Quantitative Estimates of the Demand for Cloud Computing in Europe and the Likely Barriers to Up-take

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The opinions expressed in this study are those of the authors and do not necessarily reflect the views of the European Commission

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1 EXECUTIVE SUMMARY

1.1 Cloud Computing Could Contribute up to €250 Billion to EU GDP in 2020 and 3.8 Million Jobs

Cloud computing represents a fundamental change in the way computing power is generated and distributed, transforming the delivery of IT tools and products into elastic, on demand services characterized by flexible "pay as you go" payment models. More than half of EU businesses and consumers already use some kind of cloud services, but full adoption of the cloud model is still far away, hindered by a wide range of bottlenecks and barriers.

But according to this study, policy actions aimed at removing barriers to cloud can have a relevant impact on its adoption, increasing the value of spending on public clouds from €35 billion (No Intervention scenario) to almost €80 billion (Policy-driven scenario) by 2020.

Moreover, the diffusion of cloud computing is expected to generate substantial direct and indirect impacts on economic and employment growth in the EU, thanks to the migration to a new IT paradigm enabling greater innovation and productivity. According to the model developed by IDC, the "No Intervention" scenario" of cloud adoption could generate up to €88 billion of contribution to the EU GDP in 2020. The "Policy-driven scenario", instead, could generate up to €250 billion GDP in 2020, corresponding to an increase of €162 billion over the first scenario. Cumulative impacts would of course be even stronger. IDC estimates a cumulative impact for the period 2015-2020 of some €940 billion in the "Policy-driven" scenario, compared to €357 billion in the "No Intervention" one.

Considering only the potential of creation of new jobs, IDC estimates that in the "Policy-driven" scenario cloud-related workers could exceed 3.8 million, against some 1.3 million in the "No Intervention" scenario. However, this does not take into account the jobs that would be lost or the workers displaced by cloud-related reorganization of business processes and productivity increases. Nevertheless, the cloud market is expected to be a driver of net creation of employment in the medium term. This range of potential impacts is correlated with specific policy actions, which are illustrated in the final recommendations of the study.

This is the Executive Summary presenting the key findings of a study carried out by IDC EMEA in the period October 2011-June 2012 on behalf of DG Connect of the European Commission, aimed at contributing to the development and implementation of the European Cloud Computing Strategy. The final and interim reports of the study are available online on the European Commission website on Cloud Computing Policies.

1.2 The Dynamics of Cloud Demand

The Public Cloud Market

The public cloud business market in the EU in 2011 reached €3.5 billion for software services and €1.1 billion for hardware services (server and storage capacity as a service). Although the majority of EU enterprises already use at least one or more cloud services (64% in the survey sample interviewed for this study), spending on cloud is still limited. Public cloud services in fact accounted for just 1.6% of total IT spending in the business segment in 2011. Nonetheless, the situation is changing fast and stronger spending is already anticipated for the short term. By 2014, IDC estimates that the public cloud services market will reach €11 billion in revenue (or 3.6% of the total IT market).

Companies in all vertical markets and company sizes will increasingly rely on public cloud services. Some differences will however apply. Large enterprises (over 250 employees), who already represent more than 80% of current cloud spending, will continue investing more than SMEs. Among SMEs, larger ones (with 100-249 employees) are expected to increase spending faster than smaller ones. Many SMEs adopt free cloud services. Concerning cloud investments by sector, finance and manufacturing lead the way.

FIGURE 1 THE EU PUBLIC CLOUD MARKET, 2011-2014 (€ BN)
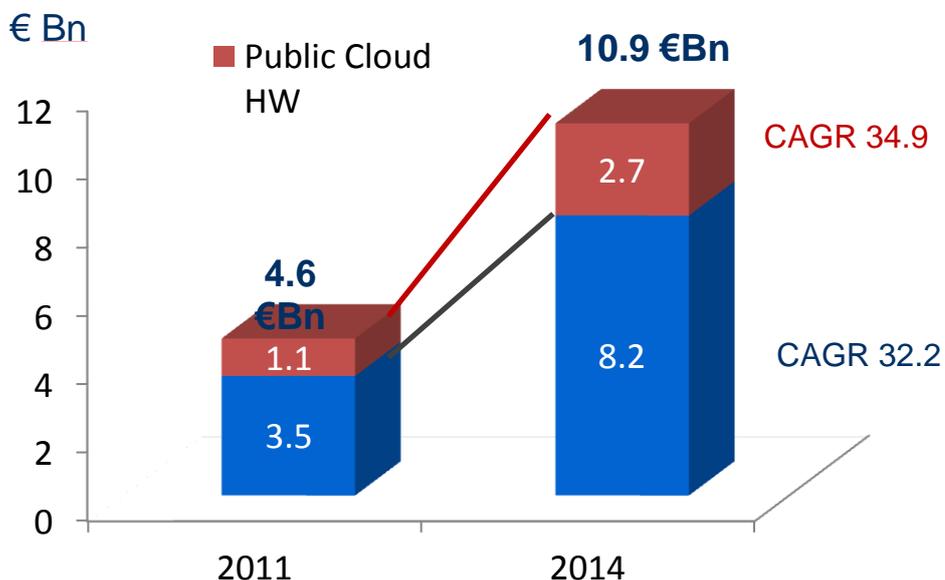
Source: IDC, 2012

Increasing Adoption by Different Business User Types

Adoption of cloud is already widespread and still growing in the EU in both the private and public sectors. But with a few exceptions, cloud represents a small portion of the IT estate even in organisations that are the strongest adopters. However, the level of adoption varies based on external factors, such as the availability of reasonably priced, reliable, and fast Internet connections (mostly an issue for consumers) but also

varies based on whether or not the organisation has had any previous experience of using cloud. For organisations that have used cloud, the attraction for further adoption relates to efficiencies, agility and flexibility – for those that have not yet started lower cost and ease of use are the main attractions. This means that in order to increase cloud adoption across the EU, there are some fundamental issues that need to be addressed (Internet access quality and cost) and different groups of potential users need to be addressed with different messages.

Economic Benefits from Cloud

Demonstrable, tangible economic benefits are available from the adoption of cloud in the EU amongst enterprises. Based on the survey conducted for this study, that included 479 enterprises already using cloud for their businesses, 81% reported lower IT costs with a 10 to 20% reduction being typical, but 12% reported savings of 30% or more. Business benefits included more effective mobile working (46%), higher productivity (41%), more use of standard processes (35%), better ability to enter new business areas (33%) and the ability to open up in new locations (32%). From the "depth" interviews also conducted for this study, the stakeholders generally believe that the cloud holds great promise and are quite bullish about what the impact could be if the barriers to wider adoption were removed.

1.3 The State of Play

The market for public cloud services is growing strongly in Europe. However, overall adoption and usage of cloud services remain some way behind the United States.

Cloud services offer a range of economic benefits to their users and to the economy as a whole. In particular, it has the multiple potential to free businesses from spending capital on IT. And it also enables businesses to be far more agile in their use of technology - no more waiting for many weeks to install new IT capacity when capacity can be added through a self-service portal.

However, cloud is also important to individuals in the EU. It enables also consumers to gain access to services, technologies and applications on a pay per use basis. While IDC's survey of consumers showed that there are certainly some perceived risks, they do not shy away from using the cloud - they do want things to be better, more secure, and more geared towards their needs than towards big businesses. The "right to be forgotten" that is being sure that personal data can be deleted and remain so is one of the priorities for consumers.

1.4 Analysis of Business Barriers

Barriers have not stopped public cloud adoption so far, but have limited the number of cloud solutions adopted. IDC's analysis has weighted business users' perception of barriers' relevance and their actual impact on their cloud adoption choices.

There is clearly a cluster of strongly correlated barriers, ranking high in relevance both in the medium and long term for all business users. This creates a negative cumulative impact on cloud adoption and short-term plans. These barriers concern unclear legal jurisdiction and data location issues, complex security and data protection regulations, uncertain trust in suppliers, and lack of guaranteed data access and portability between cloud systems. This shows that uncertainties about the way legal and security issues are managed in the cloud environment are strongly correlated with uncertainties about the relationship with and the trustworthiness of cloud providers. Data access and portability barriers are less relevant in the short term, but are expected to become more relevant in time for all stakeholders, as intensity of cloud usage increases.

The impact of barriers varies by type of user. The public sector shows a lower intensity of cloud adoption than the private sector, and this seems to be due to higher regulatory barriers, such as concerns about security and data protection, legal jurisdiction, and data location. The perceived lack of a clear business case for cloud computing is an obstacle for the public sector and for SMEs, while large enterprises seem to have a clearer awareness of cloud benefits. On the other hand, large enterprises (>250 employees) and vertical markets with the strongest cloud penetration (finance and telecommunications) are most concerned about cloud issues, since they are most aware of their practical impact.

EU enterprises tend to undervalue the relevance that some business issues have on their cloud uptake and short-term plans of adoption. IDC analysis of cloud impact indicators shows that evaluation of usefulness (particularly in SMEs), the need for local language support, and uncertainty about the ownership of customisation (particularly among large companies) have hampered adoption and short-term plans, and are at least equally as important as regulatory barriers.

Regarding technology transparency and control, IDC believes that barriers should lessen over time, as the market matures and the interaction between players becomes clearer. Particularly, concerns about the control of software and services changes and updates should lessen in time, as companies benefit from automated software upgrades with no extra cost.

Slow connectivity emerged as a constraint to cloud adoption mainly for SMEs. Clearly, eliminating the coverage gaps of broadband networks across Europe and insuring high-speed networks diffusion is a key requirement for a cloud-friendly environment.

1.5 "No Intervention" Cloud Scenario to 2020

EU enterprises, especially large enterprises, have already embarked on a public cloud journey. However, if no action against barriers is taken, the growth of demand is likely to be constrained. According to IDC, in a "No Intervention" scenario, after solid growth in 2011-2014 (33% annually), the EU compound annual growth rate of cloud spending would moderate to 21.6% in the period 2015-2020. By then, public cloud spending would amount to €35 billion (or 9% of total IT spending in the EU business segment).

As persisting barriers hamper cloud adoption in EU businesses, in this scenario growth rates would soften in all vertical markets. In particular, cloud spending in the government sector would show the lowest growth rates and remain low compared to the potential for cloud in this sector. In this scenario, SMEs would continue to lag behind and the gap of SME's cloud adoption with large companies would increase. The share of SME's of total public cloud spending would decrease from 16% in 2014 to 13% in 2020.

1.6 "Policy-driven" Cloud Scenario to 2020

If cloud barriers were removed with a set of coordinated actions, the most relevant benefit would be the increasing pervasiveness of cloud solutions leveraged across companies' business processes. All the business users in the survey declared their intentions to increase their cloud investments in this case. Although not all investment intentions will translate into real investments before 2020, cloud intensity would significantly increase.

IDC acknowledges that not all key actions can be addressed within policy frameworks, but the EC can create a favourable environment (for example, the use of cases and best practices can support cloud skills development and help foster innovation) and make a push to find solutions to non-regulatory related issues.

Under the "Policy-driven" scenario, public cloud spending would grow at a 38.3% compound annual growth rate and would amount to nearly €80 billion in 2020 against €35 billion in the "No Intervention" scenario. Despite lower IT spending (or thanks to the cost effectiveness of the cloud), in the 2020 "Policy-driven" scenario, EU companies' reliance on IT increases significantly.

Growth rates would strengthen across all vertical markets, in particular in the government sector, where several barriers have hampered large-scale cloud projects.

SMEs (especially companies with 100-249 employees) would increasingly rely on cloud solutions. SMEs share of total public cloud spending would increase to 25% in 2020.

By then, SMEs would dedicate 17.4% of their IT budgets to cloud solutions. More interestingly, although IDC assumes lower total IT spending in the "Policy-driven" scenario compared to the "No Intervention" scenario, total SMEs IT spending would be higher than in

the other scenario. Thanks to the cloud, more SMEs would adopt IT solutions for the very first time. In this context, the cloud would help EU SMEs gaining efficiency and help their competitive position in the global market.

1.7 Recommendations

Based on this study's analysis of the key stakeholders' needs and requirements, these are the recommendations for the most relevant policy actions, which should be included in the European Cloud Computing Strategy to create a "cloud friendly and proactive environment" in the EU and maximize the chances of achieving the benefits identified in the "Policy-driven" scenario.

While some of the issues addressed are perceived as more relevant than others, it is their cumulative impact which represents the real constraint for the market development. Therefore, all the recommendations are considered equally important in principle.

Removing Regulatory Barriers

The policy actions removing the key regulatory barriers should be the following:

- **Harmonising and clarifying personal data protection and privacy protection rules across the EU, protecting citizens' rights but simplifying bureaucratic requirements, no matter where the data is and developing additional instruments such as standard clauses, codes of conduct or Binding Corporate Rules for international data transfer.**

- **Clarify data jurisdiction regulation and providing EU-wide guidelines about which laws apply to data stored in the EU member states or elsewhere.**

- **Favour the identification and removal of local laws and regulation that limit the use of cloud services.**

Building Trust in the Market

- **Establish clear and harmonised principles about cloud service providers' accountability and liability, particularly about security breaches.**

- **Develop standardised contract terms from cloud service providers so that vendors' offers can be compared easily, to improve choice.**

The European Commission should take the lead to develop clear and harmonised principles about cloud providers' accountability and liability. In addition, the development of a set of standardized contract terms in order to implement these principles, on the basis of consensus-based definitions, would be extremely useful to insure comparability of offerings and the ability of business users to choose the best provider for their needs.

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- **Identify a minimum set of SLA (Service Level Agreements) which could become a quality standard for the cloud market**
- **Establish EU-wide certification or quality labels of cloud service vendors on:**
  - **Their security and data protection arrangements and guarantees, certified by the EU Data Protection Authorities**
  - **Their suitability to serve the government market with full compliance with all necessary regulation**
- **Create a one-stop EU portal to collect, examine and deal with cloud users complaints and problems about the quality of cloud services and cross-border issues of data protection, data jurisdiction, quality of cloud services.**

The creation of a cloud proactive environment in the Digital Single Market would benefit greatly from the existence of a web portal, launched and managed by an independent third party, sponsored by the European Commission, providing a one-stop information and complaint collection point for business users, particularly for cross-border issues.

Protect Consumers' Rights to Control Their Data and to Be Forgotten

- **The European Commission should make sure that the consumers' rights of access, control, correction and deletion of personal data are respected and implemented by all cloud providers, no matter their nationalities**

Insuring Data Access and Portability of Data, Applications and Services

- **The European Commission should create the pre-conditions so that the principle of data access and portability between cloud vendors is widely accepted and the risk of lock-in of users in proprietary systems is prevented.**

Business users must be able to switch from a cloud vendor to another without unacceptable costs or extended time lapses. It is clear that switching suppliers will always be more complex and difficult for value-added services, such as CRM, than for simple applications such as e-mail (but even in that case there may be hidden difficulties). The EC should defend and support this principle, as such, and in practice by incorporating it in the contractual rules, clarifying aspects such as ownership of customisation of services and applications performed for cloud services and of course of the relative data. The definition of what are in practice "unacceptable" migration costs could be a useful part of this action.

Promoting Standardisation and Interoperability

- **The European Commission should promote common standards and interoperability of public cloud systems, to maximise economies of scale across the EU and create the preconditions for portability between cloud vendors**

Building the Business Case for Cloud Adoption

- **The European Commission should promote awareness of the potential business benefits resulting from cloud adoption, particularly for SMEs, building on examples from successful business cases and providing evidence of positive impacts. In addition, it should sponsor further research on the modelling of the macroeconomic impacts of cloud adoption on growth and employment, and the analysis of the economies of scale resulting from the development of public cloud infrastructures in Europe.**

Contributing to the Business Case for High-speed Broadband Infrastructures

- **The EC should highlight the demand for high-speed broadband infrastructures coming from cloud adoption, and conversely the risk that lack of broadband may be a barrier to cloud adoption, thereby reinforcing European and national plans for NGN development.**

2 INTRODUCTION AND BACKGROUND

Cloud computing represents a fundamental change in the way computing power is generated and distributed, transforming the delivery of IT tools and products into elastic, on-demand services characterised by flexible "pay as you go" payment models. More than half of EU businesses and consumers already use some kind of cloud services, but full adoption of the cloud model is still far away, hindered by a wide range of bottlenecks and barriers.

This report presents the final results of a study carried out by IDC EMEA in the period October 2011-June 2012 on behalf of DG Connect of the European Commission, aimed at contributing to the development and implementation of the European Cloud Computing Strategy. The report presents new evidence of businesses' and consumers' perceptions of the main drivers and barriers to cloud computing, their actual behaviours in using the cloud, and what they see as the most important actions to take to remove barriers.

The report presents also two alternative scenarios of the development of the demand for cloud computing in Europe up to 2020, depending on policy actions removing the most important barriers. The study estimates as well the potential impacts of cloud computing adoption on economic growth and jobs creation, under the two scenarios. In conclusion, the report presents the main recommendations for European policies that would help accelerate the up-take of cloud computing and make Europe not only cloud-friendly, but also cloud active.

3 UPTAKE OF CLOUD IN EUROPE

3.1 Business Demand

To assess business demand, IDC carried out a survey of 1,056 EU organisations in November and December 2011. The interviewees were located in the Czech Republic, France, Germany, Italy, Hungary, Spain, Sweden and the UK, and included organisations from a cross-section of sizes (1-9 employees, 10-99, 100-249 and 250+ employees).

