INNOVATION IN THE CLOUD
BRIDGING UNIVERSITIES AND BUSINESS

IN-CLOUD

Erasmus+

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Project Number: 2015-1-IT01-KA202-004733

Analysis of the Training Needs and the Labour Market with relation to the Cloud Technologies and Services

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1. Introduction

1.1 Project Description

Recent studies emphasise the potential cloud computing prides on in terms of boosting SMEs' growth and encouraging entrepreneurial practices at all levels. Cloud Computing offers many opportunities and can help companies improve their business and use technology more efficiently[1,2]. Still, market trends indicate European SMEs are not making the best of the cost-effective solutions cloud computing has to offer. Smaller businesses can avoid large investments into hardware and software, entering the market more easily due to the cost-efficient, integrated cloud computing services. Universities themselves can greatly benefit from cloud computing, as its storage capacity and economic viability ensure more efficient research management techniques in all fields (business, medical, scientific etc.). Cloud computing is thus an optimal solution for the innovation-driven alliance between universities and companies.
While cloud computing arises a great interest in the corporate sector, several researches evidence a lack of professionals able to work in this field. According to the analyst firm IDC[3], in 2012 more than 1.7 million cloud computing jobs have remained unoccupied and the trend should lead to more than seven million cloud-related vacancies worldwide in 2015.

The European Commission has started several initiatives supporting the investment in entrepreneurship-boosting ICT and, more specifically, in September 2012 has adopted a strategy for "Unleashing the Potential of Cloud Computing in Europe".
The European Cloud Computing Strategy[4] includes three key actions; the most relevant is the creation of a "European Cloud Partnership" providing strategic options to turn cloud computing into an engine for sustainable economic growth, innovation and cost-efficient public and private services.

The IN-CLOUD proposal intends to operate pursuing the objectives of the European Cloud Computing Strategy, with the general objective of – fostering a partnership between Higher Education and the corporate sector, in order to qualify new professionals able to boost the competitiveness and growth of European Companies and Universities, thanks to the advantages offered by the cloud computing technology.

This objective is reached by pursuing the specific objectives of:

- raising awareness among European Companies, Public Administrations and Universities regarding how cloud computing can boost economical growth and innovation,
- creating VET qualifications, based on analysis of the use of cloud computing in companies, for professionals inside European Companies and Public Administrations,
- training staff to introduce and manage cloud computing technologies and services inside their organisations.

[1] S. Ouf, M. Nasr: "Business intelligence in the cloud", IEEE Third International Conference on Communication Software and Networks (ICCSN2011), pp. 650-655, 2011.
[2] M. Marian, I. Hamburg: "Guidelines for increasing the adoption of cloud computing within SMEs". Cloud Computing 2012: The Third International Conference on Cloud Computing, GRIDs, and Virtualization, pp. 7-10, 2012.
[3] IDC Report: "1.7 Million Cloud Computing Jobs Remain Unfilled, Gap Widening", 2012. Accessed on December, 28, 2015.
[4] European Cloud Computing Strategy, European Commission, 2012. Accessed on December, 28, 2015.

1.2 Objectives of Intellectual Output 1

The output consists of a report that is the basis for the development of the other project activities. It includes a description of the Cloud Computing, an analysis of the awareness of the existing cloud computing technologies and services in the private and public sectors, a needs' analysis of technologies and services connected to Cloud Computing in the public and private sectors, an analysis of the professional skills required in the area of Cloud Computing and an analysis of the labour market actual situation and prospective of employability. The first design of didactic units that can satisfy the identified didactic needs will be also proposed as a result of this output.

The realization of this output will be achieved through three activities.

Activity O1/A1 – Design of assessment instruments

This activity aims to define the strategy to be implemented for the analysis of the cloud computing state of are and of the professional skills required in the labour market. The items used for the analysis are:

- questionnaires submitted by Survey Monkey
- interviews of stakeholders
- existing sector studies, publications and reports at national and international levels

Activity O1/A2 – Needs' analysis and labour market analysis

The activity includes two tasks, an investigation of the Cloud Computing needs among companies and public administration and an analysis of the professional required by the labour market. Some existing studies and analyses on the cloud computing state of art have be collected and analysed.

Activity O1/A3 – Didactic units design

On the basis of the of the results of the needs' analysis and labour market analysis, the consortium has identified a set of topics where there is a relevant lack of knowledge, the need to improve skills or opportunity to create new competences. Then, the consortium will design a collection of didactic units addressing to the identified topics.

The didactic units will be designed for different targets (companies, public bodies, students and people in general).

For each didactic unit, the contents and the Learning Outcomes (LO) will be defined and the qualification level (from EQF4 to EQF7) will be identified.

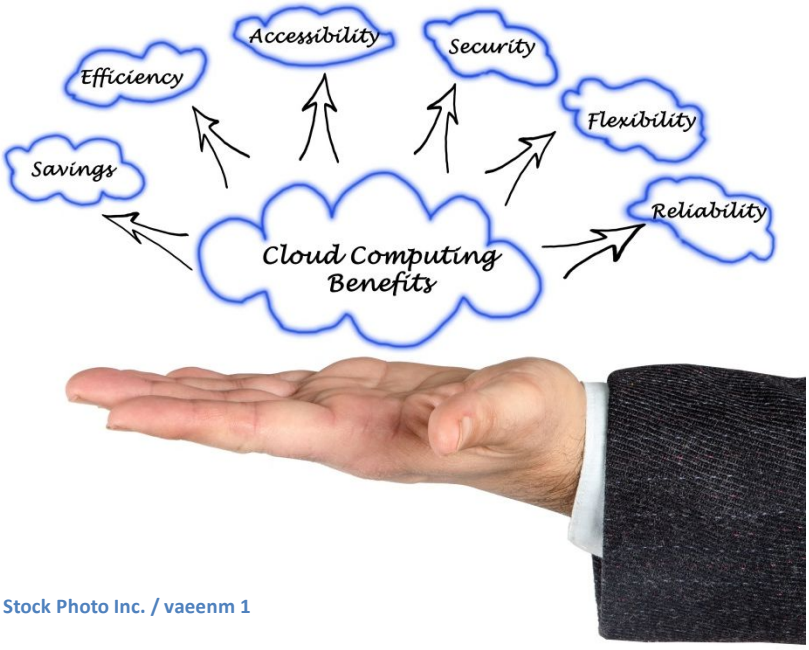
2. Cloud Computing

2.1 Overview

Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in third-party data centers[5]. It relies on sharing of resources to achieve coherence and economies of scale, similar to a utility (like the electricity grid) over a network[6].
Examples of cloud computing is Microsoft Office 365 that utilizes a form of cloud computing for storage (Microsoft One Drive). Other examples are the text processing Google Docs or the web-based file hosting service Dropbox.

2.2 Benefits of Cloud Computing

Cloud computing, as defined by the National Institute of Standards and Technology (NIST), is a model for enabling "… convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction", therefore organizations can improve their efficiency and their ability to respond more quickly and reliably to their customer´s needs[7].



Cloud computing is often referred to as a technology. However, it is actually a significant shift in the business and economic models for provisioning and consuming information technology (IT) that can lead to a significant cost savings. This cost savings can only be realized through the use of significant pooling of these "configurable computing resources" or resource pooling.

[5] M. Haghighat, S. Zonouz, M. Abdel-Mottaleb, "CloudID: Trustworthy Cloud-based and Cross-Enterprise Biometric Identification". Expert Systems with Applications, 42(21), pp. 7905–7916, 2015.
[6] "The NIST Definition of Cloud Computing", National Institute of Standards and Technology. Retrieved 24 July 2011.
[7] S. Marston, Z. Li, S. Bandyopadhyay, J. Zhang, A. Ghalsasi, "Cloud computing – The business perspective". Decision Supp Sys, 51, pp. 176-189, 2011.

Scalability & flexibility: The scalable systems of the cloud mean services and usage can expand or contract on demand. It is easy the adaptation to the size and needs of the organization.

Device & location independence, which enables users to access systems using a web browser regardless of their location or which device they are using. Capabilities for different platforms, such as mobile phones, laptops computers and personal digital assistants are available through broad network access.

Computing resources of the cloud provider are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.

Cloud capabilities can be provided to the subscriber rapidly and elastically, allowing the subscriber to either increase or decrease services. Cloud systems automatically control and optimize resource use through a capability that is appropriate for the type of service provided.

Software Updates: With cloud computing, the server maintenance is in the hands of people who do it professionally, so future upgrades are removing the need for costly and lengthy upgrade cycle.

Reliability refers to the probability that a system will offer failure-free service for a specified period of time within the bounds of a specified environment.

Sustainability through improved resource utilization, more efficient systems and carbon neutrality.

Security improvement due to centralization of data, increased security-focused resources.

Service delivery improvement, online services make the public service easier to use and new forms of use permits simplify managements. Public services are accessible easier, anytime and anywhere in the world, with the cloud appearing as a single point of access for all the computing needs of consumers, partners or citizens.

