

Banking technology has adapted to business requirements over time (but also to compliance with the regulatory mandates of local, domestic and global authorities), creating large DPCs that house highly diverse systems with custom-made developments to interconnect them, making IT expenditure an important line item on bank balance sheets. According to a Forrester Research (2012) survey of companies in the Americas, Europe and Asia, IT expenditure accounts for 7.3% of banks' revenues, versus 3.7% on average for the rest of the sectors.

But the burden of the existing infrastructure precludes agile adaptations at reasonable costs, leading to a turning point in which the technology platform must be completely redesigned.

We are currently witnessing a gradual rise in the use of client sales and transactional channels with banking services, stemming from the proliferation of mobile devices and the deployment of e-commerce. As can be seen on Figure 4, the percentage of e-banking users has grown non-stop over the last 10 years. In the European Union (28 countries), e-banking use rose from 16% in 2004 to 42% in 2013. Spain followed a similar course, from 12% in 2004 to 33% in 2013.

Figure 4
Percentage of e-banking users



Source: Eurostat: E-banking and E-commerce Database

Of note are the cases of Holland, where 80% of the population currently uses e-banking, and that of Italy at the other end, where barely 22% use it.

The new competition from non-banking players in the market

The results of consulting company Cap Gemini's annual survey published in its latest "World Retail Banking Report 2014" reveal this change in the trend of digital services consumption among the new generations. The report highlights that future consumers, mainly members of Generation Y (or Millennials), young clients who value technology above all else and are regular users of social networks, expect banks to conduct a digital transformation to meet their expectations.

Companies from the world of the ICTs (Information and Communication Technology) have started emerging in the financial sector to meet this demand, offering products and services related to the issuance of electronic money, online payment intermediation, financial data aggregation and peer-to-peer financing. Without the burden of old infrastructure and, in some cases, with less regulatory pressure, these companies render their services in the cloud, which provides them with great flexibility and agility to start up innovative ideas quickly, effectively and with tight costs.

It should be noted that the new entrants are not subject to the same premises of control and supervision, even though they offer traditional retail banking services with increasingly greater significance (shadow banking). However, in many cases they do not offer adequate levels of consumer protection, which could end up generating a distrust of "digital things," increasing consumer risk aversion among end-users and thus doing away with the opportunity that the current situation offers for economic growth.

On the other hand, the financial sector is subject to increasing supervision and regulation, which prevents it from achieving the same agility when it comes to contracting the required technological services and/or infrastructure to innovate in the digital world under the same conditions as its competitors. In several EU countries, for example, the supervisor must constantly prove how information security is guaranteed, and how the internal control over processes sent to the public cloud is maintained, regardless of the type of infrastructure and service in question.

Although financial regulation stipulates, in principle, the scope and limitations of banking activity, in practice supervision has a greater impact on the day-to-day operations of banks. This is even more evident in the specific case of cloud adoption, as there is barely any regulation, and all of the regulations in a broad sense stem from the area of supervision. The fundamental concern lies in the outsourcing of services; specifically, that the institution retains the ability to control the critical services for its activities, regardless of whether a third party is managing said services.

The fact that the regulatory burden on cloud adoption is taken from the area of supervision and not from the financial regulation has major implications: by definition, supervision is less internationally harmonised than the regulation, is defined over time in the process (lies within the purview of bilateral discussions between supervisor and supervisee), responds to problems reactively and on a case-by-case basis and, ultimately, is less consistent with a level playing-field among the diverse banks (and non-banks) that offer similar services.

However, in the case of the eurozone, the establishment of a single supervisor at the ECB (the so-called Single Supervisory Mechanism, SSM) will entail a growing level of harmonisation in the latter and in other aspects. Over the next years, eurozone supervisors will hold an in-depth debate on "good practices" in all key aspects of the supervisory sphere. Based on the experience of the years in which the euro was established, this type of debate will lead to the development of highly-detailed manuals on the different areas of supervisory action, including matters relative to the outsourcing of services and "cloud computing." This discussion is highly positive for financial institutions, which will have to be prepared to provide their experience and arguments, as well as to defend their interests. ***In summary, this is a particularly appropriate time to draft clear positions on the regulation/supervision of cloud computing and submit them to the authorities.***

5. Conclusions

The world is moving quickly through the digital era, an economic transformation that many experts compare with the Industrial Revolution, because of its impact in terms of reshaping the goods and factors markets and its consequent effect on gains in productivity and well-being. This transformation will entail the provision of innovative services, the emergence of new players, the reshaping of some and the disappearance of others.

Behind this entire digital process, the cloud is one of the technological services being fully developed and used by diverse industries. It provides companies with an array of technological services, enabling ubiquitous, on-demand access to a set of shared computing resources.

The economic impact of this new industry, which could potentially provide standardised services on a large scale (utilities), is already having substantial impacts on cost structures, product offerings, labour markets and economic growth. Nevertheless, its introduction is not free of concerns on the part of several economic agents and regulators, due to issues of adaptability, operability and security. While these issues, in theory, are not insurmountable, they must be closely monitored.

Among the trends and changes that have occurred, the role of the banking industry uniquely stands out. Since the 1970s, banking has been a paradigm of the introduction of information technology and large computing centres, factors that have sustained its development. In theory, the emergence of the cloud might entail an improvement in the way banks shape their technological support to manage financial services. However, this presents the industry with challenges of a strategic and technological nature, which curtail mass cloud implementation.

On another note, the intense supervision to which financial systems are subjected is an enormous constraint on banks' flexibility to make quick decisions on their choice of cloud model, as opposed to what takes place in other industries. The latter becomes obvious when observing the large digital companies, which are already offering financial services by tapping the benefits of the cloud (they were born together) and the scarce or non-existent regulation of their services. In this regard, we will have to see which path will be taken by the new regulation/supervision of the financial systems in the digital world that is under consideration in different regions.

In the case of the eurozone, and within the framework of its transition toward a Single Supervisory Mechanism in the near future, we can expect to find new initiatives for the development of “good practices” and/or regulations related to the cloud, which will define the evolution of cloud adoption in the territory.

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