IDC grouped enterprises into six groups according to the most advanced stage of cloud adoption they had reached across their organization:

- No usage (or intention) to use cloud;

- Thinking of using cloud in at least one area;

- Planning to use cloud in at least one area;

- Limited use of cloud in one or more areas;

- Full use of cloud in only one area;

- Full use of cloud in more than one area.

FIGURE 2 PATTERNS OF USE OF CLOUD COMPUTING IN THE EU27

Data 2011 - Sample n=1056

Source: IDC, 2012

18
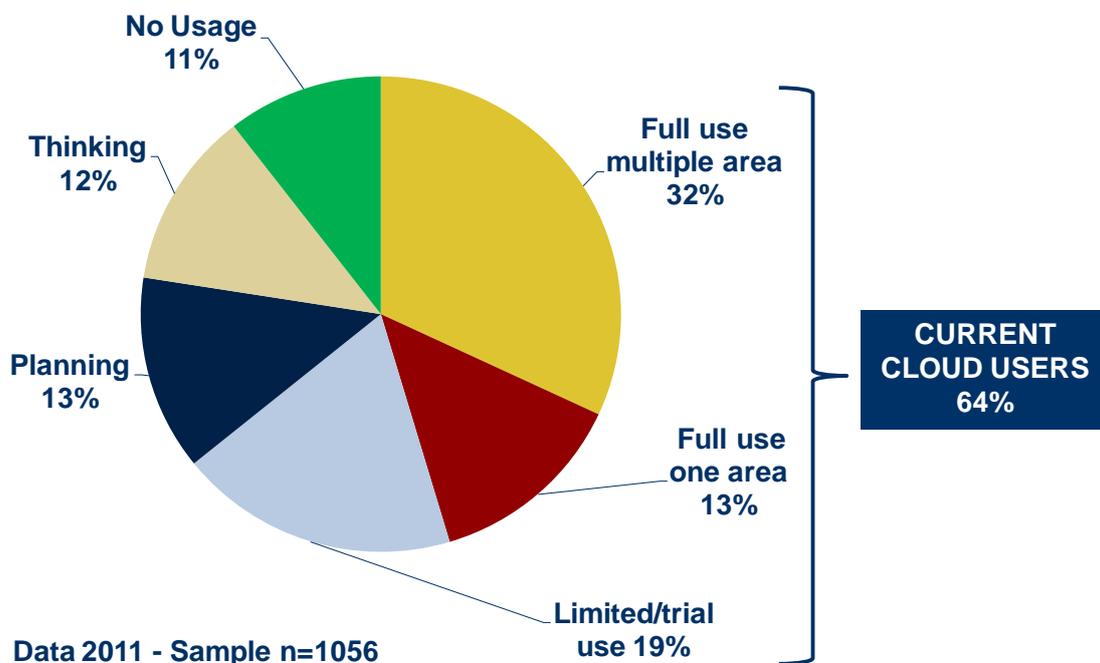
Figure 2 shows the results of this survey; in particular, that altogether 64% of EU organisations belong to the one of the last three categories above, and are therefore already users of cloud services. The largest single group is enterprises at the most advanced stage, using cloud services in more than one area (the Full use >1 area group).

However, revenue data from cloud vendors show that, even amongst organisations that have the greatest use of cloud, cloud adoption is still relatively shallow. The two most widely used cloud services are email and security, and while these are important to keep enterprises running, they do not necessarily provide businesses with competitive agility or advantage.

Cloud adoption is not even, and the most robust differences in cloud come from enterprise size. In particular, the lowest adoption is found in the smallest SMEs (1-9 employees), as Figure 3 shows. This group arguably has the most to gain from cloud, and therefore this is concerning. Running their own IT systems is generally going to be beyond their abilities, while increasingly businesses of all sizes need to have adequate systems to meet customer, supplier and legal demands.

FIGURE 3 CLOUD ADOPTION LEVEL BY SIZE SEGMENT

Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

19
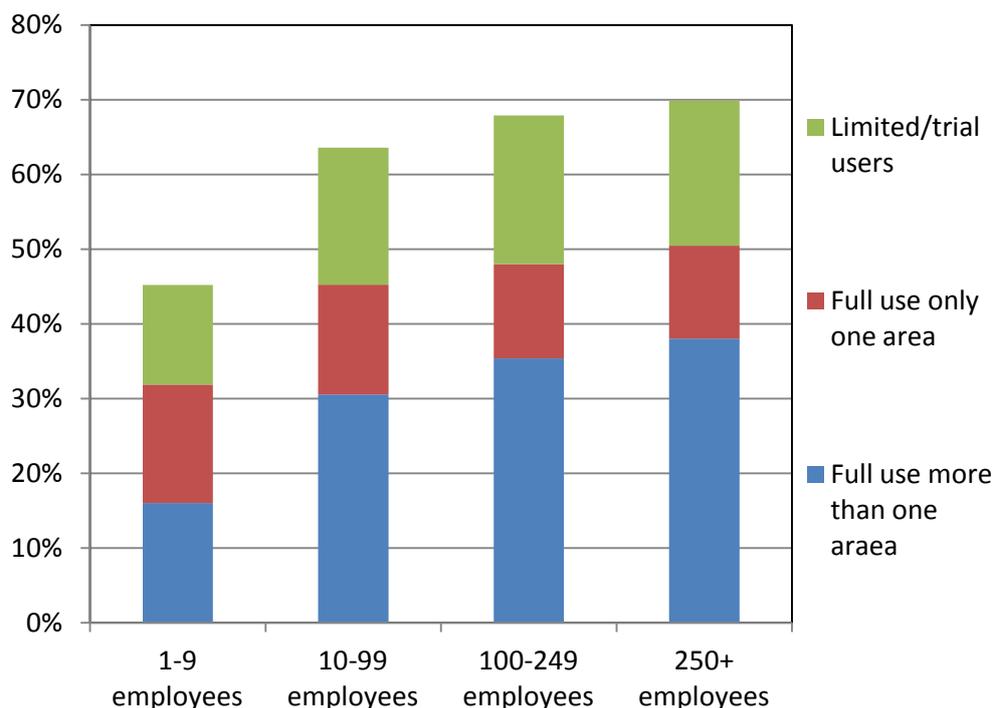
3.2 Range of Cloud Services Used

Figure 4 shows the adoption levels of the different types of cloud services, split by users who have full use of the service type and those that have limited or trial use of the service. (The abbreviations used in Figure 4 are explained in Table 1). All examples are from public cloud services, but it is expected that some respondents (especially amongst the large enterprises) will be using private cloud services.

FIGURE 4 CLOUD ADOPTION BY TYPE OF SERVICE
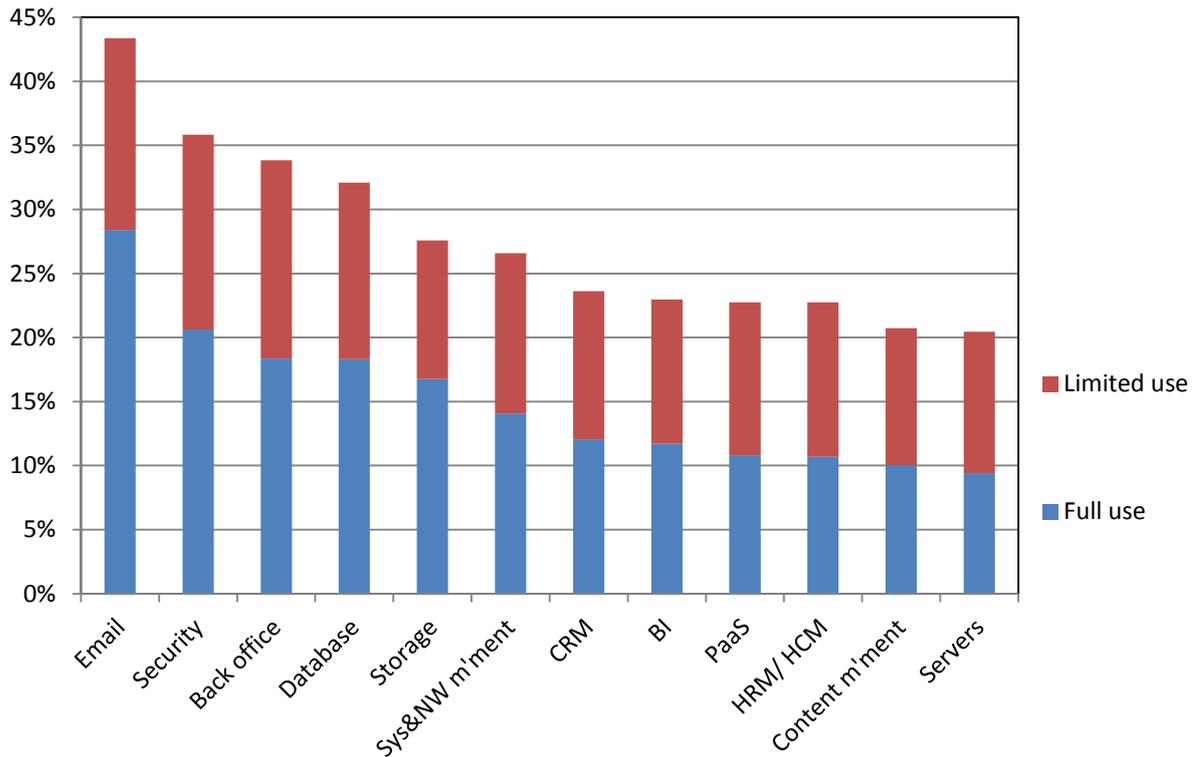
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

TABLE 1 CLOUD SERVICES ASKED ABOUT IN THE SURVEY

Full text used in interviews	Abbreviation in charts
E-mail/calendar/diary (e.g. Gmail Enterprise, Microsoft Exchange Online/Office 365)	Email
Content management (e.g. Clickability, CrownPeak, OmniUpdate)	Content m'ment
Sales management (e.g. salesforce.com, Oracle CRM On Demand)	CRM
Accounting/Back office (e.g. StepStone, Hubwoo, SAP Business ByDesign, Twinfield, Concur, Netsuite)	Back office
Personnel/HCM or Talent Management (e.g. Taleo, Successfactors)	HRM/ HCM
Databases (e.g. Enterprise DB, LongJump, Elastra)	Database
Business intelligence and analytics (e.g. IBM Smart Analytics Cloud, SAP BusinessObjects On Demand)	BI
Application development (e.g. force. com, Microsoft Azure, Servoy) and/or online testing	PaaS
Security (e.g. Google/Postini, Symantec/Messagelabs)	Security
System & network management (e.g. Service-Now. com, ZenDesk)	Sys&NW m'ment
Storage on-line including back-up and/or disaster recovery (e.g. Dropbox, Amazon S3, EMC Mozy, Acronis Online, Diino)	Storage
Infrastructure/compute power (e.g. Amazon EC2, Flexiscale, Joyent)	Servers

Source: IDC, 2012

3.3 Cloud Benefits

Of the organisations that already use cloud services, 78% said they had seen a cost saving. However, if all those who said that it was too early to tell if they had seen cost savings and all those that said they didn't know if they had made cost saving are excluded, then 97% saw cost savings compared to traditional IT (Figure 5). In addition, 36% of these organisations saw savings of 20% or more (excluding those responding don't-know and too-early-to-tell). This is an important benefit. For many businesses, IT is often consuming so much of the organisation's budgets (capital and on-going costs) that it can restrict innovation in other areas.

FIGURE 5 COST SAVINGS THANKS TO CLOUD ADOPTION
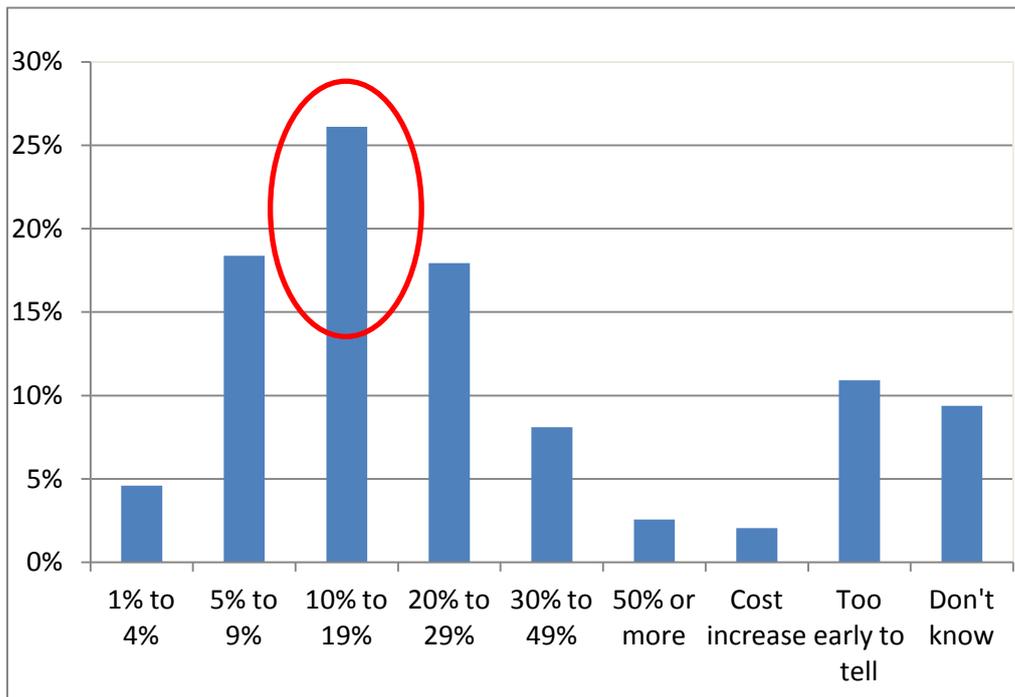
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

Cloud services offer customers a range of business benefits beyond cost savings. As Figure 6 shows, the business benefit most widely seen or expected is an increased effectiveness of mobile working. Generally, cloud applications can be accessed from anywhere with an Internet connection and increasingly this means via a mobile device; in fact mobile access is increasingly a standard feature of cloud applications but much less so for the installed base of conventional on-premise applications. Productivity also increased due to the user interfaces on cloud services often being easier to use than the software they are replacing.

FIGURE 6 BUSINESS BENEFITS SEEN AND EXPECTED
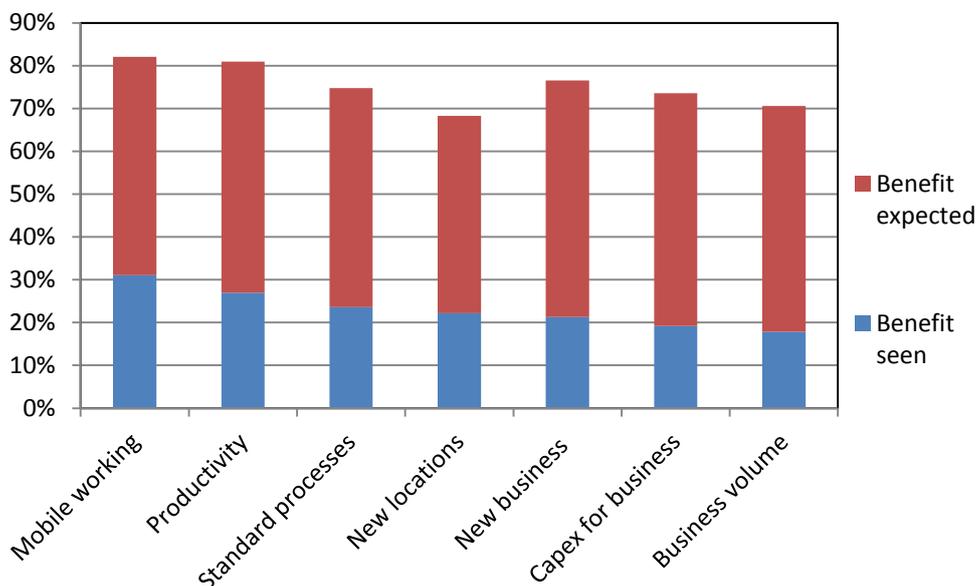
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

Other cloud benefits impact business organisation and market approach. "Standard processes" means that, through using a common cloud service, the different parts of the business are better able to ensure that core processes are executed in a standard way. "New locations" means that the cloud makes it easier to open up offices in new areas, and "new business" means that cloud has enabled the opening up of new business lines, through making it possible to "turn on" the required services rather than having to go through extended provisioning and implementation processes. "Capex for business" means that it was possible to switch capital expenditure from IT to the business – a corollary to cost savings. "Business volume" means that organisations were able to increase revenues.

Do these business benefits increase with the number of cloud services used? Yes, they do, as Figure 7 shows. The survey shows that full users of multiple cloud services see more business benefits from cloud services than either users with just one cloud applications, or users with only limited or trial services.