2.3 Cloud Service Deployment Models

There are deployment models to provide cloud services. Depending on by whom the services are provided and to which audience they are addressed, is referred to as[8]

- Public cloud
- Private cloud
- Hybrid cloud
- Community cloud

Public cloud: The public cloud is an offer of a free-access provider that makes its services openly on the Internet for everyone. Webmail services or the well-known Google Docs are also examples of public cloud offerings such as the paid services of a Microsoft Office 365 or a SAP Business by Design.

[8] A. Sulistio, C. Reich, F. Doelitzscher, "Cloud infrastructure and applications – cloudia". In: Jaatun, M.G., Zhao, G., Rong, C. (eds.), CloudCom. Vol. 5931, Lecture Notes in Computer Science, Springer, pp. 583-588, 2009.

Private cloud: For reasons of data protection and IT security the private cloud is attractive for businesses. Their IT services continue to operate and are available for their staff only. If they make use of scalable systems for their IT services, which are installation and maintenance free and can be made accessible by the web browser, then it is defined as a private cloud.

Hybrid cloud: The hybrid cloud is a mixed form of public and private clouds. While some services are run by free-access providers and are available through the internet, critical data and applications are stored and processed in a private cloud.

Community cloud: A special form of cloud is the community cloud. The cloud services are shared and used by several organisations in order to work together in a specific context like projects.

2.4 Service Models

Infrastructure as a Service (IaaS)
Infrastructure as a service (IaaS) is a type of cloud computing in which a third-party provider hosts virtualized computing resources over the Internet[9].

Platform as a Service (PaaS)
Platform as a service (PaaS) is a category of cloud computing services that provides a platform allowing customers to develop, run and manage Web applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app.

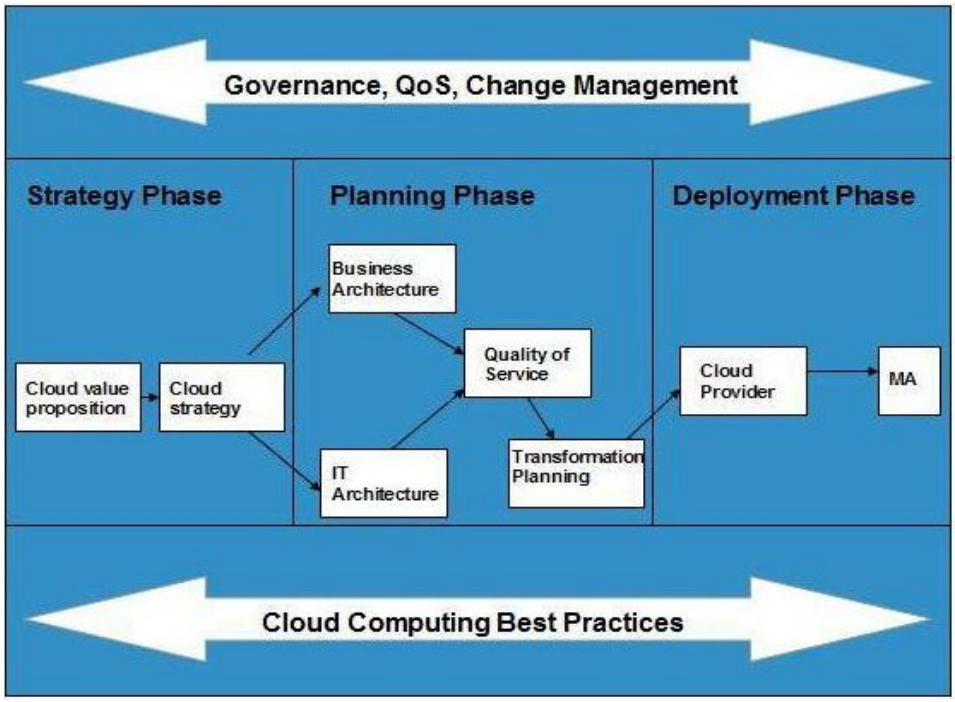
Software as a Service (SaaS)
Software as a Service (SaaS) is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.

2.5 Planning of Cloud Computing in Business and Organisations

Before realizing cloud computing in an organization it is necessary to consider the requirements, especially the business ones.
The planning of the cloud can be categorized into three phases:

- Strategy Phase
- Planning Phase
- Deployment Phase

[9] Laugesen, N., Lauritzen, J.R., Carpenter, G., Ellegaard, C.M., Bucher, M., Stabe, M.: "Cloud Computing Cyber Security and Green IT: The impact on e-Skills requirements". Prepared by the Danish Technological Institute and Fraunhofer for the European Commission, May 2012.



Strategy Phase

In the first phase of planning the value proposition of the cloud has to be examined. So the factors, which influence the stakeholders when applying cloud computing and target key problems will be analysed.

The key factors are:

- IT management simplification
- Operation and maintenance cost reduction
- Business mode innovation
- Low cost outsourcing hosting
- High service quality outsourcing hosting

The results of the analysis induce the strategy planning. A strategy document is prepared according to the conditions faced when applying cloud computing in the organisation.

Planning Phase

The planning phase is the step to recognize the kinds of plans that are required to transform the current business to cloud computing modes.

Based on the strategy the risks are examined that might be caused by cloud computing application from a business perspective. From this it follows that the applications are identified, which support the business processes and the technologies required to support enterprise applications and data systems.

To recognize the requirements on quality of service development is an important step for the success of applying cloud computing. They refer to the non-functional requirements such as reliability, security, disaster recovery, etc.

Deployment Phase

After the two above steps the deployment phase is initiated. It involves the following two steps:

- Selecting a cloud computing provider
- Ensuring maintenance and technical service

Depending on the type of cloud (public, hybrid, private) a cloud provider will be selected. Based on a Service Level Agreement (SLA) the level of services is defined which the provider will meet.

The maintenance and technical service are also provided by the cloud provider.

They must have to ensure the quality of services.

3. Labour Market and Qualifications

Nowadays labour market is influenced by different factors, mainly by investment in latest machinery, office automation software systems and computer based solutions. Use of computer has benefited the employment market on vast scale, depending on the requirements of a particular business, its size and financial capabilities, and the intention to use.

In today's world, the utility model of cloud computing made it more popular and a favourite choice for the companies, institutes and other organisations to free up their internal resources and reduce the costs and the number of administrative staff needed to maintain. At the European level, different studies (2015)[10,11] indicate that cloud computing will produce around 2.5 million new European jobs and new business opportunities in coming next few years (and an annual boost of €160bn, around 1% of GDP). However, which countries and sectors see the most benefits depends in part on the developed policy. The economic impacts of cloud computing depends on region and sector; the IT sector mainly will have the most advantages. This impact in Europe will depend on how service providers, governments and managers understand it. European cloud services providers need to offer competitive prices and guarantee safe and reliable technology. Governments need to ensure an appropriate legal environment, procurement practices and energy prices. It will also depend on the willingness of managers to adopt the new practices necessary to exploit the technical and economic advantages of cloud computing.

Like any change, the spreading of cloud computing both in public or private domain of the European economy will cause others, in the IT job market. For a smooth transition into the cloud, a well-trained pool of experts is essential. But what are the specializations principally needed?

From the supply side, integrators need to possess high quality knowledge in order to market the new services offered. The supply side's role is crucial for the functioning and success of cloud computing. Obviously consulting services will play a major role in the transition process.

Cloud computing presents a number of new employment opportunities for qualified individuals in the IT space. And many administrators are looking to ditch the server and hop onto the cloud bandwagon to climb the corporate IT ladder.

According to theoretical research[12], the contribution of the ICT sector to economic growth is mainly derived through these three sources:

1) the value-added of production activity in related sectors,
2) the utilisation of ICT services as resources in the production activity of other sectors in the economy,
3) the multiplier effect from the impact of ICT on the total factor productivity (multifactor productivity).

Especially with regards to the impact of ICT sector on labour productivity, the benefits stem from:

1) the changes in the level of ICT services used by a labour unit,
2) the effect of using ICT services on the rest of capital resources,
3) the improvement in the quality of labour outcome due to the use of ICT services,
4) the combined outcome of the above factors on total productivity

[10] "Where Cloud Computing jobs will be in 2015", Forbes, Dec. 2014.
[11] "European Cloud Computing Strategy to create two and a half million new jobs", ComputerWeekly, Jan. 2014.
[12] G. Moschovis, J. Anderson, "Greece: Debt sustainability improved", The Institute of International Finance (IIF), Research Note, August 3, 2011.