FIGURE 7 BUSINESS BENEFITS SEEN AND EXPECTED
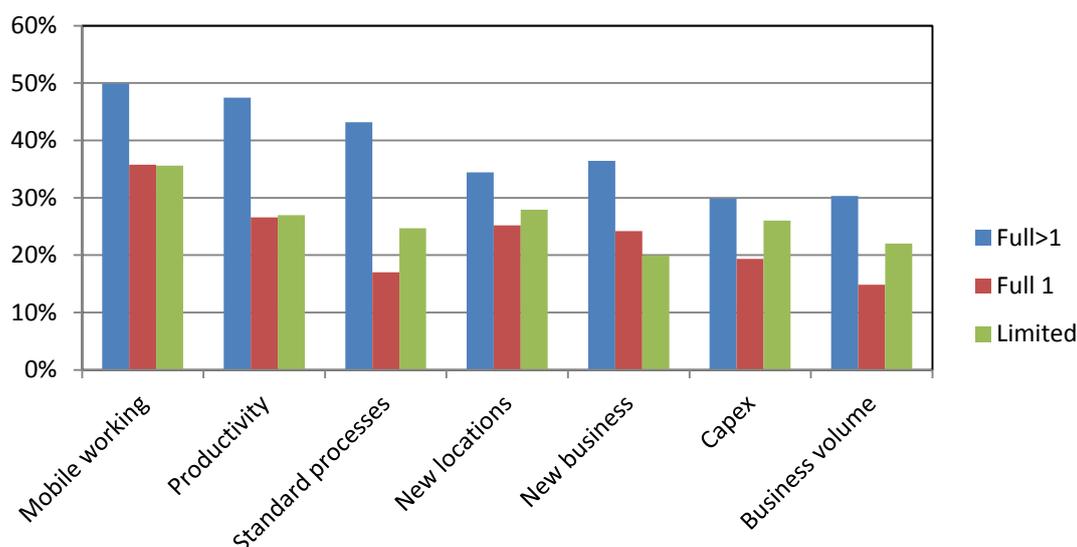
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

An interesting aspect is that the limited users see more benefits than the users with full use of only one cloud service. This may be because the use of multiple cloud services (even if in a limited or trial way) helps to achieve the range of benefits described above, while using a single service may have a limited impact.

3.4 Consumer Demand

Most consumers do not recognize the term "cloud" but the vast majority do use cloud services of one sort or another. This is one of the key findings of the survey carried out by IDC in November-December 2011 of a sample of 947 Internet users over 14 years old, distributed in nine EU countries. Interesting considerations emerge when the sample of Internet users is split based on their approaches to technology adoption[1] as follows:

- **Innovators:** people who identify with the statement "I like being one of the first"

- **Early Adopters:** people who identified with the statement "I wait until I have read the first reviews, but usually I buy new technologies early on"

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[1] This is based on a modified version of model for technology adoption describe in The Diffusion Process, by George M. Beal and Joe M. Bohlen of Iowa State University (North Central Regional Publication No. 1, 1962)

- **Majority Adopters:** people who identify with the statement "I wait until I see a lot of my friends using the technology so I feel is it safe before buying"

- **Laggards:** people who identify with the statement "I only buy new technology when I have to"

As shown in Figure 8, even within the Innovators group many do not understand the term "cloud". Only innovators and early adopters are aware that many of the services they use are cloud services.

FIGURE 8 CONSUMER AWARENESS OF THE TERM "CLOUD"
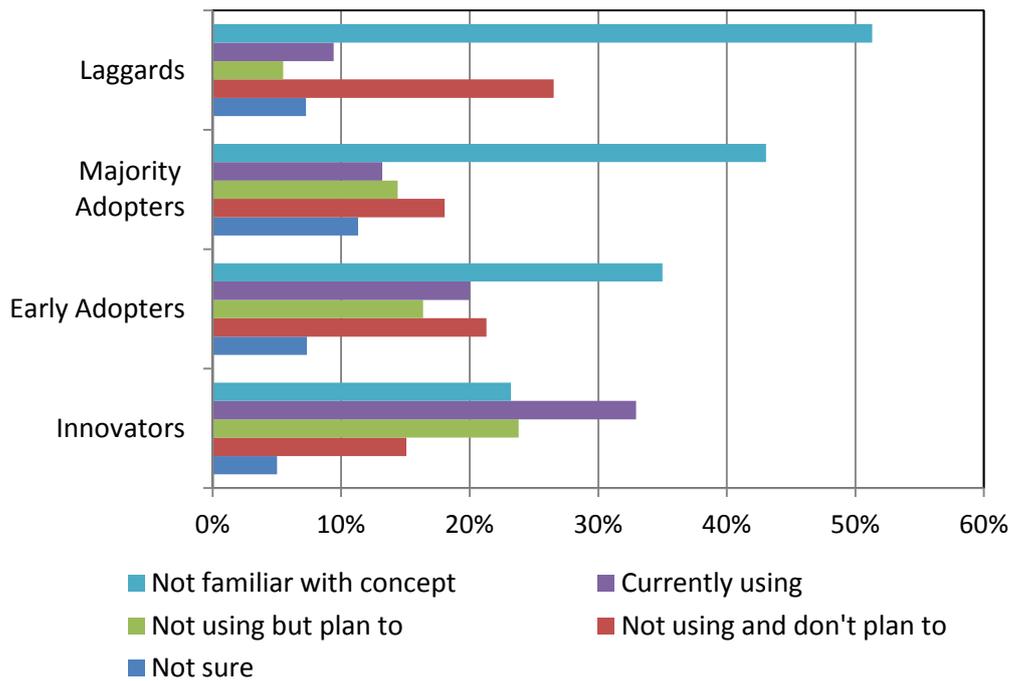
Data 2011 - % of respondents

Sample n=946

Source: IDC, 2012

However, Figure 9 shows that nearly all Internet users have already adopted cloud services. Other than games, consumers intend using more free cloud services and (except for social networking and backup services) more paid services as well, though as Figure 9 shows, the majority of consumer cloud usage is free not paid services.

FIGURE 9 CLOUD SERVICES USED BY CONSUMERS
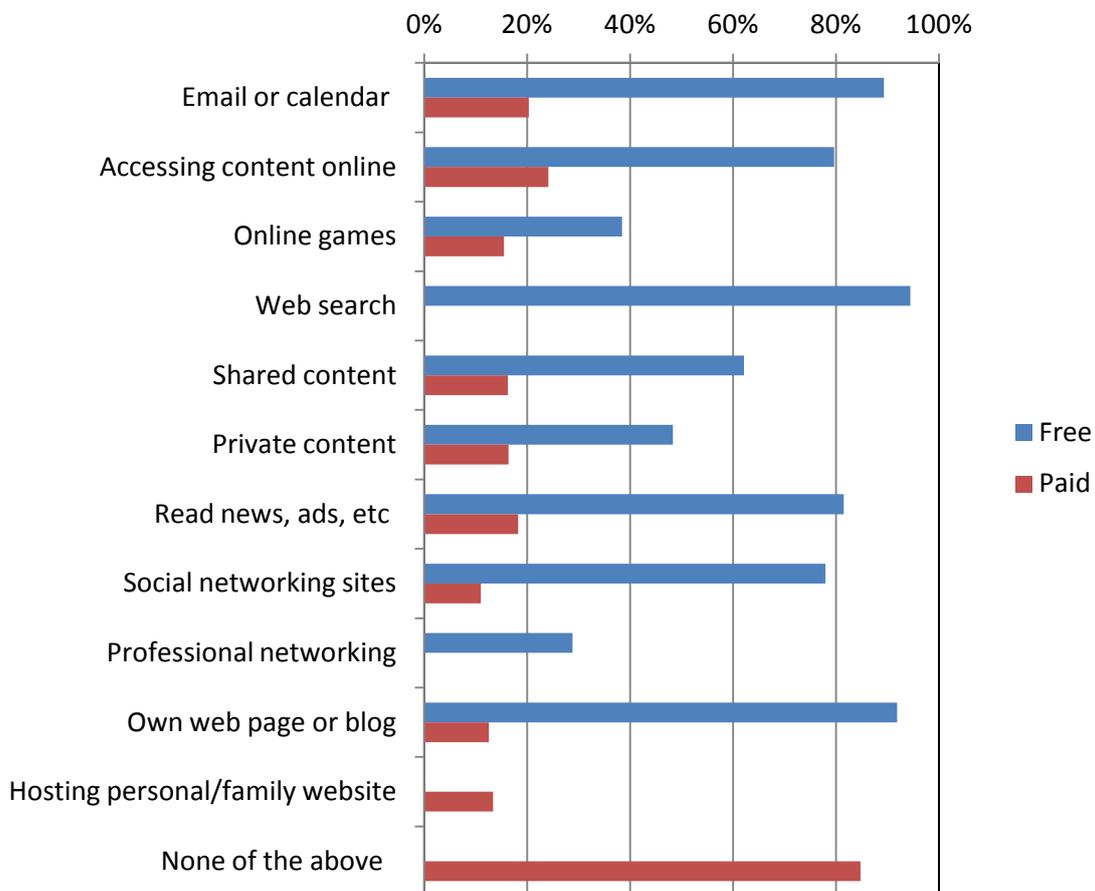
Data 2011 - % of respondents

Sample n=946

Source: IDC 2012

Why do consumers use cloud particular services and not others? The overwhelming reason is that the consumer needs or is interested in any particular cloud service. Conversely, 53% of consumers said that lack of interest was the main reason for stopping the use of any particular service compared to 14% giving security as the main reason and 11% giving data location as the main reason (Figure 10).

The need for the service is a higher barrier to usage for the less "aggressive" adopters. This indicates, perhaps not unexpectedly, that the attitude to technology adoption (try before others, be one of the first) also follows the usage of new cloud services and that the more conservative adopter groups need to be convinced of the usefulness/need for a specific service before they start usage.

FIGURE 10 REASONS WHY CONSUMERS DO NOT START USING A CLOUD SERVICE
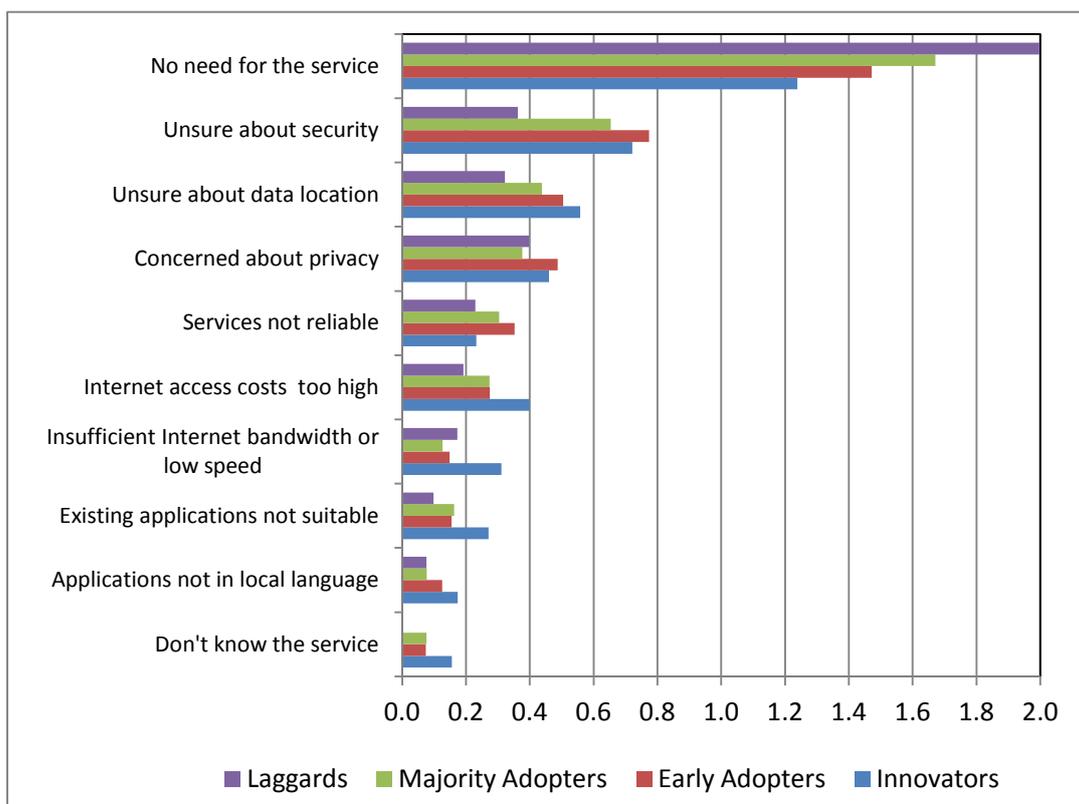
Legend: Scoring based on weighted rankings, where Rank 1=3, Rank 2=2, and Rank 3=1. Higher scores correspond to higher rankings

Data 2011 - % of respondents

Sample n=946

Source: IDC, 2012

However, when adopting cloud services in the first place, security, data location, and data privacy are of major importance, cited by 43% of the total survey. IDC therefore asked those consumers (totalling 411 respondents) which, if any, of the options below would remove their concerns about adopting further cloud services (the wording in parenthesis has been used for the presentation of the results in the Figure 11 below):

- That I can complain in case of security breaches or data losses, and be sure of adequate compensation (complaint process)

- That I am informed if/when security and personal data breaches occur and how consequences are managed (informed of security breaches and actions)

- That I am sure that my deleted data does not remain in the service providers' archives (data deleted from service provider)

- That I can control access to my data through privacy-protection settings (data privacy control)

- That I can correct/delete my data in an easy and efficient way (correct/delete data)

- That I know where my data is and that it is protected e.g. that my rights are protected no matter where the data is (data location/protection)

- That the service complies with EC regulation on consumer protection, data and privacy protection (EC regulation compliance)

Figure 11 examines which barriers are most important to remove by adoption type, using the same approach as above. If all options received an equal number of first, second and third rankings, the average score would be 0.85, as indicated by the vertical line in the figure. All the factors with a higher score have a particularly high relevance.

FIGURE 11 MOST IMPORTANT BARRIERS TO REMOVE BY USER'S PROFILE
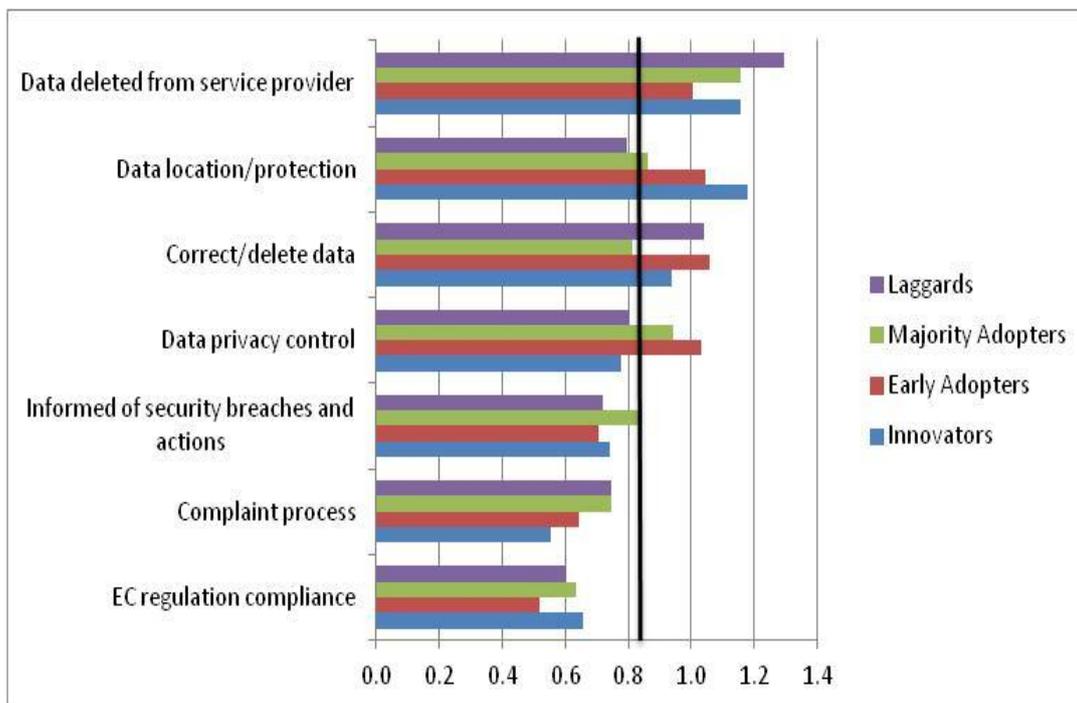
Legend: Scoring based on weighted rankings, where Rank 1=3, Rank 2=2, and Rank 3=1. Higher scores correspond to higher rankings Source: IDC 2012

Data 2011 - % of respondents

Sample n=411 cloud users

Source: IDC, 2012

Overall, 20% of respondents indicated that the most important factor that would increase their cloud usage was the certainty that when they or the service provider delete their data, that data would remain indeed inaccessible and would not continue to be used by the service provider -

in effect this is the "right to be forgotten." To this should be added another 15% who ranked as the most important reason to increase usage the ease of correcting and deleting their own data. Therefore, control of one's own data seems to be a key factor to increase cloud usage. The other main reason quoted by respondents was control of data privacy.

On most options, there is little difference by adopter types: all four groups rank the issue of ensuring data deletion highly. However, the Early Adopters do stand out a little here. To this group the four areas of data privacy, data location/protection, data deletion/correction, and data removal from the service provider are seen as more or less equally important. In fact, data privacy control is more important to this adopter type than any other barrier.

The Innovators are mostly concerned with data location/protection (more than any other group) and ensuring that data is fully deleted from the service provider. Interestingly, for Innovators data deletion was much more of an issue for new services than for services they already use.

In summary, there are clear differences between consumers' attitudes to cloud services, based on their general approaches to innovation and technology adoption. The most important factor driving consumers' choices is the perceived usefulness of services, as is natural. However, security and data protection concerns come immediately after usefulness and certainly play a role in consumers' behaviour online. Moreover, the request to maintain control of one's data and be able to correct/delete it when so desired emerged as a leading requirement and a determining factor of trust in service providers. Creating the conditions so that service providers respect this requirement and consumers are aware that as an important factor to make the EU market "cloud pro-active".

3.5 Market Growth 2011-2014

Public cloud services accounted for just 1.6% of EU IT spending in the business segment in 2011, amounting to some €4.6 billion in 2011. IDC forecasts that this will grow to €10.9 billion, or 3.6% of EU IT spending in the business segment, a compound annual growth rate of 35%. Figure 12 shows the growth of the market between 2011 and 2014[2].

FIGURE 12 THE EU PUBLIC CLOUD MARKET, 2011 -2014 (€ BILLION)
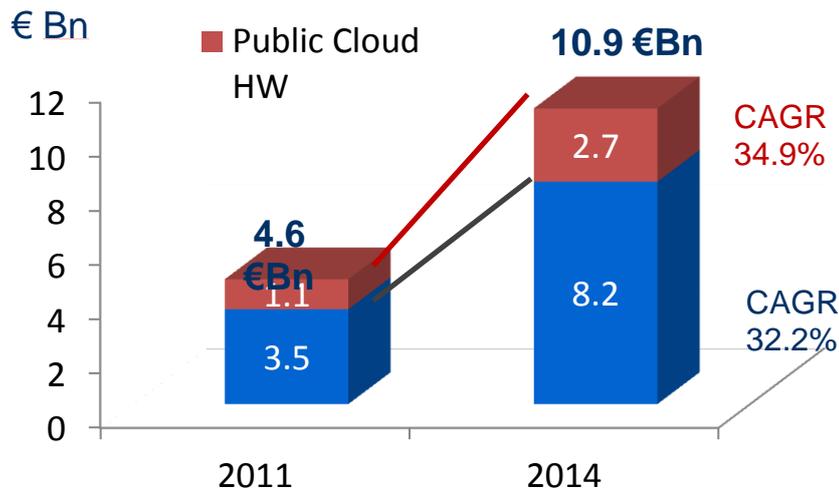
Source: IDC, 2012

IDC believes that the worsening economic outlook will not affect the growth of the cloud services market. In the past, economic downturns have had little or no impact, indeed, in some cases the cloud services market has benefited from the lack of capital availability that occurs when there are economic problems. In addition, cloud services still represent a small, though rapidly growing, and share of the overall IT market.

In conclusion, the market for public cloud services is growing strongly in Europe. However, overall adoption and usage of cloud services remain some way behind the United States.

Final Considerations

Cloud services offer a range of economic benefits to their users and to the economy as a whole. In particular, it has the potential to free businesses from having to spend an capital on IT. And it also enables businesses to be far more agile in their use of technology - no more

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[2] IDC has recently changed its taxonomy of cloud services, and public cloud hardware is now called Infrastructure-as-a-Service (IaaS). Public cloud software is now divided into to two main sectors, Software-as-a-Service (SaaS) and Platform-as-a-Service (SaaS). This aligns IDC's nomenclature with that of NIST.

waiting for many weeks to install new IT capacity when capacity can be scaled up through a self-service portal.

However, cloud is also important to individuals in the EU. It enables also consumers to gain access to services, technologies and applications on a pay per use basis. While IDC's survey of consumers showed that there are certainly some perceived risks, they do not shy away from using the cloud – however, they do want things to be better, more secure, and more geared towards their needs than towards big businesses.

4 ANALYSIS OF BARRIERS TO CLOUD DEMAND BY ENTERPRISES

4.1 Analysis of Cloud Barriers

Despite relatively high adoption rates, cloud adoption by business users is currently higher for "basic" solutions (such as e-mail and security), and among large companies. Cloud intensity (measured as the number of cloud solutions' adopted by each enterprise) is also rather limited: only 28% of companies adopt more than one cloud solution (beyond e-mail), and just 2.6% adopt all twelve cloud solutions IDC investigated in the survey.

This is due to the existence of a wide range of barriers to cloud demand. This chapter presents the in-depth analysis of these barriers, based on a set of impact indicators on actual cloud use and plans of cloud services adoption by business users, based on the results of the enterprise survey and the stakeholder interviews carried out by IDC.

The survey investigated a wide range of bottlenecks and barriers hindering full adoption of the cloud model in the EU, including:

- Security: "We are worried about the security and data protection guaranteed by cloud services"

- Trust: "It is difficult to judge which cloud services are trustworthy"

- Data location: "We do not know and/or cannot control the location of our corporate data"

- Local support: "There is no local support for the services"

- Change control: "We cannot control software changes and upgrades made by the vendor"

- Ownership of customisation: "We do not know who owns the customisations/changes we make to the cloud services"

- Evaluation of usefulness: "We do not know how to evaluate the usefulness of cloud service for our organisation"

- Slow Internet connection: "Our Internet connection(s) is/are not reliable or fast enough"

- Local language: "There is no local language version of the services"

- Tax incentives: "Tax and other incentives make buying with capital more attractive than paying for what we use on subscription."

- Legal jurisdiction: "If we have a dispute with the cloud service provider, I may have to go to court in another country inside the

EU" or "If we have a dispute with the cloud service provider, we may have to go to court outside the EU"

- Data access and portability, covering concerns over:

  - "Concern about our ability to move data from one vendor to another or onto our own IT"

  - "Concern about our ability to move our business processes from one vendor to another or onto our own IT"

  - "Concern about our ability to move our software and systems from one vendor's cloud platform to another's or onto our own IT."

  - "Concern about our ability to connect business processes in the cloud services to business processes on our existing systems"

  - "Concern about continuous availability and access to our data stored on cloud services, and/or to delete it"

Figure 13 below shows how many business users perceive each barrier as strongly restricting the adoption of cloud services. No single barrier emerges as the most important one (there is no "killer barrier", so to speak). Rather, there is a cluster of six barriers, strongly correlated, indicated by more than 62% of respondents as the most relevant. And the barriers following in the ranking should not be overlooked, because they are also considered relevant by many respondents. Therefore, the real problem for the market is the cumulative negative impact of these barriers.

Overall, legal jurisdiction, and security and data protection are at the top of the ranking. Nearly 32% of respondents believe that issues related to legal jurisdiction are currently restricting (very or completely) the uptake of cloud. Nearly 12% think they are restricting completely their cloud use. Security and data protection follows in the ranking, with 30.5% of respondents seeing it as a strong barrier, and with up to 10% of respondents saying that this restricted their cloud use completely.

Large companies (>250 employees) and vertical markets with the strongest cloud penetration (finance and telecommunications) present the highest levels of concern with cloud issues. In the government sector, most important barriers are security and data protection, legal jurisdiction, and data location.

FIGURE 13 RELEVANCE OF CLOUD BARRIERS

% of respondents stating barrier is restricting (very/completely) cloud adoption
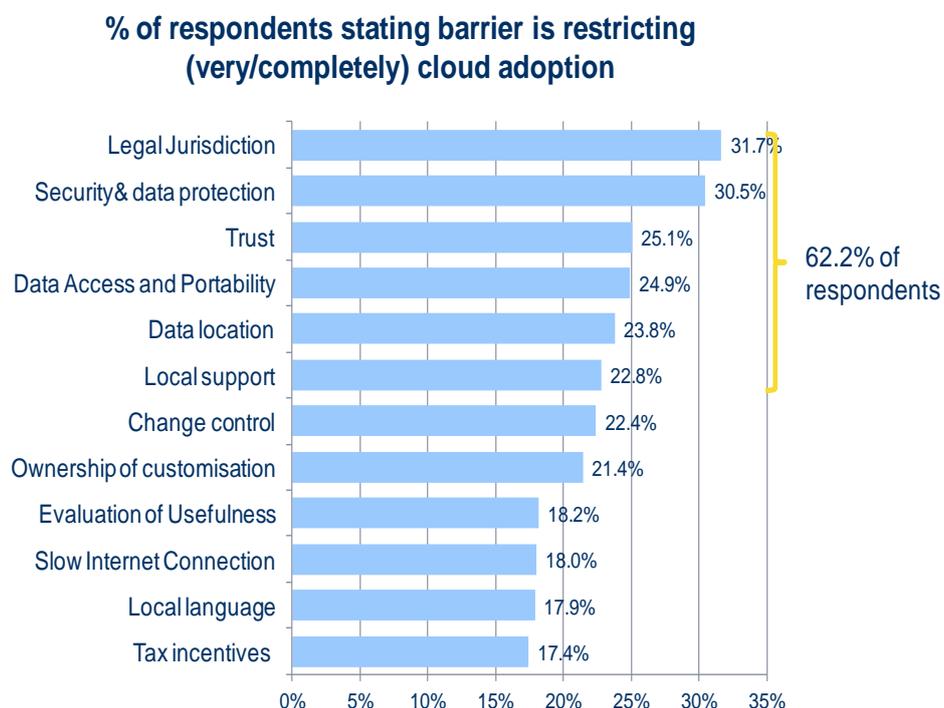
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

An analysis of the top three barriers by user group also gives interesting results.

- **Full cloud users in more than one area** are most concerned with barriers that call for policy intervention (security and data protection, legal jurisdiction, data access and portability);

- **Full cloud users in only one area** are more concerned with a mix of barriers, ranging from legal aspects (legal jurisdiction) to trust and the ability to control software changes;

- **Limited/trial users** are concerned with security, but also with the ownership of customization and the lack of local support;

- **Users planning cloud adoption** are particularly worried with security and data protection, data access and portability, and limited local support;

- **Non-cloud users** (whether they are thinking of it or not) consider security and data protection, data access and portability, and lack of local support the main issues restricting their potential adoption or plans.

4.2 Assessment of Barriers' Relevance

The data in Figure 13 refers to companies' own assessment of barriers; what they said in the survey to be restricting their cloud usage. To understand to which level each barrier is really impacting cloud adoption and plans, IDC undertook a more in-depth analysis of survey results, considering two broad groups of companies for each barrier (companies that said the barrier is strong and companies that said the barrier is low to moderate) and two main indicators[3]:

- **Indicator 1: Companies' own assessment of cloud relevance:** it measures companies' own assessment of the relevance attached to the different barriers and represents the ranking of importance as indicated by EU companies in the survey, weighted to give more relevance to responses of SMEs (the laggards on the cloud journey).

- **Indicator 2: Average impact indicator:** built as an average of the following "impact" indicators:

  o **Impact on current cloud adoption:** it measures the impact the barrier has on the adoption of cloud, by evaluating the difference in the adoption status of companies that assigned low to moderate relevance to a barrier versus those that assigned strong relevance to the same barrier.

  o **Impact on current cloud intensit**y: it measures the impact the barrier has on the number of cloud solutions companies adopt, by evaluating the difference in the adoption status by solution area of companies that assigned low to moderate relevance to a barrier versus those that assigned strong relevance.

  o **Impact on non adoptio**n: it measures the relevance of the barrier for companies not adopting/planning to adopt cloud, by evaluating the difference in the rate of non adoption of companies that assigned low to moderate relevance to a barrier versus those that assigned strong relevance.

  o **Impact on cloud plans:** it measures the impact the barrier has on plans for adoption of cloud, by evaluating the difference in the adoption plans of companies that assigned low to moderate relevance to a barrier versus those that assigned strong relevance.

  o **Impact on the evolution of cloud intensity:** it measures the impact the barrier has on the number of cloud solutions companies plan to adopt, by evaluating the difference in plans of adoption by solution area of companies that assigned low to moderate relevance to a barrier versus those that assigned strong relevance.

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[3] More details in Deliverable 3 of this study "Analysis of Barriers"

Key findings related to each "impact" indicator include:

- Evaluation of usefulness, ownership of customisation, data access and portability, and local language have the strongest impact on *current cloud adoption*.

- Legal jurisdiction, evaluation of usefulness, and trust are hampering *current cloud intensity.*

- Data location, data access and portability, security and data protection are the key barriers hampering *plans of adoption*.

- Trust, legal jurisdiction, security and data protection, and data access and portability are the key barriers *stopping investments*.

- Evaluation of usefulness, legal jurisdiction, trust, security and data protection hamper the *strengthening of cloud intensity*.

A comparison of Indicator 1 (companies' own assessment of barriers' relevance) and Indicator 2 (the average of the impact indicators described above) provides a reality check of what companies perceive as key barriers and how barriers have really impacted adoption and are impacting current plans of investment.

The comparison is shown in Table 2. It is evident that EU companies in the survey have undervalued the impact that some business-related barriers have on cloud adoption. More specifically, the evaluation of usefulness – the assessment of the business case - has quite an impact on actual adoption and plans, particularly for SMEs, as it usually happens with emerging technologies. The availability of cloud solutions in the local language is also more important than what companies indicated in the survey. The lack of transparency of ownership of customised changes made to the cloud solution is also a more important barrier than claimed by EU enterprises, particularly for large ones. On the other hand, the impact of barriers linked to regulation and policy appears to be high, but relatively less relevant than originally claimed by enterprises, particularly by SMEs.

Therefore, the reality check (comparing perceived relevance of barriers with their synthetic impact indicator) provides a somewhat different view of the barriers, raising business-related issues. Unfortunately, this does not lessen the need to remove the other regulation-related barriers, as shown in the following paragraphs.

TABLE 2 BARRIERS' ANALYSIS: REALITY CHECK

	Indicator 1 - Assessment of cloud relevance	Indicator 2-Average Impact Indicator
Legal Jurisdiction	1.00	0.72
Security& data protection	0.93	0.70
Trust	0.86	0.70
Data Access and Portability	0.79	0.66
Data location	0.71	0.58
Local support	0.54	0.42
Change control	0.45	0.33
Ownership of customisation	0.36	0.61
Evaluation of Usefulness	0.27	0.84
Slow Internet Connection	0.18	0.17
Local language	0.09	0.45
Tax incentives on capital spending	0.00	0.22

Indicator range: 0 to 1, where 1 = most important barrier.

Source: IDC, 2012

To deepen the analysis further, the barriers were categorised based on their nature and the type of actions needed to overcome them, as follows:

Data Jurisdiction and Location*:* covering concerns about where data reside and which court/laws are applicable in case of a dispute:

- Legal jurisdiction

- Data location

Security and Trust*:* covering aspects of data security, data protection and overall reliability of cloud vendors:

- Security and data protection

- Trust

Portability and Technology Transparency/Control*:* grouping technical concerns over data (and business processes') portability from one vendor to another and onto companies' own IT systems; fears of losing control over software changes; and lack of transparency over ownership of customization of cloud solutions done by end-users:

- Data access and portability

- Change control

- Ownership of customisation

Business*:* including business issues related to enterprises' evaluation and understanding of cloud services and the type of support given to users:

- Lack of Local support

- Evaluation of usefulness

- Lack of Local language support

Industrial policy*:* barriers related with issues that go beyond the specific cloud computing market and would require interventions of industrial policy, rather than cloud policy. They include:

- Slow Internet connection (obviously related with broadband infrastructures development and investment policy);

- Tax incentives on capital spending (by promoting the purchase of hardware, they discourage enterprises from switching to the cloud model based on the payment of services. This barrier is particularly relevant for the accounting rules of the public sector).

The table below shows how top barriers to the cloud are currently a mix of data jurisdiction and location issues, security and trust, and business concerns.

TABLE 3 FINAL BARRIERS' RELEVANCE

Cluster	Barrier	Final Barrier Relevance	Ranking of barrier relevance
Data jurisdiction and location	Legal Jurisdiction	0.78	1
	Data location	0.60	6
Security and Trust	Security& data protection	0.75	2
	Trust	0.73	3
Portability and technology transparency	Data Access and Portability	0.68	5
	Ownership of customisation	0.56	7
	Change control	0.35	10
Business	Evaluation of Usefulness	0.73	3
	Local support	0.44	8
	Local language	0.38	9
Industrial policy	Tax incentives on capital spending	0.18	11
	Slow Internet Connection	0.17	12

Indicator range: 0 to 1, where 1 = most important barrier.

Source: IDC, 2012

4.3 Impact of Cloud Barriers for SMEs

As SMEs lag behind large companies in the cloud journey, it is interesting to analyse data by company size to understand what is hampering adoption at the low-end of the market. IDC went through the analysis of the indicators presented for the total market, for both SMEs (<250 employees) and large companies (>250 employees). Summary results of the impact of barriers for SMEs are presented in Table 4.

The following considerations emerge:

- **Evaluation of usefulness** is a much higher barrier for SMEs than for other enterprises.

- **Trust** is one of the most important barriers for SMEs (with almost the same "impact" score of evaluation of usefulness), because of their need to rely on their suppliers, lacking specialised resources to deal with them.

- **Lack of solutions in local language** has a medium relevance for SMEs.

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- **Ownership of customisation** is less relevant for SMEs than for other companies.

The analysis of impact indicators confirms that large companies have a realistic perception of their current top barriers to cloud adoption, with a high coherence between their assessment of relevance and the impacts. This is particularly true for legal jurisdiction and security and data protection barriers.

On the contrary, SMEs appear to suffer from a gap between their perception of barriers and their behaviour. SMEs assigned strong importance to legal jurisdiction, security and data protection and data location barriers. However, these barriers have so far had a more limited impact on cloud adoption compared to the evaluation of usefulness and trust.