Cloud computing jobs range from architects and developers to data scientists, security pros and more, all of which require a specific focus. Honing your IT skills to cloud is crucial to receive that big promotion, land that next hot cloud job and enjoy a long cloud career.
The benefits from promoting the adoption of web based technologies in the public sector (such as e-government) are the following[13]:

• Effective use of IT systems in crucial sectors of public administration, aiming at increasing efficiency (e.g. tax collection mechanism), lowering operating cost and limiting mismanagement of resources (e.g. social security, healthcare).
• Boost of labour productivity and optimization of Human Resource management in the public sector.
• Mobilisation of the private sector in order to implement and technically support such solutions, thus revamping relevant industry sectors and contributing to the reverse of the trends of the overall economic activity.
• The effective implementation of e-government structural reforms will also gain public opinion support, as they will contribute to the modernisation of public administration, boost transparency and improve the services provided by the state.
Infrastructure specialists are the big losers with the migration of applications to the cloud. As investments, as well as the size of small, in-house datacenters decrease, the demand for these professionals should decrease, accentuating the trend that has already forming since when companies began to migrate internal infrastructure for outsourced data centers.
Big Data specialists dig through that data to find trends otherwise missed by standard business processes. They must also become experts in the data that needs to be collected in order to meet business requirements by working with Cloud developers and architects.

Cloud computing requires also new skills i.e.

Technical skills: depending on how much of the cloud will be built and managed in-house.

Cloud Architects - Designing a better Cloud future: Cloud Architects possess a strong understanding of how to design and build Cloud environments to meet both performance and cost requirements. Their knowledge of a Cloud platform is broad enough to know which services are best suited for any particular situation including whether or not a hybrid environment makes sense. They lead migration projects to move companies into the Cloud. They design for disaster recovery and mitigation.
Architects can be employed in companies that build applications and/or infrastructure in the Cloud.

Application Developers are a highly sought after bunch in the tech industry. Increasingly, job requirements for developer opportunities are adding Cloud Computing as a must-have skill. Teams of developers can take advantage of managed services such as databases, queues, workflows, and more to bring new applications to market quicker and cheaper than ever before.

[13] S. Danchev, A. Tsakanikas, N. Ventouris, "Cloud Computing :A Driver for Greek Economy Competitiveness", Microsoft Innovation Center, November 2011

DevOps Engineers: DevOps represents a merger between development and operations. It breaks down the barrier of developers and operations engineers with the goal of streamlining the application lifecycle.
The role often is responsible for managing the infrastructure through version-controlled source files that can be used to recreate Cloud environments in hours and minutes instead of weeks and days under the traditional model.

Business and financial skills: Cloud computing providers need to be able to adapt the business case for a cloud deployment, build a return on investment (ROI) case, and monitor and make judgment calls on metrics based on business performance versus the costs of supporting or subscribing to the cloud.
Enterprise architecture and business needs analysis: Essential for laying out a roadmap of what services – whether they are coming from IT or an outside provider – will be needed. Able to work with the business, speak the language of business, as well as work with IT professionals. An understanding of the principles of service-oriented architecture would go a long way.

Project management skills: Since cloud computing offers end-users the potential to run wild with new requests for services, effective project management skills are needed to keep cloud projects from eventually costing far more than the on-premises systems they were designed to replace.
Contract and vendor negotiation: Working with cloud providers, able to negotiate service-level agreements, availability.

Security and compliance: An understanding of security protocols is essential, no matter what type of cloud is being deployed. **Cloud Security Specialists** help Cloud architects in engineering solutions that take security into account from the very beginning. They assist developers in building secure applications that limit potential exposure to information leakage. They must keep up with the latest security news to help mitigate them while ensuring that all aspects of the environments they manage conform to industry best practices.

Data integration and analysis skills: having e information on which to base business decision requires consistency and timeliness.

Mobile app development and management: In many cases, the move to cloud computing is being driven by the need to provide services that can be accessed by any and all devices, be they laptops or smartphones. There is strong demand for professionals who can build and deliver apps that can reside in the cloud and reach employees, partners and customers anywhere and anytime.

The Microsoft Think Tank Recommendations can be summarized as follows[14]:

1) Entrepreneurs should select trustworthy service providers, those who are able to assure an appropriate level of security of the data processed.
2) Cloud computing is a very good tool for testing and implementing new IT applications, at the same time with a lower business risk. Thus the cloud environment should in particular be used by innovative businesses valuing low costs, as they will benefit the most from CC.

[14] Cloud computing: Flexibility Efficiency Security, Gdańsk Institute for Market Economics Report, Microsoft Think Tank, 2011.

3) Cloud adoption rates may be improved through cloud providers offering a free-of-charge test period. This will allow companies to learn more about the principles of operation of such a solution and in future will simplify their choice of the best IT resource combination from the business point of view.

In conclusion, Cloud computing (CC), is currently among the most dynamically developing IT services. Demand for solutions reducing costs of doing business, while at the same time boosting processing capacities, fuels the growing popularity of this model of IT resource management. This tendency is being noted more and more in each EU country. Expert recommendations target particularly four sectors: the health services, education including distance learning, public administration and small and medium-sized businesses

4. Research Methodology

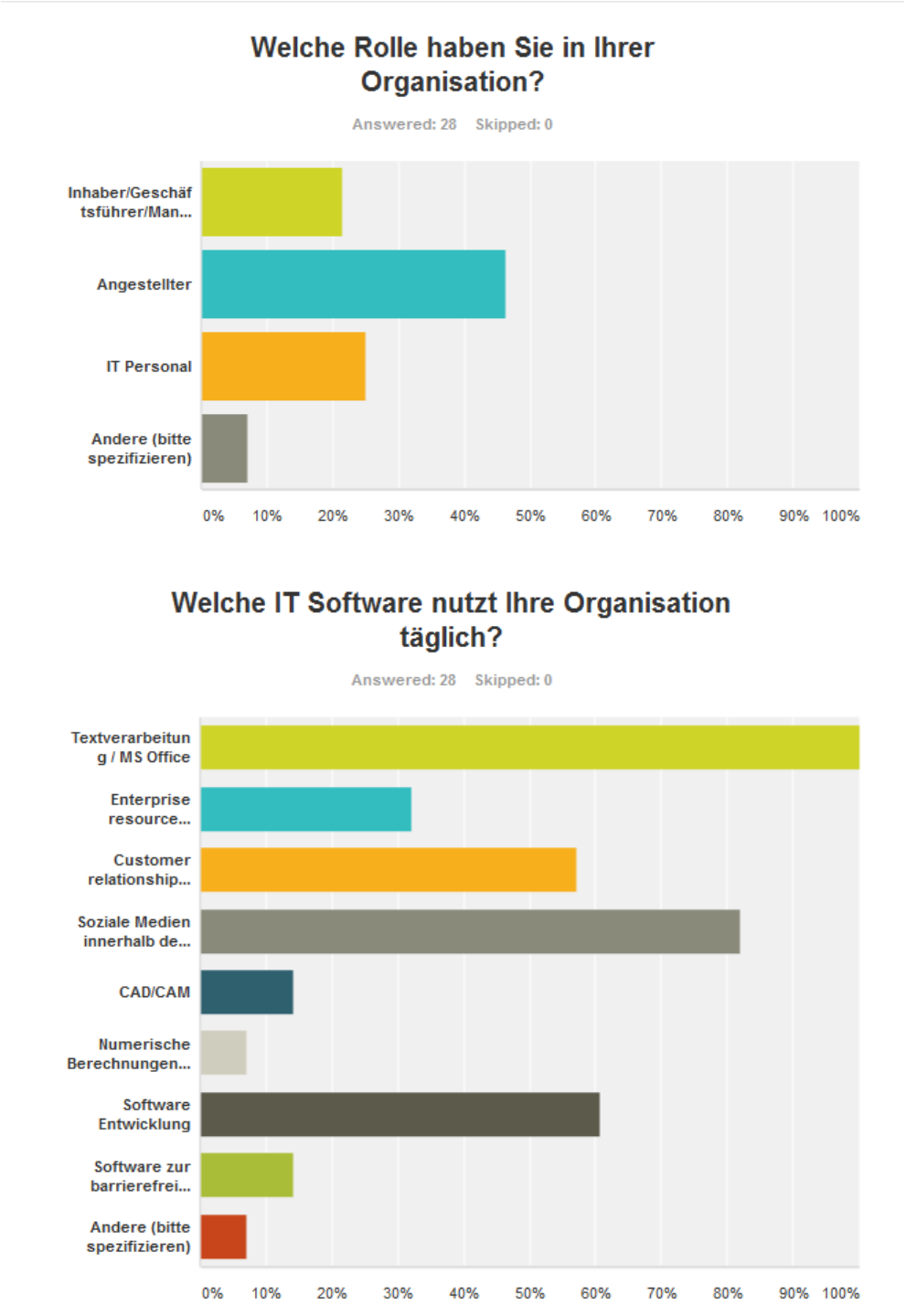
The use approaches for the analysis of the cloud computing state and of the professional skills required in the labour market are:

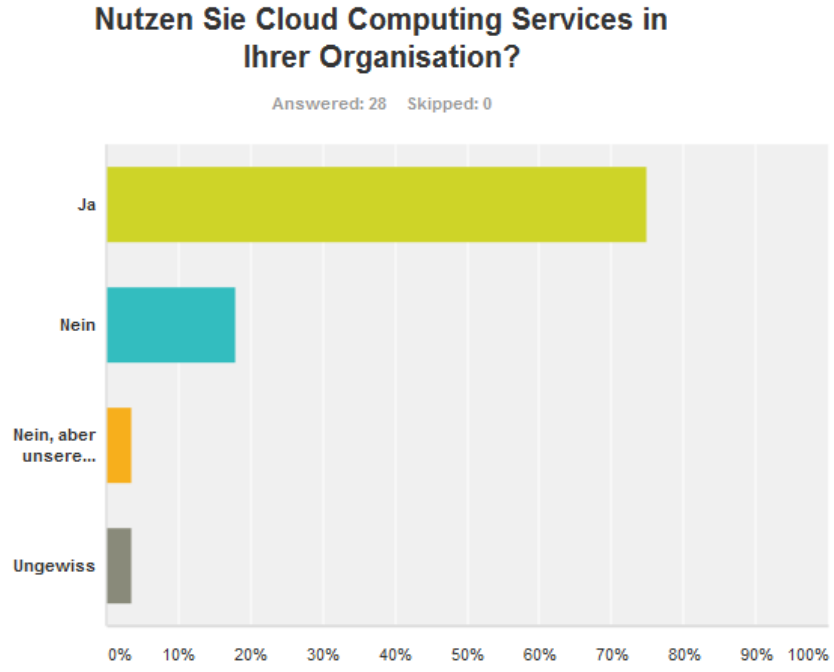
- Questionnaires submitted through the web completed with short interviews
- Existing sector studies, publications and reports at national and international level
- In order to interview companies through the web, IAT developed a first draft of survey.
- The survey contains ten questions about general company information, software usage and cloud computing. In particular, the questions are:
    - Q1: What is your job role?
    - Q2: In which sector does your business/organisation operate?
    - Q3: How does your business/organisation use IT on a daily basis?
    - Q4: Do you use cloud computing services in your business/organisation?
    - Q5: Why don't you use cloud computing services in your business/organisation?
    - Q6: Which cloud computing services do you use within your business/organisation?
    - Q7: What benefits does the cloud offer to your business/organisation?
    - Q8: Which cloud services do you aspire in the future to use in your business/organisation?
    - Q9: Please rank your primary concerns regarding the adoption of cloud computing into your business/organisation
    - Q10: Which of these skills and competences, required for successful implementation of cloud computing, does your business/organisation have?
- It was created with the help of Survey Monkey, an online survey development cloud-based company. It provides free, customizable surveys, as well as a suite of paid back-end programs that include data analysis, sample selection, bias elimination and data representation tools.
- Each partner searched for studies, publications, reports and projects about cloud computing.

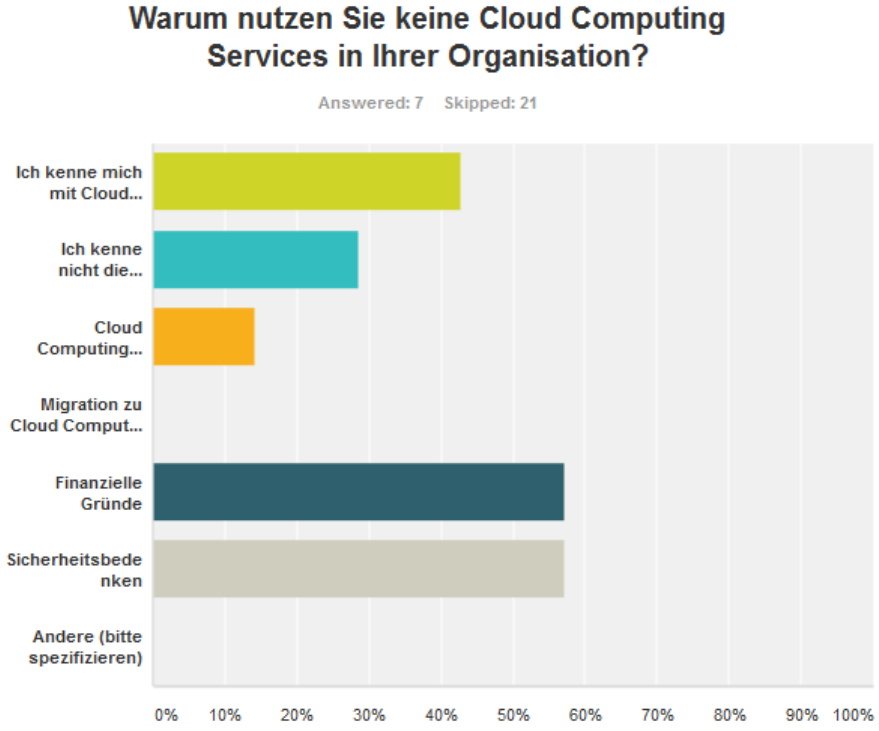
5. European survey on Cloud Computing

In the following paragraphs, the analysis of the collected survey is shown and discussed. At first, the statistics are shown for each different country in terms of graphs. Then, the aggregated data are analysed and discusses.

5.1 Survey results: Germany

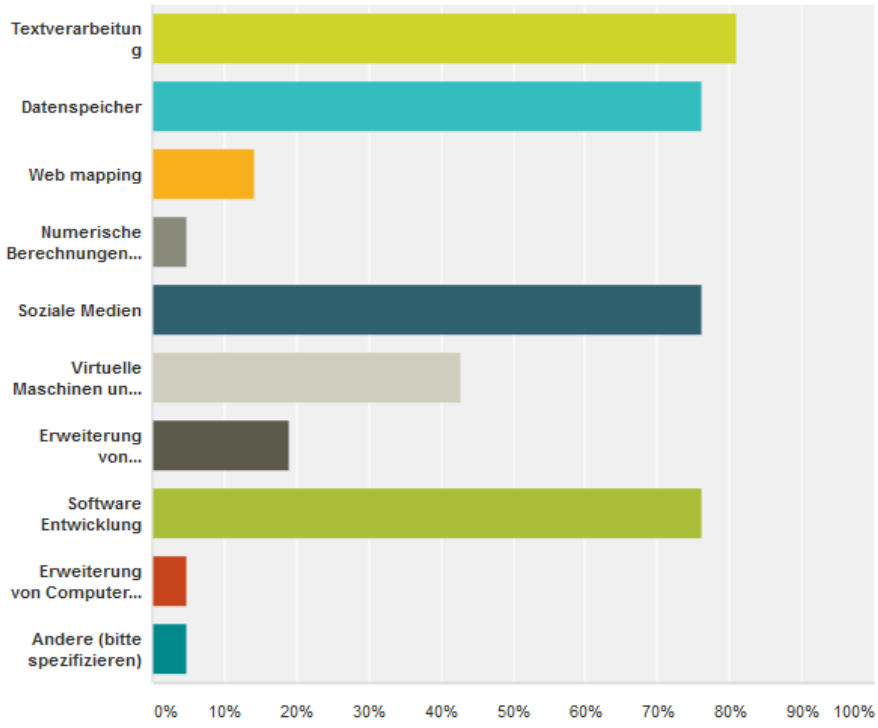



Nutzen Sie Cloud Computing Services in Ihrer Organisation?
Answered: 28 Skipped: 0
Ja
Nein
Nein, aber unsere...
Ungewiss
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%


Warum nutzen Sie keine Cloud Computing Services in Ihrer Organisation?
Answered: 7 Skipped: 21
Ich kenne mich mit Cloud...
Ich kenne nicht die...
Cloud Computing...
Migration zu Cloud Comput...
Finanzielle Gründe
Sicherheitsbedenken
Andere (bitte spezifizieren)
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

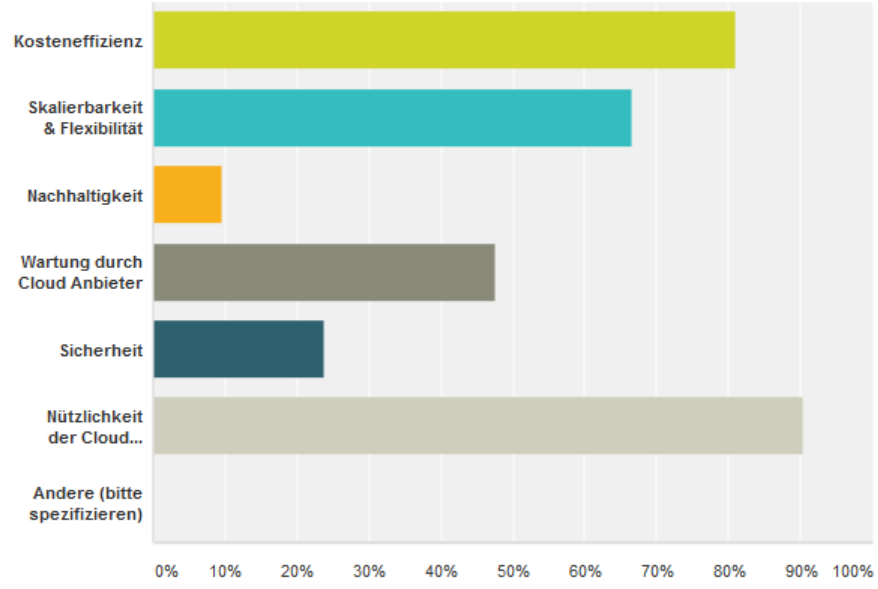
Welche Cloud Computing Services nutzen Sie in Ihrer Organisation?

Answered: 21 Skipped: 7



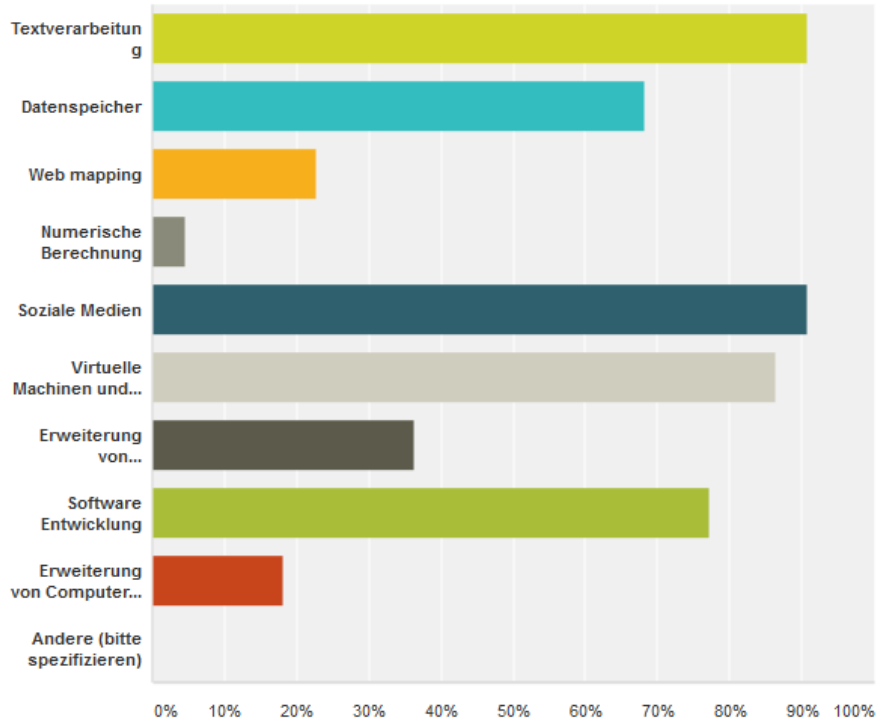
Welche Vorteile bietet Cloud Computing Ihrer Organisation?

Answered: 21 Skipped: 7



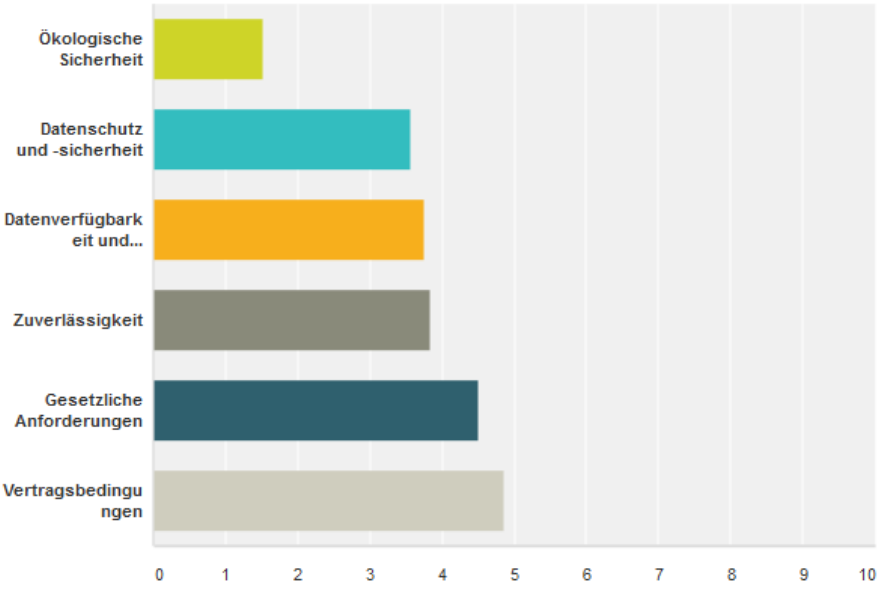
Welche Cloud Services möchten sie zukünftig in Ihrer Organisation nutzen?

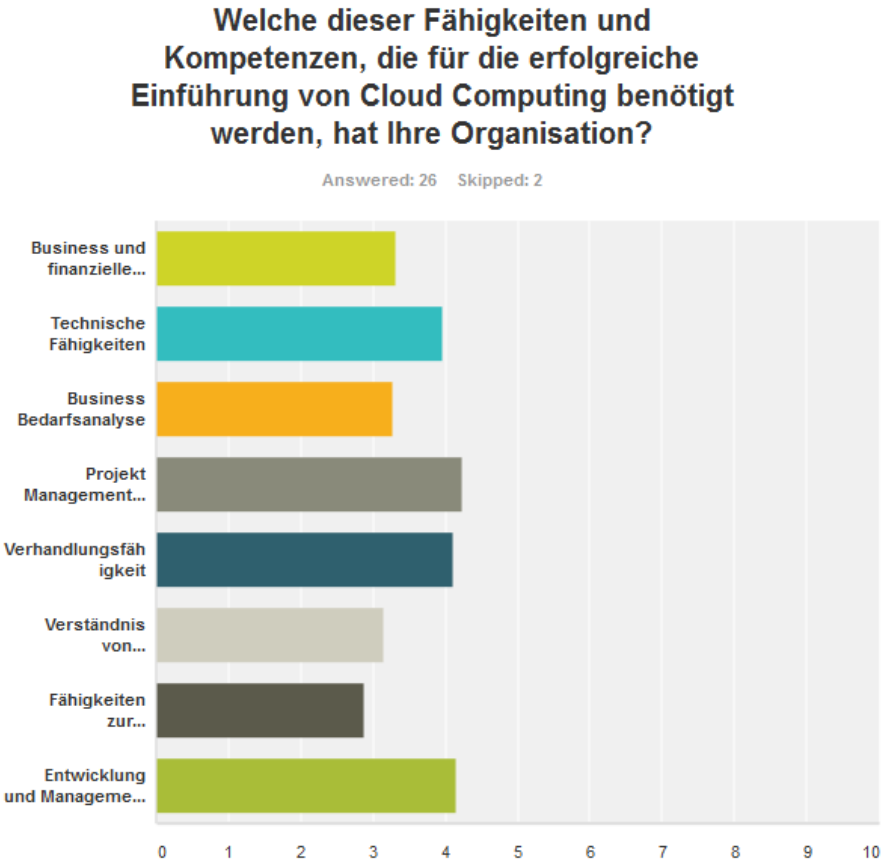
Answered: 22 Skipped: 6



Bitte stufen Sie Ihre Bedenken in Bezug auf die Einführung von Cloud Computing in Ihrer Organisation ein