Nonetheless, legal jurisdiction, security and data protection concerns have an impact on SMEs' short-term cloud plans (especially on plans for "non adoption"), which makes them areas to look at for the development of cloud among EU SMEs.

TABLE 4 BARRIERS' ANALYSIS: REALITY CHECK SMES

Barriers	Indicator 1 - Assessment of cloud relevance	Indicator 2 Average Impact Indicator
Legal Jurisdiction	1.00	0.57
Security& data protection	0.93	0.39
Data location	0.86	0.39
Data Access and Portability	0.79	0.73
Trust	0.71	0.79
Change control	0.54	0.36
Local support	0.45	0.47
Ownership of customisation	0.36	0.51
Evaluation of Usefulness	0.27	0.83
Local language	0.18	0.44
Slow Internet Connection	0.09	0.17
Tax incentives on capital spending	0.00	0.26

Indicator range: 0 to 1, where 1 = most important barrier.

Source: IDC, 2012

4.4 Impact of Cloud Barriers for the Public Sector

There is reason to believe that the public sector may suffer from higher barriers to cloud adoption than the private sector, because there is a lower level of intensity of adoption of cloud services. Therefore, IDC analysed the relevance and impact of barriers in the survey results for the government, healthcare and education sectors (public sector: 239 respondents) versus all other vertical markets (private sector: 817 respondents). This further breakdown of the survey data has lower reliability than aggregated results, but provides some useful indications.

- Security and data protection are the most important barriers for the public sector. The analysis of impact indicators confirms the relevance of this barrier on cloud adoption and plans of adoption. This barrier is also relevant for the private sector, but less so.

- Trust and evaluation of usefulness have so far had a stronger impact on public institutions' cloud strategy than what they claimed in the survey.

- Legal jurisdiction, data location and data access and portability had a lower impact on the public sector's cloud strategy than what they perceive. However, legal jurisdiction is already hampering current cloud intensity and short term plans of adoption. Data location also has a negative impact on short-term plans. Therefore, these barriers cannot be under-evaluated.

- Ownership of customisation has more impact on the cloud strategy of the private sector than of the public sector. The availability of solutions in local language is also somewhat more important than perceived for the private rather than for the public sector.

Based on this analysis, the public sector appears to be particularly sensitive to the regulation and policy-related barriers, and equally sensitive as the private sector to the issues of trust and evaluation of usefulness.

TABLE 5 BARRIERS' ANALYSIS: REALITY CHECK FOR THE PUBLIC SECTOR

Barriers	Indicator 1 - Assessment of cloud relevance	Indicator 2 - Average Impact Indicator
Legal Jurisdiction	1.00	0.64
Security& data protection	0.91	0.85
Data location	0.82	0.59
Data Access and Portability	0.73	0.50
Ownership of customisation	0.64	0.30
Change control	0.55	0.31
Local language	0.45	0.31
Local support	0.36	0.48
Trust	0.27	0.69
Tax incentives on capital spending	0.18	0.15
Slow Internet Connection	0.09	0.27
Evaluation of Usefulness	0.00	0.78

Indicator range: 0 to 1, where 1 = most important barrier.

Source: IDC, 2012

4.5 Evolution of Barriers' Relevance

Some barriers to the diffusion of an emerging technology tend to decrease naturally with time (for example, lack of awareness of its benefits). In order to assess the need of proactive actions to remove barriers, IDC analysed the evolution of relevance perceived over time. According to the survey (Figure 14), business users expect the following barriers to increase in relevance in the medium to long term:

- Security and data protection

- Data access and portability

- Service providers liability and responsibility

- Data location

- Legal jurisdiction

More than 43% of the business users interviewed point at security and data protection as an obstacle likely to become worse, rather than better, almost as many are concerned about data access and portability.

The other barriers indicated are also considered as here to stay by more than a third of the respondents of the survey. These opinions are shared by most of the stakeholders and highlight the need for positive action to overcome the critical barriers to cloud demand.

FIGURE 14 EVOLUTION OF BARRIERS' RELEVANCE

% of respondents

Barrier	Total	Barrier significantly strengthening over time	Barrier somewhat strengthening over time
Legal Jurisdiction	32.5%	8.5%	24.0%
Data location	32.5%	9.1%	23.4%
Service providers liability and responsibility	35.8%	9.3%	26.5%
Data Access and Portability	38.8%	10.5%	28.3%
Security& data protection	43.5%	14.4%	29.1%
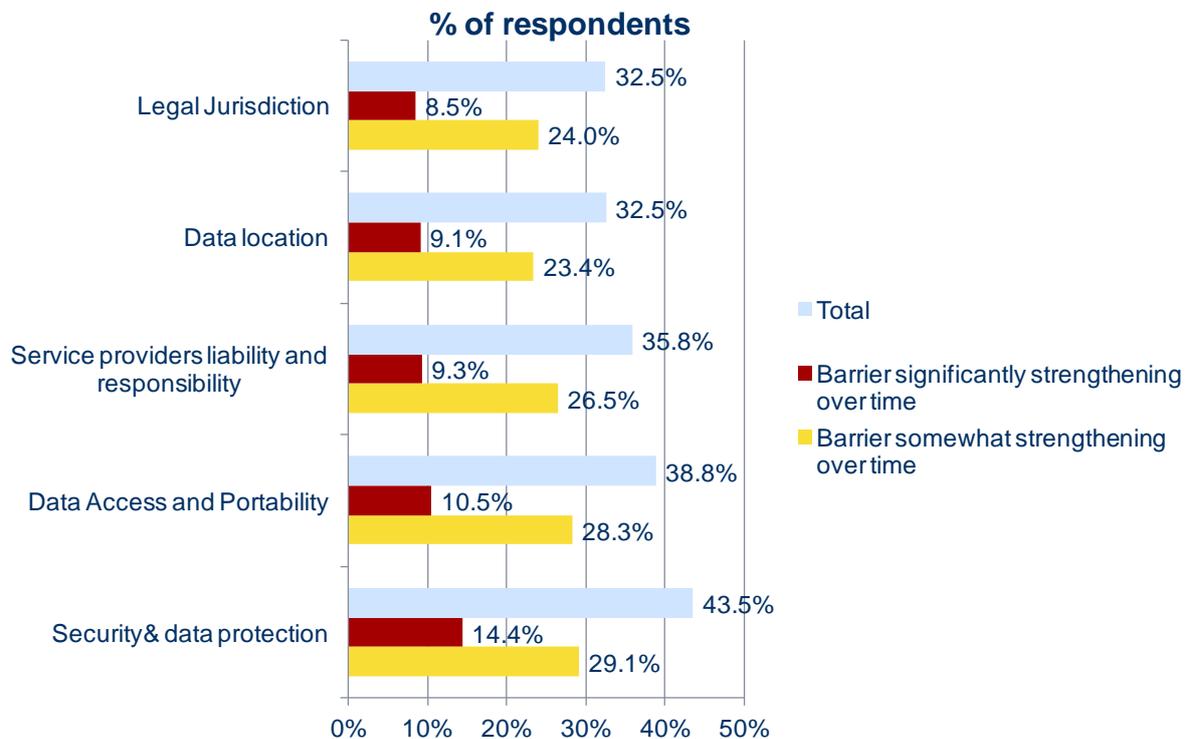
Source: IDC, 2012

Concerning portability, IDC believes that the more companies engage with cloud, the more portability issues will become relevant and difficult to solve. Accordingly, companies expecting data access and portability to become a more relevant barrier are already full cloud users in more than one area. In general, full cloud users in more than one area expect the significance of barriers to strengthen more than any other user group. This means that cloud intensity (measured as the number of cloud solutions adopted) is likely to remain limited unless actions are taken to overcome these barriers.

4.6 Conclusions on Cloud Barriers' Relevance and Impact

The impact analysis presented above confirms again that there is quite a long list of barriers to cloud demand in Europe, and most of them are likely to become more relevant in time. Overall, the analysis confirms that the real problem is the cumulative impact of barriers, since none of the problems identified is sufficient by itself to stop cloud adoption. Taken together, though, their impact on the speed of development of the market is unmistakable. However, there are differences in the perception and impact of barriers by type of user, which are important to know to guide policy action.

The main conclusions of the analysis are presented below (Tables 6 and 7), highlighting where assessment diverge between the public and the private sector, large enterprises and SMEs. The first table focuses on the impact of barriers in the current and short term (up to 2014). The second table describes expectations of the evolution of barriers' relevance in the longer term (up to 2020), based on the survey's results and IDC's assumptions on the natural evolution of the market with respect to technology and business issues, in the case that no action is taken to overcome the main barriers. Therefore, the second table is a first step towards the description of a "No Intervention" scenario, characterised by the absence of policy actions.

TABLE 6 SHORT-TERM FINAL BARRIERS' RELEVANCE

Cluster	Barrier	Short-term relevance of Barrier	Relevance for Large companies	Relevance for SME Companies	Relevance for the Public Sector	Relevance for the Private Sector
Data jurisdiction and location	Legal Jurisdiction	High	High	High	High	High
	Data location	Medium	Medium	Medium	High	Medium
Security and Trust	Security& data protection	High	High	Medium	High	High
	Trust	High	High	High	Medium to high	High
Portability and technology transparency	Data Access and Portability	Medium	Medium	High	Medium	High
	Ownership of customisation	Medium	High	Medium	Low to Medium	High
	Change control	Low to medium	Low	Medium	Low to Medium	Medium
Business	Evaluation of Usefulness	High	Medium	High	High	Medium to High
	Local support	Medium	Low	Medium	Medium	Medium
	Local language	Low to medium	Low	Low to Medium	Low to Medium	Low to Medium
Industrial policy	Tax incentives on capital spending	Low	Low	Low	Low	Low
	Slow Internet Connection	Low	Low	Low	Low	Low

Source: IDC, 2012

TABLE 7 LONG-TERM FINAL BARRIERS' RELEVANCE

Cluster	Barrier	Long-term relevance of Barrier	Relevance for large companies	Relevance for SME Companies	Relevance for the Public Sector	Relevance for the Private Sector
Data jurisdiction and location	Legal Jurisdiction	High	High	High	High	High
	Data location	High	High	High	High	High
Security and Trust	Security& data protection	High	High	High	High	High
	Trust	High	High	High	High	High
Portability and technology transparency	Data Access and Portability	High	High	High	High	High
	Ownership of customisation	Medium	Medium	Low to medium	Low to medium	Low to medium
	Change control	Low	Low to medium	Low	Low to Medium	Low
Business	Evaluation of Usefulness	Medium	Low to medium	High	Low to medium	Medium
	Local support	Low to medium	Low	Low to medium	Low to medium	Low
	Local language	Low	Low	Low	Low	Low
Industrial policy	Tax incentives on capital spending	Medium	Low to medium	Low	Medium	Low to medium
	Slow Internet Connection	Medium	Low to medium	Medium	Low to medium	Low to medium

Source: IDC, 2012

There is clearly a cluster of highly correlated barriers, ranking high in relevance both in the medium and long term for all business users. They concern Legal Jurisdiction, Data Location, Security and Data Protection, Trust, and Data Access and Portability. This clearly shows that uncertainties about the way legal and security issues will be managed in the cloud environment are strongly correlated with uncertainties about the relationship with and trustworthiness of cloud providers. Data access and portability barriers are less relevant in the short term, but are expected to become more relevant in time for all stakeholders, as intensity of cloud usage increases.

The impact of barriers varies by type of user. The problem of data location ranks high for the public sector in the short term, more than for the private sector and for SMEs. Large enterprises seem to have a clearer awareness of cloud benefits, while all other stakeholders have more difficulty in evaluating the usefulness of clouds; the lack of a clear business case for cloud computing for the public sector and SMEs is a

relevant obstacle to investment decisions, particularly to increase the intensity of cloud usage. In the medium-long term, uncertainty about the evaluation of usefulness is expected to remain a highly relevant barrier only for SMEs.

Regarding technology transparency and control, IDC believes that barriers should lessen over time, as the market matures and the interaction between players becomes clearer. The offering should grow in time, providing local support with local language where necessary. Nevertheless, uncertainty about the ownership of customisation is a relevant problem for large enterprises today, and will remain a medium level barrier in the longer term. This is clearly a sensitive issue, which cannot be left only to the negotiation between large business users and individual cloud providers, without some kind of reference framework to insure a level playing field and prevent users' lock-in.

On the other hand, escaping from the need to update and maintain software is one of the key drivers of cloud adoption, so that concerns about the control of software and services changes and updates should lessen in time. As the market matures, enterprises should start recognising the benefits related to automated upgrades done by vendors at no extra costs. IDC believes that this should be particularly true in the SME area, while large companies with big IT departments may still fear losing control of their IT systems.

Finally, the existence of tax incentives for capital spending, particularly in the public sector and for SMEs (which may counterbalance the economic benefit of moving to the cloud model of pay-as-you-go service) seems to have a low impact in the short term. However, it may increase in relevance in time, unless industrial policies on tax incentives are revised to take into account the cloud model.

Similarly, slow connectivity was indicated as a constraint to cloud adoption mainly by SMEs. Clearly, eliminating the coverage gaps of broadband networks across Europe and insuring higher-speed networks diffusion is a key requirement for a cloud-friendly environment.

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5 CLOUD SCENARIOS TO 2020: NO-INTERVENTION VS POLICY DRIVEN

5.1 2020 Forecast: "No Intervention" Scenario

EU enterprises, especially large enterprises, have already embarked on a public cloud journey. There is strong evidence showing that adoption is growing fast, even though key barriers may limit the full potential of public cloud services' adoption. As discussed above, some of these barriers are likely to lessen in time, but many will not disappear without specific action.

Looking at the years ahead, if no actions are taken to overcome barriers, IDC expects the growth of public cloud services spending to slow down from 32.9% annual compound growth rate (CAGR) in 2011-2014, to 21.6% CAGR from 2014 to 2020. This compares to an expected growth rate of total IT spending in the EU from 2014 to 2020 in the order of 4% annually in the EU business segment (or 3.3% when considering other IT spending beyond cloud). So by 2020, IDC anticipates that in the "No Intervention" scenario, the public cloud services market will represent some 9% of the total IT market, that is some €35 billion overall (Figure 15).

FIGURE 15 PUBLIC CLOUD "NO INTERVENTION" 2020 SCENARIO
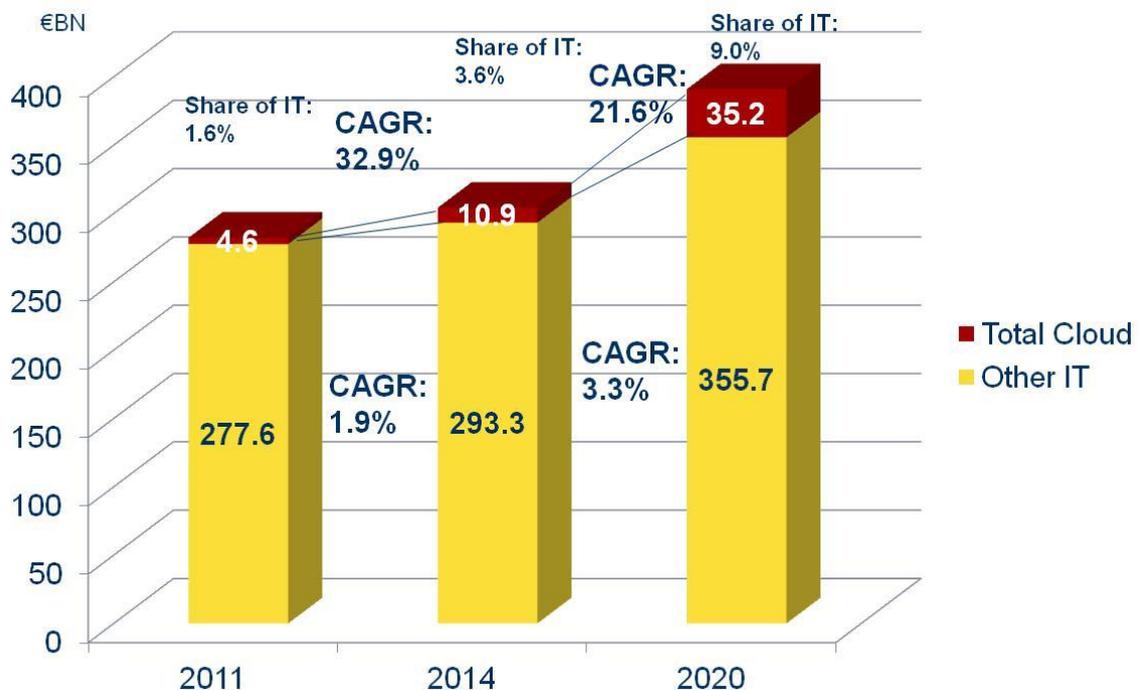
Source: IDC, 2012

This forecast scenario is based on the strict assumption that no EU policy intervention directly related to addressing and relenting some of the most pressing issues around cloud is taken on, in particular for legal jurisdiction, security and data protection, trust, data access and portability, and data location.

Although security and data protection will remain a barrier to cloud adoption, IDC assumes also in this scenario that there will not be a major security accident (in the EU or elsewhere in the world) that may further damage EU companies' confidence in the security of cloud services.