Answered: 26 Skipped: 2




Welche dieser Fähigkeiten und Kompetenzen, die für die erfolgreiche Einführung von Cloud Computing benötigt werden, hat Ihre Organisation?
Answered: 26 Skipped: 2
Business und finanzielle...
Technische Fähigkeiten
Business Bedarfsanalyse
Projekt Management...
Verhandlungsfähigkeit
Verständnis von...
Fähigkeiten zur...
Entwicklung und Manageme...
0
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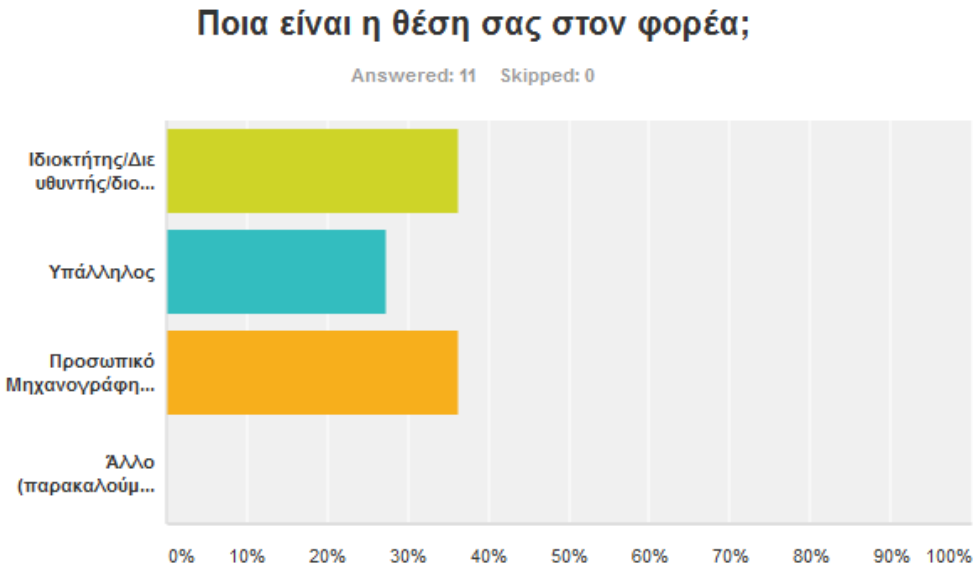
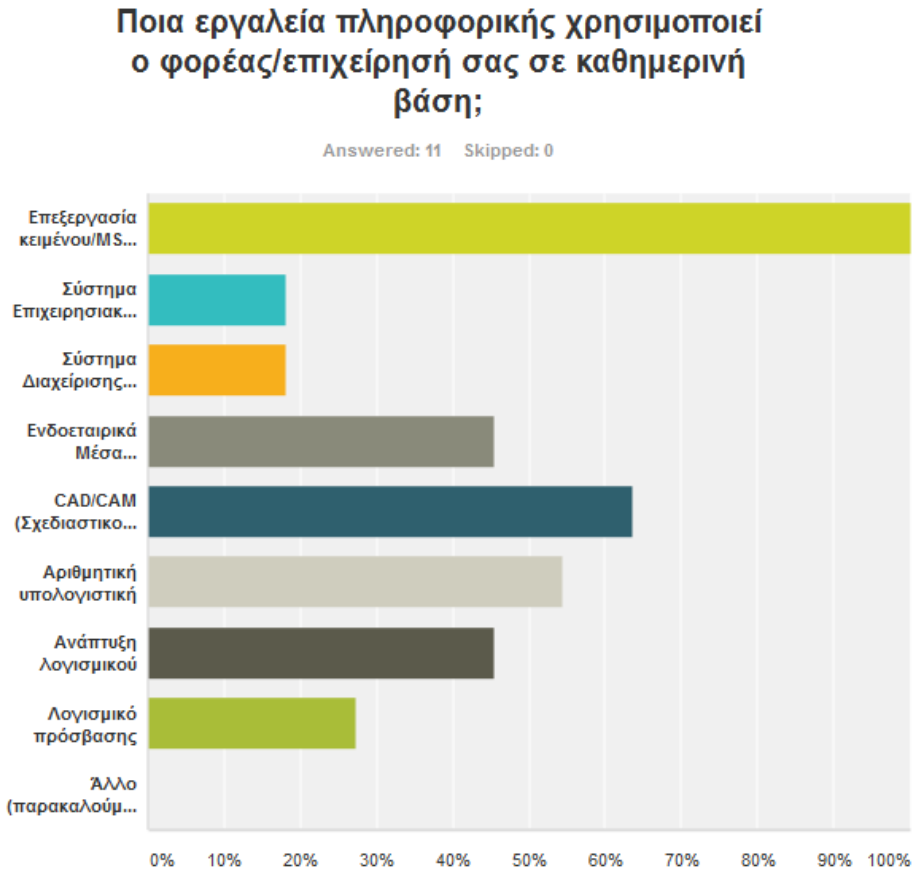
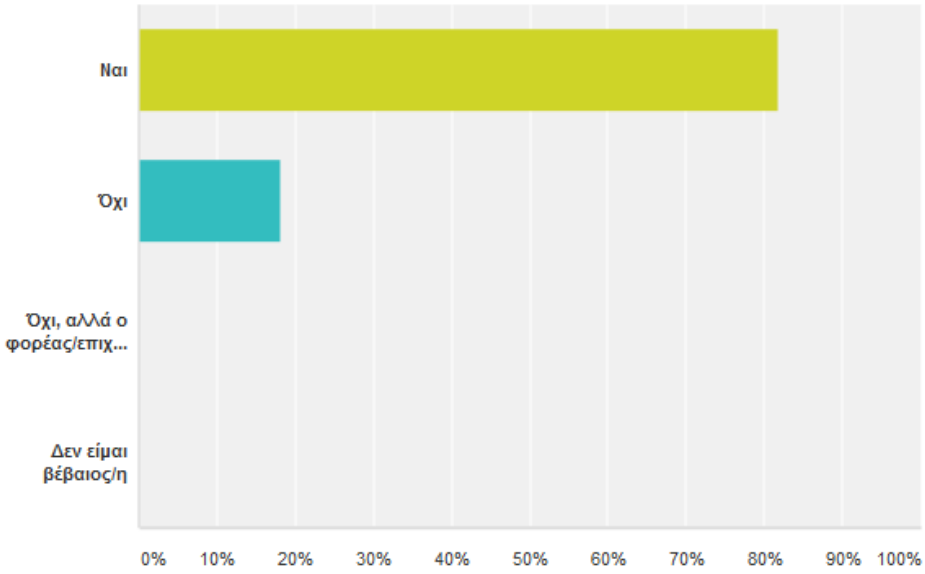
5.2 Survey results: Greece





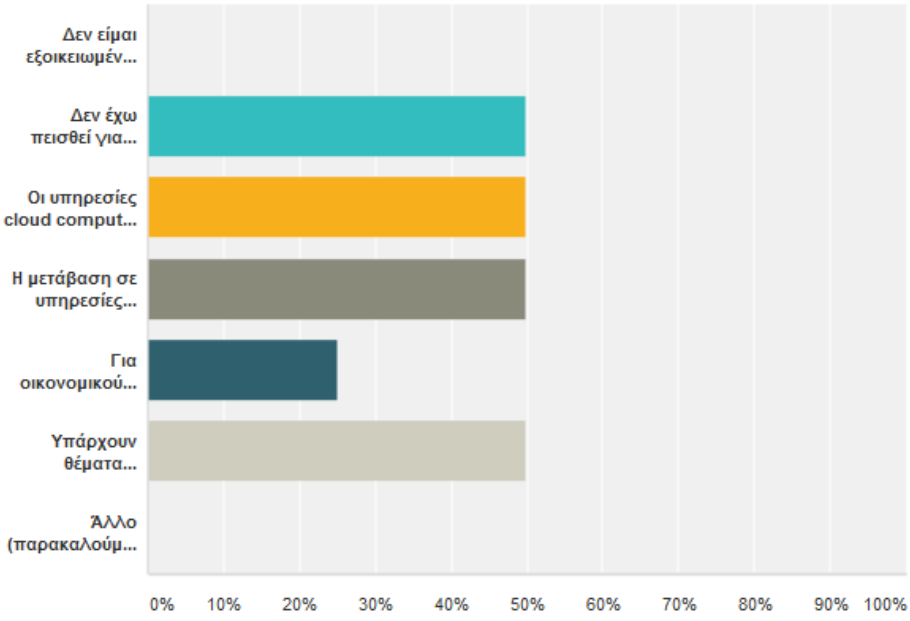
Χρησιμοποιείτε υπηρεσίες cloud computing στον φορέα/επιχείρησή σας;

Answered: 11 Skipped: 0



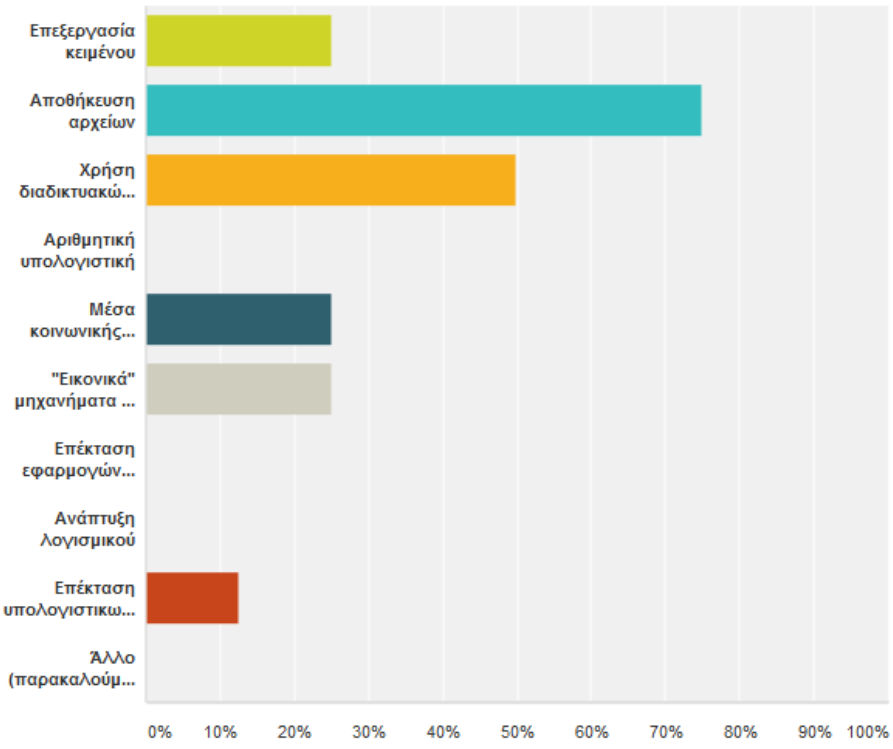
Γιατί δεν χρησιμοποιείτε υπηρεσίες computing στον φορέα/επιχείρησή σας;

Answered: 4 Skipped: 7



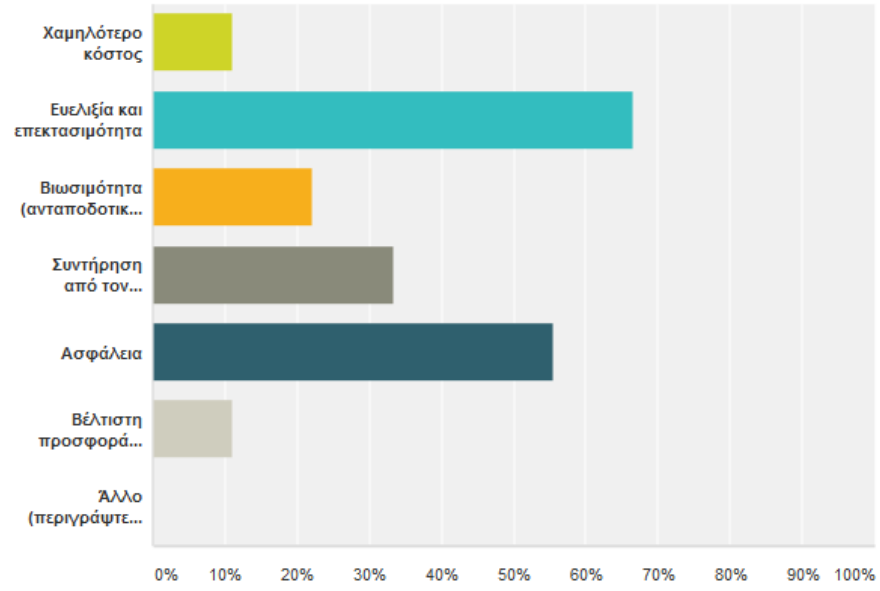
Ποιες υπηρεσίες cloud computing χρησιμοποιείτε στον φορέα/επιχείρησή σας;

Answered: 8 Skipped: 3



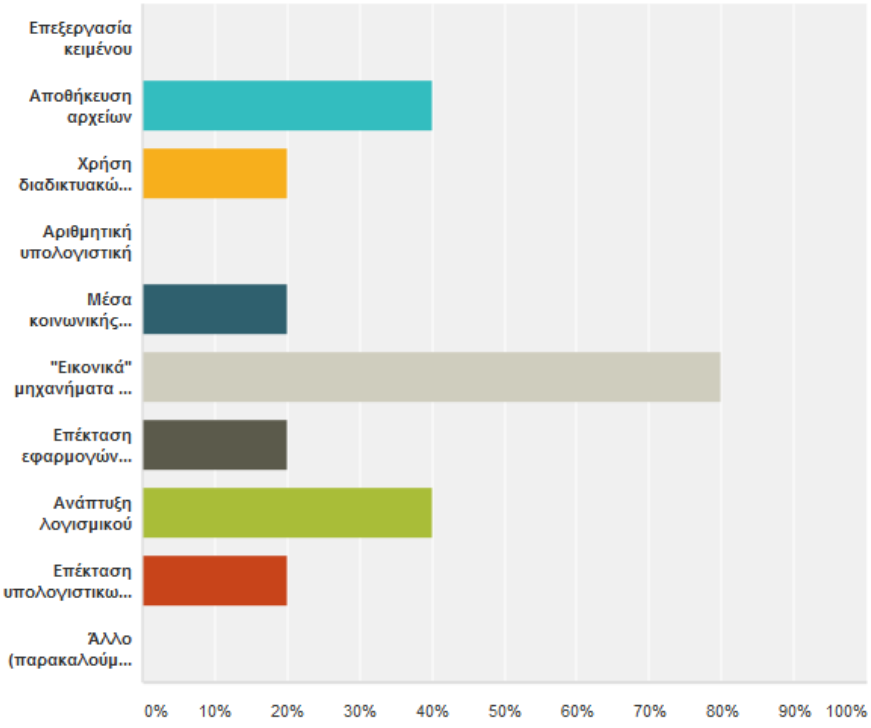
What benefits does the cloud offer to your business/organisation?

Answered: 9 Skipped: 2



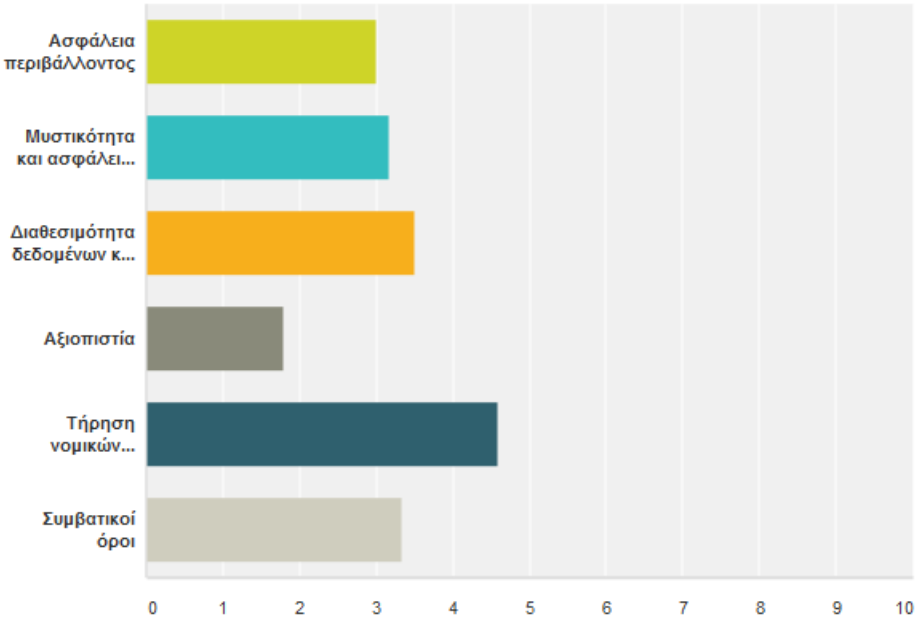
Ποιες από τις παρακάτω υπηρεσίες cloud computing σκοπεύετε να χρησιμοποιήσετε στο μέλλον στον φορέα/επιχείρησή σας;

Answered: 5 Skipped: 6



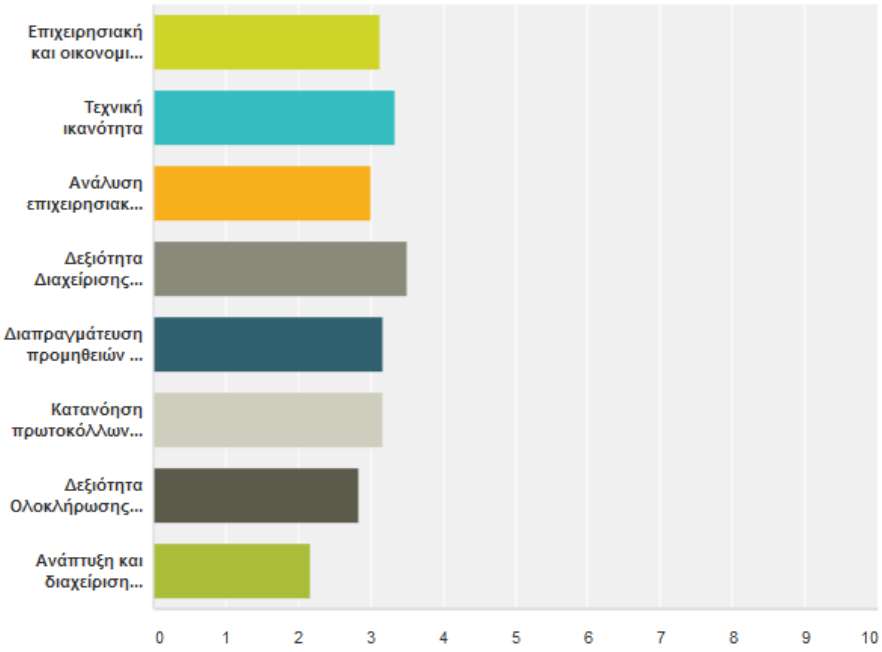
Παρακαλούμε να βαθμολογήσετε τις κυριότερες ανησυχίες σας ως προς την υιοθέτηση υπηρεσιών cloud computing από τον φορέα/επιχείρησή σας