The other key assumptions of this scenario are the following:

From a *macroeconomic perspective*:

- No change to the EU27 market composition will happen and no country will exit the Euro area.

- After a period of weakness, the EU economy will return to moderate growth in the 2014-2020 timeframe, with average annual GDP growth expected to reach 1.6% in the 2014-2020 timeframe.

- After a difficult 2011 and 2012, unemployment will remain relatively stable starting 2013.

- There will be no factors/happenings/external shocks that may cause a big deviation from the long-term average of the EU business and consumer confidence indicators, for a persistently long time frame.

- Political instability in the Middle East will remain fluid but will not have a strongly adverse impact on the EU economic growth up to 2020.

- The €/$ exchange rate will remain relatively stable along the scenario forecast period.

In terms of capitalization:

- Bank loans will remain the primary source of funds for SMEs. Lending conditions to SMEs will have somewhat improved in 2014-2020.

- Venture capital investments will also moderately improve.

- There will not be a prolonged stock market plunge, as observed in mid-2011, which deteriorated business confidence driving lower economic expectations across EU countries.

In terms of labour supply:

- Lack of IT talents will remain a structural constraint, especially in SMEs. This should, however, favour the adoption of cloud computing.

- There will be an increasing focus on cloud specialists in the vendor community and universities will gradually start to adopt new approaches to teach graduates about cloud computing.

From a cloud infrastructure and offerings perspective:

- Broadband will evolve, but Internet connectivity will remain an issue in less business-intensive geographical areas.

- By 2020, more IT vendors will have entered the public cloud market, including traditional vendors and new entrants. The number of available offerings will also have increased. However, barriers' pressures will hamper the launch of cloud solutions that deal with most sensitive data and business processes (i.e. vertical specific applications).

- By 2020, IT vendors will have made some progress in building an effective channel targeting SMEs with tailored solutions.

Under these assumptions, cloud adoption of at least one solution will increase across all industries, but cloud intensity will remain limited, with most companies adopting cloud just in selected solution areas and not across the board. Basic cloud solutions (like e-mail and security) will experience the fastest growing demand. Due to lack of offerings, investments in cloud-based vertical specific solutions will lag behind. Compared to the expected annual rates to 2014, growth will lessen across all vertical markets. In particular, without clear rules around data location, protection, jurisdiction and overall actions aimed at improving trust, the government sector will remain a cloud laggard, with investments happening just in those solutions that do not include storing sensitive data and/or selecting domestic cloud providers, with local data centres.

EU SMEs will continue to rely on free cloud solutions (currently available or that will be available in the future), and consequently their spending will remain limited. In this market scenario, although the cloud perfectly suits SMEs' IT needs, it will not be able to generate a substantial "leapfrog" phenomenon. SMEs will focus on selected cloud functionalities, mainly free of charge. This will hamper the adoption of sophisticated IT solutions, and the realisation of benefits derived by increased automation and efficiency across key business processes.

5.2 Actions to Overcome Cloud barriers

As there is no single barrier to the cloud, there is also no single solution to cloud barriers. The study investigated a number of potential actions that could facilitate the adoption or strengthen current investments in cloud computing. They include:

- Standardisation: "Better interoperability and standardisation of cloud services, to guarantee choice"

- Connection: "Ensuring better and more reliable Internet connectivity for businesses"

- Accountability: "Clear rules about cloud service providers accountability and liability about security, no matter which country they are from"

- Security certification: "EU-wide certification of cloud service vendors on their security and data protection arrangements"

- Government certification: "EU-wide certification of cloud services vendors on suitability for government usage"

- Data jurisdiction: "EU-wide rules clarifying that my country's laws and only my country's laws apply to my data stored in another EU country"

- Customer rights: "EU-wide standards on the rights of customers of cloud services vendors".

- Incentives: "Funds or incentives to adopt cloud services"

- Portability: "Guaranteed data and applications portability between cloud vendors"

- Data protection: "Harmonized regulation about data protection standards, no matter where the data is"

- EU confinement: "Regulation forcing cloud services providers to store and back up corporate data only in the EU"

- Standardised contracts: "Standardised contract terms from cloud service providers so different vendors' offers can be easily compared"

- Remove local laws: "The removal of local laws and regulations that limit the use of cloud services"

Out of all these actions, EU businesses clearly indicated that the definition of clear rules about cloud service providers' accountability and liability regarding security, and portability of data and applications are the most important actions that would strengthen their cloud adoption (Figure 16).

Around one third of respondents mentioned accountability and portability. Better Internet connectivity and security certification also rank

high, with 26% of respondents mentioning these. These first four actions were indicated by 80% of respondents. Almost the entirety of respondents (96%) mentioned the first six actions (including also customer rights, data protection and data jurisdiction). As such, the analysis gives good indications on priority actions able to encourage cloud investments in the EU.

FIGURE 16 BUSINESS USERS' RANKING OF KEY ACTIONS TO IMPROVE CLOUD ADOPTION

% of respondents that ranked action 1, 2 or 3
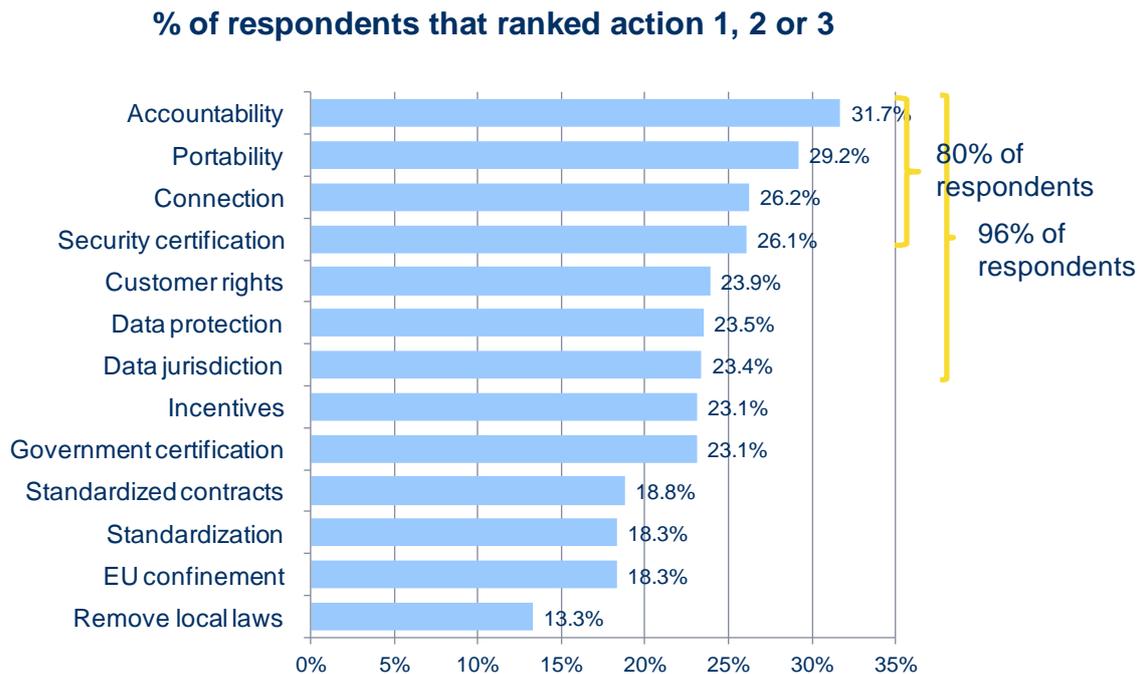
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

There are some differences by type of actor in the priority of actions suggested. Improving Internet connectivity is particularly requested by SMEs, who so far are lagging behind large enterprises in cloud adoption. Providing better access to funds and/or incentives to adopt cloud is appreciated by many enterprises, but again particularly by SMEs.

Almost a third of medium-large enterprises (over 250 employees) gave high marks to the provision of EU-wide certification of cloud services vendors on suitability for government usage. The same number of medium-large enterprises gives a high priority to actions ensuring data and applications portability between cloud vendors. Moreover, medium-large enterprises give a high importance to insuring customer rights across the EU, through EU-wide standards. Large enterprises, which are more likely to operate across multiple markets, evidently feel the need to be sure to comply with customer rights regulation, no matter which service provider they choose or where their data is located.

The public and private sectors share similar priorities for top actions about the accountability of service providers and their liability about security. However, private sector actors are much more interested in data portability than public actors are. Public sector organisations, on the other hand, are more interested in better Internet connectivity.

Clarifying data jurisdiction rules across the EU is a significantly more urgent action for organisations in the public sector than in the private sector. Obviously, public sector organisations also place a strong emphasis on the need for certification of providers' compliance to government requirements (mentioned by some 26% of public sector respondents, versus 22% of private sector respondents). Conversely, private sector respondents indicate stronger urgency than public sector respondents for actions related to security certification and EU-wide customer rights standardisation.

5.3 Impact of Actions on Cloud Investments

The survey investigated the potential impact of the actions mentioned on the cloud investment choices by business user. The results are remarkable. Almost half of the respondents declared that if actions were taken, they would start or increase investments in e-mail/calendar/diary and security solutions, respectively (Figure 17). More interestingly, 47.2% of respondents would invest in storage online, 43.6% would invest in cloud-based databases, and nearly one third of respondents would strengthen or start investing in most of the areas. In other words, there would be a definite positive impact on the acceleration of cloud investments.

FIGURE 17 IMPACT OF ACTIONS ON CLOUD INVESTMENTS BY SOLUTION AREA

% of respondents that would start investing/strengthen investments if actions were taken
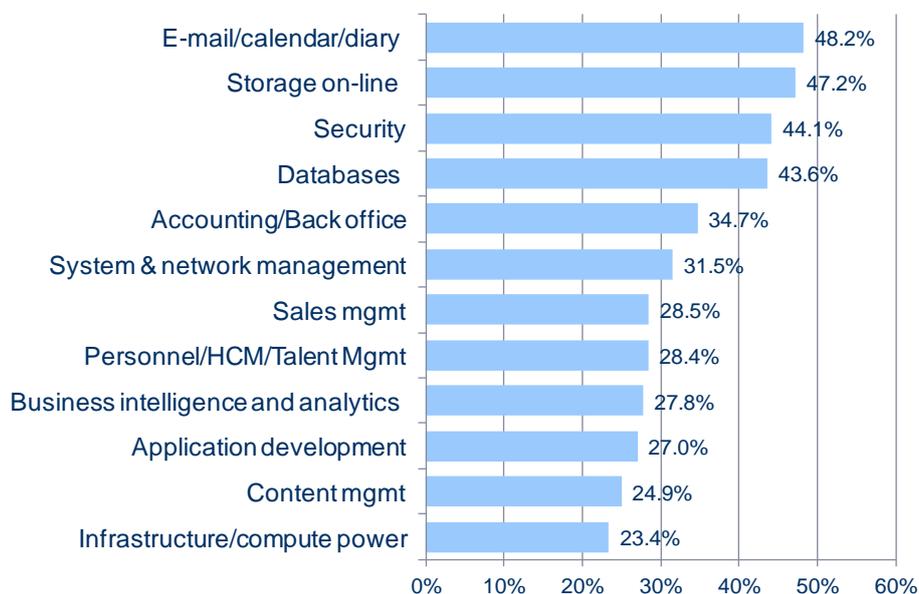
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

The analysis by cloud user groups provides even more positive results. More than 98% of companies would start or increase investments in at least one cloud area (up to 96% will invest beyond e-mail). If cloud barriers were removed, nearly 100% of companies that plan to adopt cloud (but have not yet invested), and more than 96% of companies that are just thinking about the cloud (without formal plans) will embark on the cloud journey. 93.6% of companies that are not planning, nor thinking about the cloud ("no cloud") will also start investing.

FIGURE 18 IMPACT OF ACTIONS ON CLOUD INVESTMENTS BY CLOUD USER GROUP

**% of respondents that would start investing/strengthen investments if actions were taken**
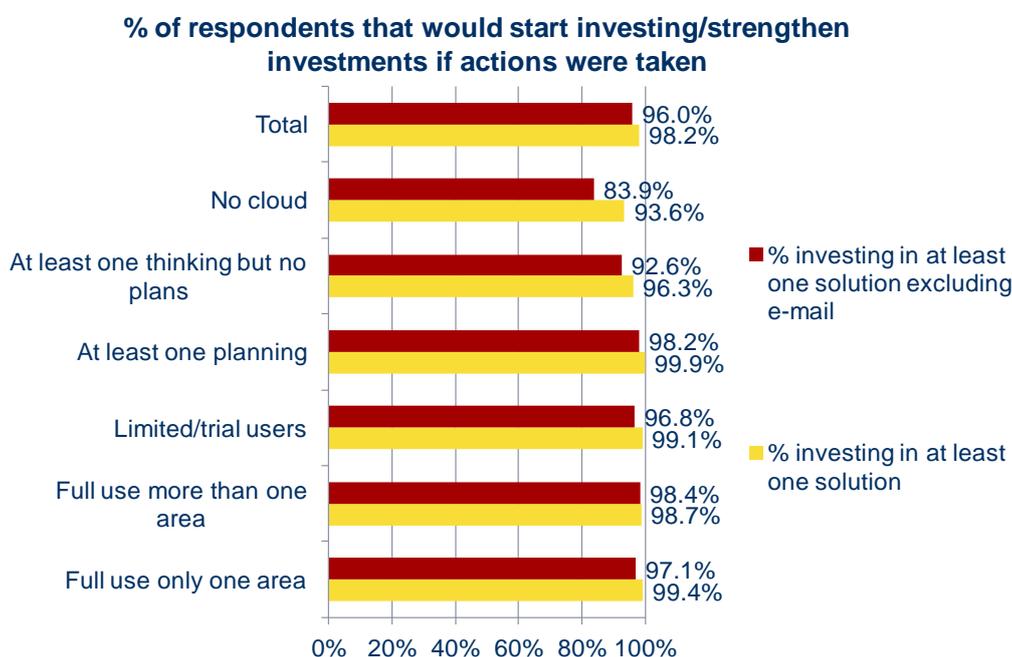
Data 2011 - % of respondents

Sample n=1056

Source: IDC, 2012

Not only would cloud adoption increase, but cloud intensity would also strengthen if key coordinated actions were taken. According to the survey, enterprises would invest in 4.1 cloud areas on average (3.6 excluding e-mail). This is true for all cloud user types: even companies not planning or thinking about the cloud would invest in at least 2.5 cloud areas (two excluding e-mail).

IDC acknowledges that these results are somewhat optimistic, and that enterprises do not always do what they say they will. Even when talking about short-term plans, not all of these translate into real investments. Nonetheless, the indication that barriers hamper cloud investments and that specific actions can help adoption is undoubtedly clear and strong.

5.4 2020 Forecast: "Policy-driven" Scenario

Building on the considerations presented above, we have developed an alternative "Policy-driven" scenario assuming that, in the short-medium term, the most important actions requested by stakeholders will be implemented. This includes the following:

- Accountability: "Clear rules about cloud service providers accountability and liability about security, no matter which country they are from"

- Connection: "Ensuring better and more reliable Internet connectivity for businesses"

- Security certification: "EU-wide certification of cloud service vendors on their security and data protection arrangements"

- Data jurisdiction: "EU-wide rules clarifying that my country's laws and only my country's laws apply to my data stored in another EU country"

- Portability: "Guaranteed data and applications portability between cloud vendors"

- Data jurisdiction: "EU-wide rules clarifying that my country's laws and only my country's laws apply to my data stored in another EU country"

- Data protection: "Harmonised regulation about data protection standards, no matter where the data is"

Addressing these issues would produce a strong impact on the demand for cloud solutions in the EU. Not only would more companies adopt the cloud model, but xcloud solutions would also become more pervasive across companies' business processes. Although not all investment intentions will translate into real investments before 2020, cloud intensity would significantly increase.

FIGURE 19 PUBLIC CLOUD "POLICY DRIVEN" 2020 SCENARIO
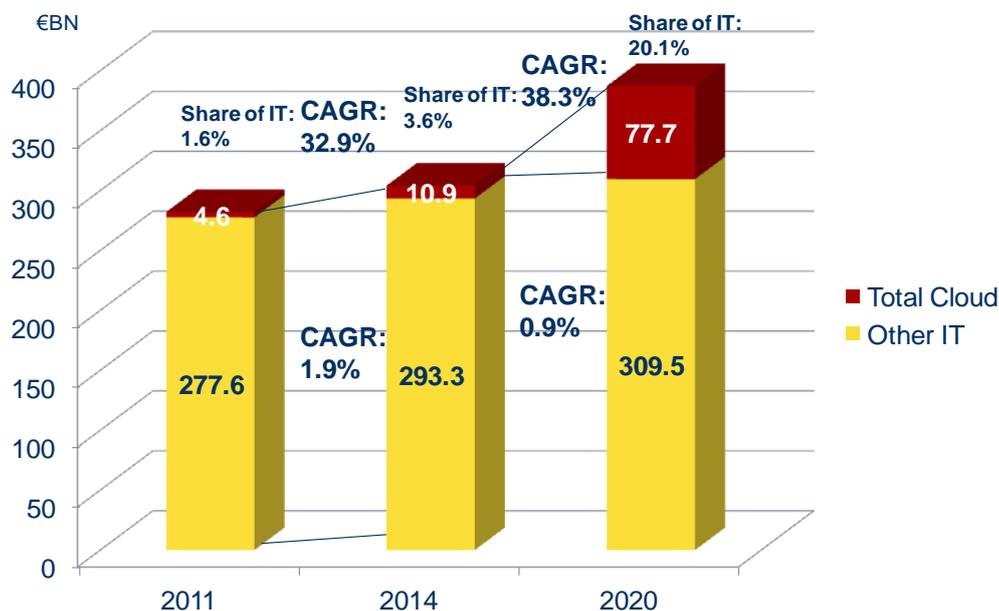
Source: IDC, 2012

In this scenario, IDC estimates that public cloud spending would grow at a 38% compound annual growth rate in the period 2014-2020 (diverging from the previous one from 2014). This would lead to a public cloud market of €80 billion in 2020 (Figure 19), more than double of the €35 billion in the "No Intervention" scenario.

The macroeconomic and business environment assumptions of this scenario are the same as for the "No Intervention scenario". The key variable that differentiates the two scenarios is the introduction of dedicated actions to increase cloud adoption. However, the resulting increase in cloud adoption and spending would have an impact on some of the assumptions presented in the "No Intervention" scenario.

More specifically, the following trends differentiate the "Policy-driven" scenario from the previous one:

- The demand for cloud specialists will increase much faster, creating more pressure on universities to educate new specialists.

- Increasing end-user demand and decreasing concerns will push the launch of new cloud solutions, not only in the traditional horizontal IT areas, but also in the vertical specific area. Increasing demand from SMEs will also push vendors to strengthen their channel cloud strategies and launch new and more solutions tailored at their needs.

- The availability of new solutions will strengthen demand from end-users, creating a positive cycle for the development of the cloud model in the EU.

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- Increasing investments in cloud solutions will have an impact on the rest of the IT market. This impact will be mixed:

    o Positive on software: more IT will be bought through the cloud, creating a shift in the way companies source and consume their IT products. The cloud would also facilitate the move from "home grown" systems to packaged software, with a positive impact on external software spending, and freeing up companies' internal resources. Moreover, the policy driven scenario assumes companies will start investing for the first time in new solutions they have never leveraged before, driven by evident benefits and low costs. The overall net impact on software growth should be positive.

    o Mixed on hardware: strong investments in the cloud will have a negative impact on enterprise hardware purchases (including servers, storage and network equipment). Indeed, savings on IT capital spending is and will remain one of the key drivers of cloud uptake. However, hardware investments from cloud service providers are set to increase, to face the need for increased capacity generated by strong demand for their services. Moreover, the impact on access devices (the PC, and more importantly mobile devices) should be positive, as cloud could become the real enabler of EU companies' mobility strategies.

    o Negative on selected IT services: IT outsourcing will see the largest negative impact, especially towards the end of the scenario period, as there will be substitution of existing services with cloud services. We do not expect negative impacts on IT consulting services. System integration and custom application development services will see lower costs per project, because of standardisation and the use of cloud-based tools, but the impact is expected to be less dramatic than in the outsourcing domain. IT deployment and support services will also see lower demand.

Under these assumptions, business IT spending (excluding cloud) should grow by just 0.9% annually in the period 2014-2020 in the "Polic-driven" scenario, against some 3.3% in the "No Intervention" scenario. Therefore, the total IT market (including cloud) in the 2020 "Policy-driven" scenario is just slightly lower than in the "No Intervention" scenario, but the cloud share increases from 9% in the "No Intervention" to 20% in the "Policy-driven". Despite lower spending (or thanks to the cost effectiveness of the cloud), in the 2020 "Policy-driven" scenario, EU companies' reliance on IT increases significantly.

This scenario assumes strong growth of cloud spending across all vertical industries, and in particular in the government sector, where several barriers have hampered large-scale cloud projects.

In this scenario, we expect SMEs (especially companies with 100-249 employees) to rely increasingly on cloud solutions. The share of SMEs'

spending on total public cloud spending will increase to 25% in 2020. By then, SMEs will dedicate 17.4% of their IT budgets to cloud solutions. More interestingly, although IDC assumes lower total IT spending in the "Policy-driven" scenario compared to the "No Intervention" scenario, total SMEs' IT spending would be higher in the "Policy-driven". Thanks to the cloud, more SMEs would adopt IT solutions for the very first time. In this setting, the cloud would help EU SMEs gain efficiency and help their competitive position on the global market. This is one of the key changes that positive action to remove cloud barriers could trigger.

5.5 Impact on the EU economy

The diffusion of cloud computing is expected to generate substantial direct and indirect impacts on economic and employment growth in the EU, thanks to the migration to a new IT paradigm enabling greater innovation and productivity. Building on the existing literature on the economic benefits of cloud computing and its own research, IDC has estimated the macroeconomic impact on the economy of the two cloud scenarios described above, as well as the potential number of jobs created.

As evidence shows, the direct impacts of cloud computing are more extensive if enterprises adopt the cloud model fully. Full cloud users in more than one application area see more benefits from their cloud investments, because they are able to exploit efficiency and effectiveness benefits from cloud services across their business processes. It is not just about cost savings, but also about increased standardisation of business processes, more effective mobile strategy, increased productivity, better scalability and flexibility, the ability to launch new services and enter new markets with reduced fixed costs (without the need to invest in costly IT infrastructures and equipment).

These positive direct impacts in turn generate a "multiplier" effect of indirect growth and economic activity, creating a virtuous cycle of development. This type of benefits is potentially very important for Europe, if it can help to increase the level of IT adoption by European SMEs, and to improve the productivity of the main services sectors, thanks to faster adoption of IT-based innovation[4].

But there is a risk that the slow diffusion of cloud services (as in the first scenario) may fail to trigger the "virtuous cycle" of innovation and growth and substantially reduce the potential benefits to the EU economy as a whole.

In order to assess the range of the potential benefits to the economy of the two cloud scenarios, IDC developed an impact model, building on the evidence collected in this study about the level of current cloud benefits. Of course, since this is still the early phase of diffusion of

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[4] Low productivity growth in Europe has been attributed to insufficient investment and exploitation of ICT innovation particularly in the services sectors. See: European Commission (2010) Europe's Digital Competitiveness Report, par.1.3 Investment in ICT European Commission: Luxembourg. Available at: http://ec.europa.eu/information_society/digital-agenda/documents/edcr.pdf

cloud, these must be considered as best effort estimates, to be revised in the future as cloud adoption deepens and there is more evidence about the macroeconomic impacts.

The main inputs used to develop these estimates were:

- This study survey results on capital cost savings thanks to cloud computing and other benefits;

- IDC's Economic Impact Model of Cloud Computing. This model takes conservative estimates of the degree to which public IT cloud services can increase IT innovation, and then uses standard revenue to IT spending ratios to estimate potential business revenues from public IT cloud services.[5] These increased business revenues are then equated with job creation using standard revenue per employee ratios based on the U.S. Bureau of Economic Analysis (BEA) Input/output tables and adjusted for each country. This model was the starting point for the model presented in this study, revised and adapted for the EU on the basis of the evidence collected in this study.

- IDC's Worldwide Black Book: a quarterly updated analysis of the status and projected growth of the worldwide ICT industry in 54 individual countries, providing end user spending for the main ICT technologies for the current year and five years forecasts.

- IDC's assumptions on cloud cost savings on internal IT resources.

- Main EU Member States Input-Output tables.

Macroeconomic Impacts by Scenario

According to IDC, the "No Intervention" scenario of public cloud adoption would generate €88 billion of contribution to the EU GDP in 2020. The "Policy-driven" scenario could generate up to €250 billion GDP in 2020, corresponding to an increase of €162 billion over the first scenario (Figure 20).

This increase of the EU GDP represents the aggregated direct and indirect impact of IT capital savings, of savings on internal resources, of increased revenues generated by a better ability to face peak demand, of overall improved business volumes by business users; of the creation of new innovative SMEs; and of the launch of new services by enterprises adopting cloud services.

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[5] White Paper "Cloud Computing's Role in Job Creation," February 2012, created for and sponsored by Microsoft

FIGURE 20 PUBLIC CLOUD IMPACT ON THE EU ECONOMY, 2020 (€BN)
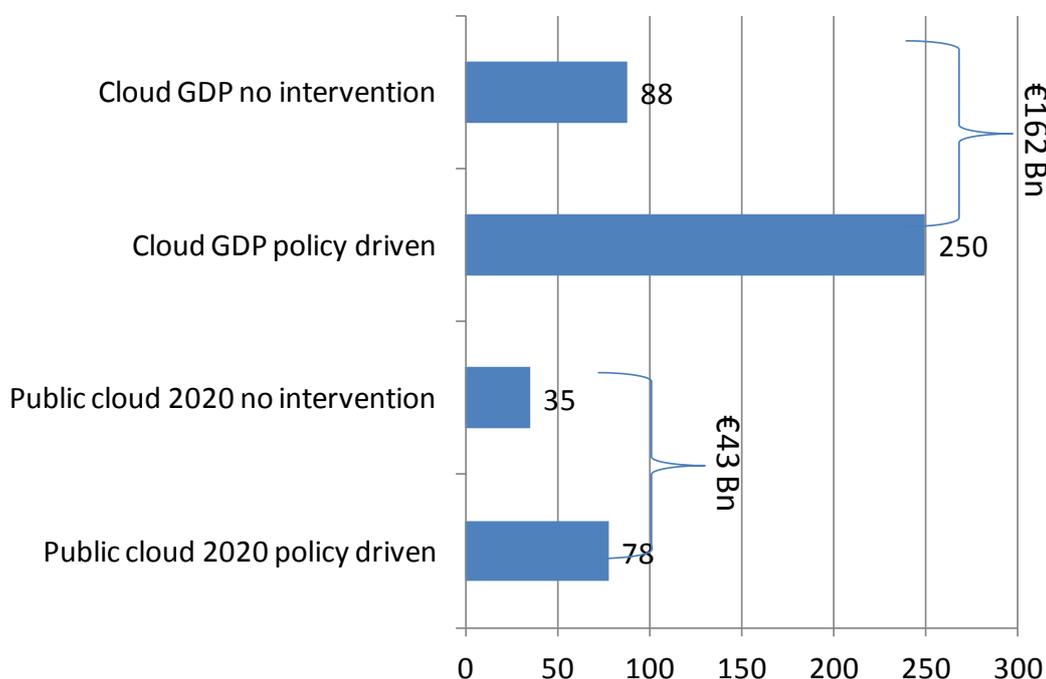
Source: IDC, 2012

As shown in Figure 20, the total value of the public cloud market in the "Policy-driven" scenario in 2020 is double the size of the market in the "No Intervention" scenario; but its positive impact on the EU economy would almost triple in the first scenario, compared to the second one, thanks to multiplier effects. Cumulative impacts are of course even stronger. IDC estimates a cumulative impact for the period 2015-2020 of some €940 billion in the "Policy-driven" scenario compared to €357 billion in the "No Intervention" one.

Estimating the impact on employment is more complex. Considering only the potential of creation of new jobs, IDC estimates that in the "Policy-driven" scenario cloud-related workers could exceed 3.8 million, against some 1.3 million in the "No Intervention" scenario. This does not take into account the jobs that would be lost or the workers that would be displaced by cloud-related reorganisation of business processes. The productivity increases driven by cloud efficiencies would most probably create in the short term an overall neutral (or even slightly negative) impact on total EU employment. However, in the medium-long term the overall dynamics of economic growth driven by cloud should result in a positive driver of employment, particularly considering the creation of new SMEs.

Analysing the impacts by sector, we estimate that savings in IT capital and internal resources will be stronger in finance, the public sector and overall among large companies, which have large IT departments and complex IT environments, difficult and costly to manage.

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The "Policy-driven" scenario assumes that many SMEs will start investing in IT solutions for the first time, gaining benefits such as improved efficiencies, increased business volumes and the ability to launch new services and enter new markets without high investments. In the case of SMEs, the primary benefits from cloud adoption will not be IT cost savings (which are low anyway).

Other Evidence from Literature

There are several studies estimating the economic impact of cloud computing based on economic models. At least two studies share IDC's basic assumption about the relevance of direct and indirect impacts on economic growth and jobs, corroborating indirectly IDC's estimates.

The Centre for Economics and Business Research[6] developed in 2010 an economic model to estimate the impact of widespread adoption of cloud computing on the five major economies of the EU (France, Germany, Italy, Spain, UK). According to this study, cloud computing (including public, private and hybrid) had the potential to generate over €763 billion of cumulative economic benefits over the period 2010 to 2015, corresponding to 1.57% of total cumulative GDP of the five economies over the same period. Cloud computing adoption (including public, private and hybrid) was also expected to yield annual net new jobs of 446 thousand across the five economies by 2015. These impacts were attributed to three main drivers:

- Cost savings on IT budgets;

- Increased revenues thanks to new business development opportunities (such as handling more efficiently and effectively business peaks in the retail or tourism sectors, exploiting the flexibility and scalability of cloud services);

- The creation of new businesses, thanks to lower market entry barriers, again due to cloud services.

The cumulative impact of these three drivers was expected to generate an economic growth "multiplier", creating induced and indirect economic activity. Of course, these estimates were developed before the economic crisis struck again in 2010, and today seem optimistic, even if the analysis of the growth mechanism seems valid. In addition, this study focused on the impact of public cloud services only, while private and hybrid cloud systems are likely to have a very high impact as well.

In the paper "Economics of Cloud Computing"[7], economist Federico Etro presents two possible scenarios: slow diffusion of the new technology leading to a 1% reduction of the fixed production costs, and rapid

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[6] "The Cloud Dividend" by CEBR LTD, The economic benefits of cloud computing to business and the wider EMEA economy France, Germany, Italy, Spain and the UK – December 2010
http://uk.emc.com/collateral/microsites/2010/cloud-dividend/cloud-dividend-report.pdf

[7] "The economics of cloud computing" by Federico Etro, Department of Economics, University of Venice Ca' Foscari, February 2011
http://www.intertic.org/Policy%20Papers/JManEc.pdf

adoption leading to a 5% rapid reduction in the fixed costs. In the first scenario, cloud computing is expected to generate additional GDP growth in the main EU economies of approximately 0.1% a year; in the rapid adoption scenario, GDP growth could go up to 0.4% in the medium run (up to 5 years). According to Etro, the most relevant benefit of cloud adoption is the generalized reduction of the fixed costs of entry and production, in terms of shifting fixed capital expenditure (CAPEX) in ICT into operative costs (OPEX) depending on the size of demand and production. This contributes to reduce the barriers to entry, especially for the SMEs, with a strong potential impact on the creation of new enterprises, new jobs, and the exploitation of new business opportunities. According to Etro, this mechanism could lead to the permanent creation of up to 400,000 new SMEs in Europe. In the phase of introduction of cloud computing, the creation of new jobs could vary between 300,000 jobs in the slow adoption scenario and 1 million jobs in the rapid adoption scenario.

6 RECOMMENDATIONS

The "No Intervention" and the "Policy-driven" scenarios have been designed as polar opposites in a range of possible outcomes of the development of the cloud computing market in Europe. However, they show clearly the potential benefits for the EU economy and industry of a proactive policy action, able to remove the main barriers to cloud adoption described in depth in this report.

Based on this study's analysis of the key stakeholders' needs and requirements, we present here our recommendations for the most relevant policy actions which should be included in the European Cloud Computing Strategy to create a "cloud friendly and proactive environment" in the EU and maximize the chances of achieving the benefits identified in the "Policy-driven" scenario.

While some of the issues addressed are perceived as more relevant than others, it is their cumulative impact which represents the real constraint for the market development. Therefore, we consider all the recommendations as equally important in principle.

Removing Regulatory Barriers

The policy actions for removing key regulatory barriers should be the following:

- **Harmonising and clarifying personal data protection and privacy protection rules across the EU, protecting citizens' rights but simplifying bureaucratic requirements, no matter where the data is and developing additional instruments such as standard clauses, codes of conduct or Binding Corporate Rules for international data transfer.**

This is a crucial policy action for all stakeholders: business users operating across the Internal Market, who want to be sure that using cloud computing services will not lead them to violate their customers' rights in some member states; cloud providers, who want to be compliant with regulation without negotiating with 27 Data Protection Authorities; and citizens, who want to be sure that their rights are protected no matter where their data is hosted.

The current proposal of reform of the 1995 Directive on Data Protection appears to go in that direction.

- **Clarifying data jurisdiction regulation and providing EU-wide guidelines about which laws apply to data stored in the EU member state or elsewhere**

There is too much uncertainty about which laws apply to data produced in a member state and stored in another, not to mention outside of the EU. The business users would like to be sure that their data would be subject to their national laws, no matter where it is stored. But many governments have laws requiring to be granted access according to their own regulatory principles, in the name of national interests, if the

data is stored in their territory or if the cloud provider is of their nationality (for example the US Patriot Act). IT vendors would prefer that the EU prepared general guidelines, to avoid having to choose between their clients' interests and the requests of some government.

- **Favour the identification and removal of local laws and regulation that limit the use of cloud services**

Besides data protection regulation, some member states have local laws and regulations about the relationship between customers and service providers that may hinder the adoption of public cloud services, particularly in the public sector. The European Commission should continue monitoring the regulatory framework and collaborate with the member states to update national and local regulation so that these restraints are removed.

Building Trust in the Market

- **Establishing clear and harmonised principles about cloud service providers' accountability and liability, particularly about security breaches.**
- **Develop standardised contract terms from cloud service providers so that vendors' offers can be compared easily, to improve choice**

The first step towards reducing uncertainty about the trustworthiness and reliability of cloud service providers is the creation of a transparent and consensus-based set of principles about their accountability and liability. Users would like to drop all the main problematic issues of the cloud market on the shoulders of the vendors, from compliance to multiple data protection requirements, to the responsibility for any security breach and/or possible violation of customers' rights. While this is not a likely scenario, it is also not acceptable to continue with the present situation, where cloud providers may choose not to be responsible for anything, from guaranteeing data access to guaranteeing integrity and security. In the current situation, the definition of contractual terms is left to private negotiation. This weakens the position of SMEs, who do not have the power to negotiate improved terms.

Therefore, the European Commission should take the lead to develop clear and harmonised principles about cloud providers' accountability and liability. In addition, the development of a set of standardised contract terms in order to implement these principles, on the basis of consensus-based definitions, would be extremely useful to insure comparability of offerings and the ability of business users to choose the best provider for their needs.

- **Identify a minimum set of SLA (service level agreements) which could become a quality standard for the cloud market**
- **Establish EU-wide certification or quality labels of cloud service vendors on**

- o **Their security and data protection arrangements and guarantees, certified by the EU Data Protection Authorities**
- o **Their suitability to serve the government market with full compliance with all necessary regulation**

The next step to build trust in the market is to identify a minimum set of quality standards for cloud service provisions and develop an EU-wide scheme of certification or quality labels for cloud service vendors. This could be a mandatory scheme with third party validation, or a volunteer scheme, based on transparent and clear documentation of offerings. Since the cloud is a global market, a volunteer quality label system would probably work best to gain the consensus of cloud providers. For such a scheme to be respected, it would still need the definition of a minimum set of standards for service level agreements and the identification of independent, third-party experts providing at least some validation of the vendors' statements and the possibility to retire the quality label if the respect of the quality standards is proven to be insufficient.

The current proposal of revision of the Data Protection Directive foresees that multinational business organisations can deal with only one Data Protection Authority in the country where they have their main establishment. However, the cloud market would require something more: the certification of compliance of data protection regulation for all member states, issued by a one-stop Data Protection Authority. This would be an undeniable progress over the current situation.

- • **Create a one-stop EU portal to collect, examine and deal with cloud users' complaints and problems about the quality of cloud services and cross-border issues of data protection, data jurisdiction, quality of cloud services.**

The creation of a cloud proactive environment in the Digital Single Market would benefit greatly from the existence of a web portal, launched and managed by an independent third party, sponsored by the European Commission, providing a one-stop information and complaint collection point for business users, particularly for cross-border issues.

If cloud adoption increases rapidly, there are likely to be new problems and issues between users and vendors, not easily solved at national level, for which enterprises (particularly SMEs) may be at a loss on where to go or with whom to talk. While this web portal would not have the authority to actually solve problems or contractual issues, it could go a long way in providing clear information and action guidelines for enterprises, helping them navigating the multi-layered European ecosystem and defending their rights. Providing a one-stop information and support point for cloud users therefore could be a very useful tool to create trust in the cloud market. This one-stop point could be, for example, modelled or linked with the network of one-stop points of access for e-government and e-business services being developed to implement the Services Directive. This could also be a useful tool to help enterprises solve problems related to lock-in in proprietary systems.

Protect Consumers' Rights to Control Their Data and to be Forgotten

- **The European Commission should make sure that the consumers' rights of access, control, correction and deletion of personal data are respected and implemented by all cloud providers, no matter their nationalities.**

The survey highlighted that consumers' priority concerning personal data protection and privacy is to be able to control, correct and delete their data when so desired. The "right to be forgotten", i.e. that consumers' data will actually disappear from cloud systems if deleted by the owner, is a priority. Consumers have become aware that this apparently simple principle is not so easy to implement in practice and would like to have guarantees that this right will be respected.

Ensuring Data Access and Portability of Data, Applications and Services

- **The European Commission should create the pre-conditions so that the principle of data access and portability between cloud vendors is widely accepted and the risk of lock-in of users in proprietary systems is prevented.**

Business users must be able to switch from a cloud vendor to another without unacceptable costs. It is clear that switching suppliers will always be more complex and difficult for value-added services such as CRM rather than for simple applications such as e-mail (but even in that case there may be hidden difficulties). The EC should defend and support this principle, as such, and in practice by incorporating it in the contractual rules, clarifying aspects such as ownership of customisation of services and applications performed for cloud services and of course of the related data. The definition of what are in practice "unacceptable" migration costs could be a useful part of this action.

Promoting Standardisation and Interoperability

- **The European Commission should promote common standards and interoperability of public cloud systems, to maximise economies of scale across the EU and create the preconditions for portability between cloud vendors**

The cloud market is currently characterised by a very high number of technology standards, at the EU and global level. It is very important that the EC will promote the development and interoperability of public cloud systems at the EU level, so that the benefits of public cloud systems are maximised across Europe.

Building the Business Case for Cloud Adoption

- **The European Commission should promote the awareness of the potential business benefits resulting from cloud adoption, particularly for SMEs, building on examples from successful business cases and providing evidence of positive impacts. In addition, it should sponsor further research on the modelling of the macroeconomic impacts of cloud adoption on growth**

and employment, and the analysis of the economies of scale resulting from the development of public cloud infrastructures in Europe.

Contributing to the Business Case for High-speed Broadband Infrastructures

- **The EC should highlight the demand for high-speed broadband infrastructures coming from cloud adoption, and conversely the risk that lack of broadband may be a barrier to cloud adoption, thereby reinforcing European and national plans for NGN development.**

Many large and small companies pointed out that insufficient and patchy high-speed broadband coverage remains a serious obstacle to full cloud adoption in the EU. The development of network infrastructures is not a specific objective of cloud policies. However, there is always a need to strengthen the business case for the investments needed to develop broadband networks in Europe. By providing evidence and estimates about the demand for such infrastructures arising from cloud users, and the potential benefits for the socio-economic system resulting from widespread cloud adoption, the EC could give a useful contribution to infrastructure development policies.

7 METHODOLOGY APPENDIX

7.1 Appendix 1: Survey Methodologies and Demographics

Enterprise Survey Methodology

The enterprise survey of 1,056 organisations was conducted online through a Computer Aided Web Interviews (CAWI) programme during November and December 2011 in the following nine countries: UK, Sweden, Czech Republic, France, Germany, Hungary, Spain, Poland and Italy.

The survey was conducted in local language with respondents with the following profile:

- Decision-makers responsible for company's ICT (Information and Communication Technologies) procurement and maintenance;

- Companies with at least a PC installed;

- Companies with less than 250 employees have also to be independent companies, not local subsidiaries of large multinational ones;

- A balanced representation of industry sectors: Manufacturing, Public Sector (Government, Healthcare and Education), Financial Services Sector (Banking, Insurance and Other Finance), Distribution Sector (Retail, Wholesale, Hotels and Restaurants), Telecommunication Sector and Other Services;

- A balanced representation of company sizes, based on the number of personnel employed, aggregated into the following segments: 1–9, 10–99, 100–249, and 250+ employees.

Enterprise Survey Weighting

The employment-weighting scheme was adopted. The enterprise-weighting scheme reflects the actual distribution of enterprises in the real world across size and industry. The employment scheme reflects the distribution of employees at enterprises across size and industry. Given the distribution of enterprises in the EU (biased to the very low-end of the market), the employment scheme is preferable for these types of the projects.

IDC followed a two-steps procedure to get weighted results:

- Country level: data have been weighted by number of employees by company size in each country

- EU level: data have been weighted by number of employees by company size interlocked by vertical market and by the employment contribution each country has to the total EU.

The criterion for selecting respondents was that they had influence on IT decisions in their organisations. Overall, 42.7% were the person who was solely or ultimately responsible for IT buying decisions, 41.2% were part of a group that influenced major buying decisions, and 16.1% made buying decisions that related to their area of the business.

The number of respondents was controlled by three other criteria: industry, country, and size of organisation.

Figure 21 shows the proportion of respondents by industry.

FIGURE 21 ENTERPRISE RESPONDENTS BY INDUSTRY

Industry Split (N=1056)
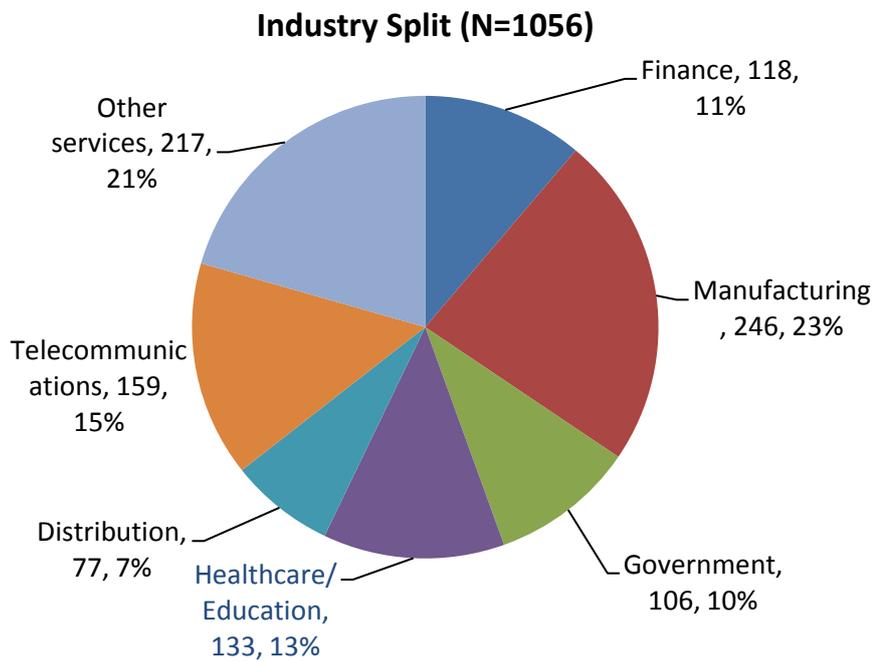
Source: IDC, 2012

Figure 22 shows the proportion of respondents by country.

FIGURE 22 ENTERPRISE RESPONDENTS BY COUNTRY

N=1056
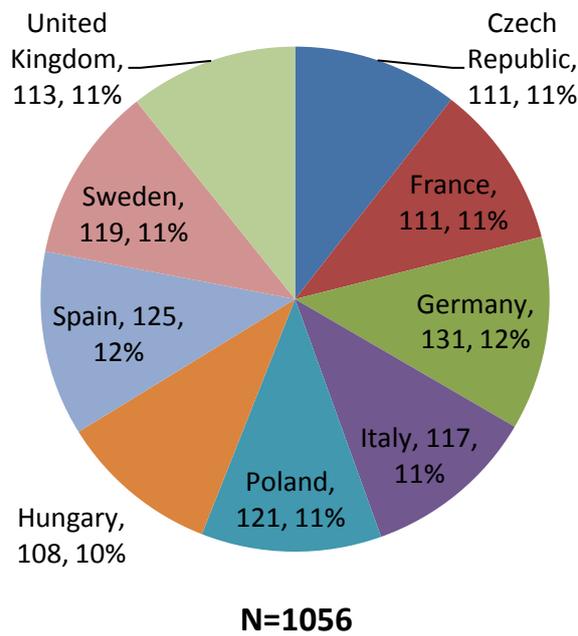
Source: IDC, 2012

Figure 23 shows the proportion of respondents by size of organisation.

FIGURE 23 ENTERPRISE RESPONDENTS BY ORGANISATION SIZE

N=1056
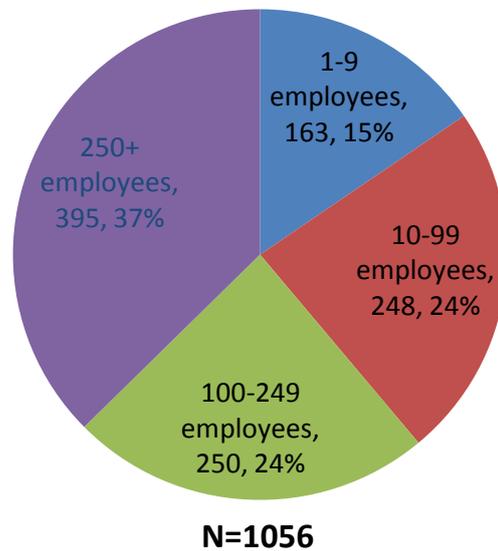
Source: IDC, 2012

Respondents were asked if the site whether where they worked was the location of their company's worldwide headquarters or a subsidiary. 51.7% said it was the worldwide headquarters, 34.0% said it was a subsidiary and the main country office, and 14.3% said it was a subsidiary but not the main country office.

Respondents were also asked if they made independent decisions just for the site they worked at or for other sites as well in the EU. 92.2% said they made independent decisions for their site only and 6.8% said they made decisions for other subsidiaries in the EU that reported to them. The wording of the question means that companies with a single site in the EU would be included in the 92.2% that make decisions for their site only.

Consumer Survey Methodology

The consumer survey of 947 people was conducted online through a Computer Aided Web Interviews (CAWI) programme during November and December 2011 in the following nine countries: Sweden, Germany, UK, France, Spain, Poland, Czech Republic, Italy, and Romania.

The survey was conducted in local language with respondents older than 14 years old.

Consumer Survey Weighting

The consumer survey was addressed to online individuals. Results can be extended only to online consumers and not the total of the EU population. The weighting scheme had to consider that. IDC weighted the results as follows:

- Country level: data have been weighted by number of Internet users by age in country

- EU level: data have been weighted by number of Internet users by age and by the contribution each country has on Internet users by age bands at the EU level.

### Consumer Survey Demographics

The following Figures provide the profile and demographics of the consumers surveyed.

FIGURE 24 CONSUMER RESPONDENTS BY COUNTRY
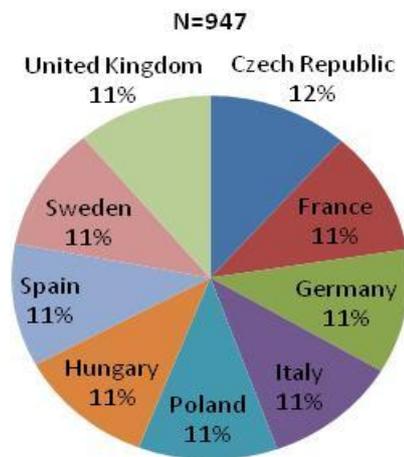
Source: IDC, 2012

FIGURE 25   CONSUMER RESPONDENTS BY AGE GROUP

Source: IDC, 2012

73
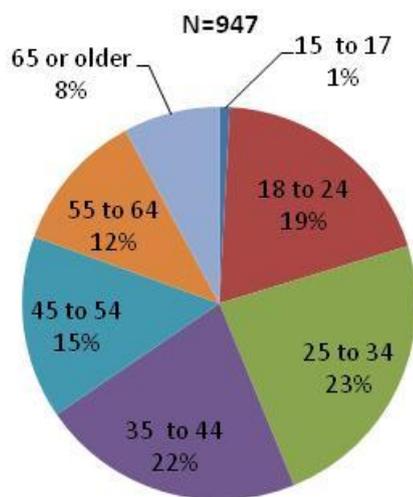
7.2 Appendix 2: Stakeholder Interviews Methodology and Demographics

Stakeholder Interviews Methodology

The large-scale surveys provide a large amount of data, but to delve deeper into the reasons behind the data, IDC undertook a program of 50 "in-depth" interviews with members of the cloud ecosystem and with selected market experts. The ca. 1 hour interviews were conducted by senior IDC analysts with particular expertise and detailed insights in cloud computing. IDC managed the contact-identification process, leveraging indications from the project team and IDC's network of analysts in Europe, to identify and make contact with these experts.

IDC developed three interview guidelines, one for each main stakeholder typology (supply side, demand side and other/academia). Rather than a questionnaire, the interview guidelines are checklists of topics to be covered, allowing for interaction with the interviewee. The main output of the interviews will be opinions and qualitative insights, which will be aggregated through a longitudinal analysis.

Stakeholder Interviews Demographics

The following tables provide details of the composition of the stakeholder interviews in terms of geographic region, type of stakeholders, vertical sector, etc.

TABLE 8: COMPLETED STAKEHOLDER INTERVIEWS BY REGION AND TYPE

	Users	Experts	Vendors	Total
Western European EU countries	14	6	15	**35**
Central Eastern European EU countries	8	3	5	**16**
Total	22	9	20	**51**

TABLE 9: COMPLETED USER ORGANISATION INTERVIEWS BY REGION AND INDUSTRY

	Manuf.	Public Sector	Transp. & Logistics	Media	Financial Services	Other	Total
WE EU countries	3	2	1	1	4	3	**14**
CEE EU countries	1	3		1	1	2	**8**
Total	4	5	1	2	5	5	**22**

TABLE 10 : COMPLETED EXPERT INTERVIEWS BY REGION AND TYPE

	Academia	Influencers/ Think Tanks	Expert Bodies	Total
WE EU countries	3	2	1	**6**
CEE EU countries	1	2		**3**
Total	4	4	1	**9**

TABLE 11 : COMPLETED VENDOR INTERVIEWS BY REGION AND TYPE

	Public Cloud	Telcos	Private Cloud	Total
WE EU countries	4	5	6	**15**
CEE EU countries	2	1	2	**5**
Total	6	6	8	**20**