Answered: 7 Skipped: 4

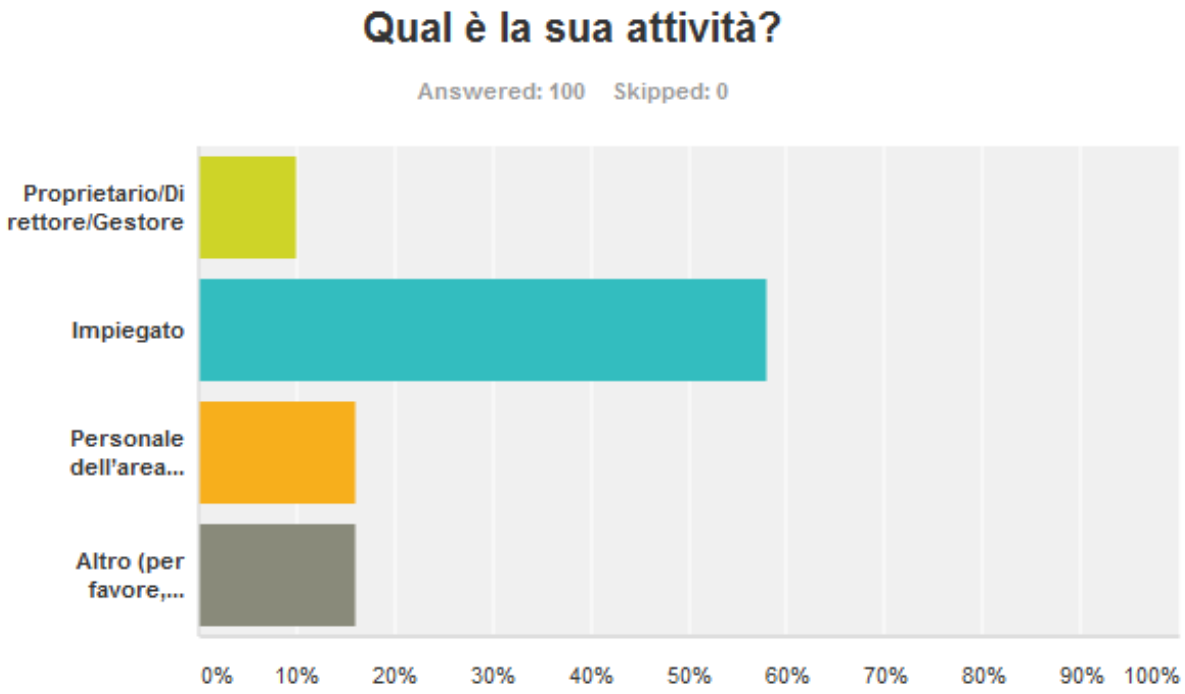


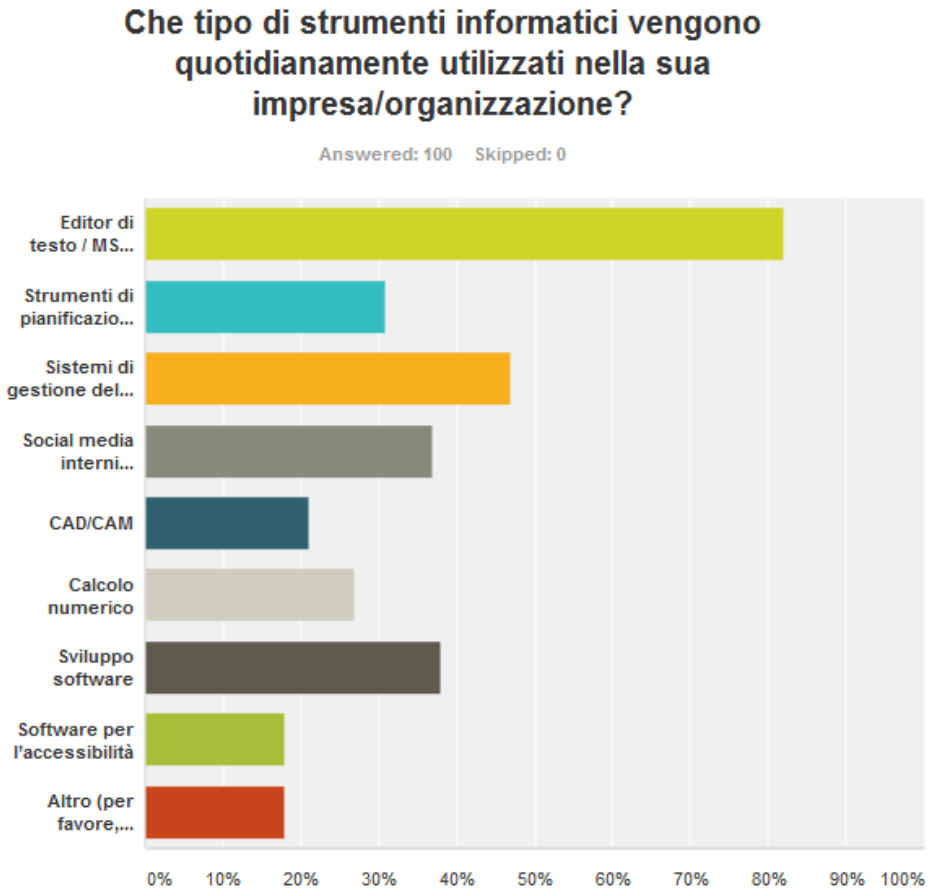
Ποιες από τις παρακάτω, απαραίτητες για την επιτυχή υλοποίηση του cloud computing, δεξιότητες και ικανότητες διαθέτει ο φορέας/επιχείρησή σας;

Answered: 7 Skipped: 4



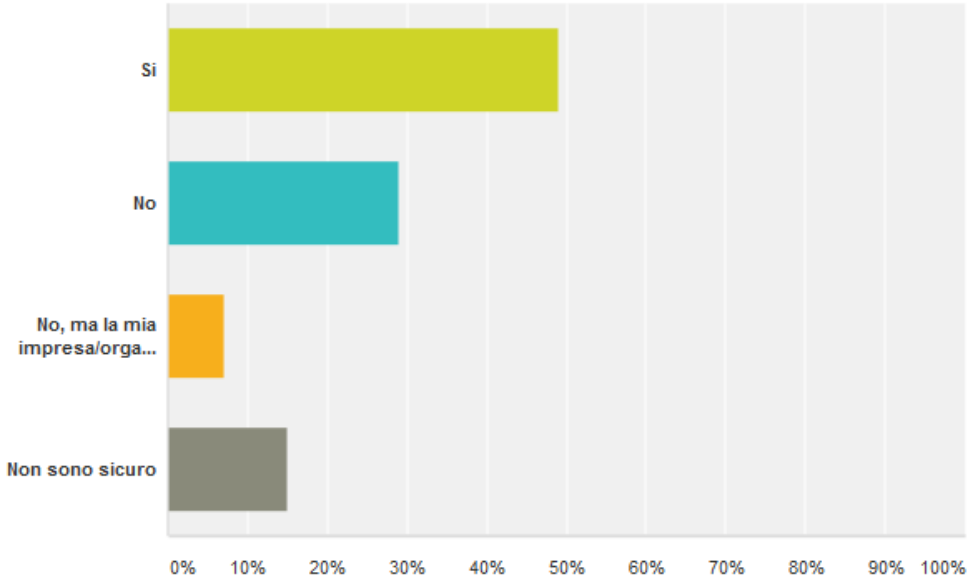
5.3 Survey results: Italy





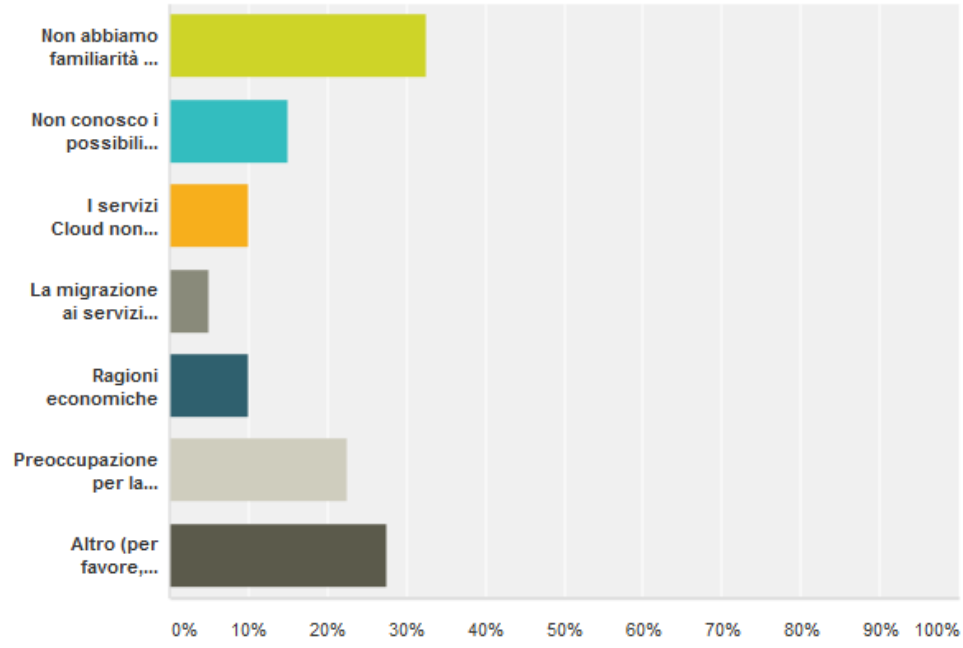
Utilizza servizi Cloud nella sua impresa/organizzazione?

Answered: 100 Skipped: 0



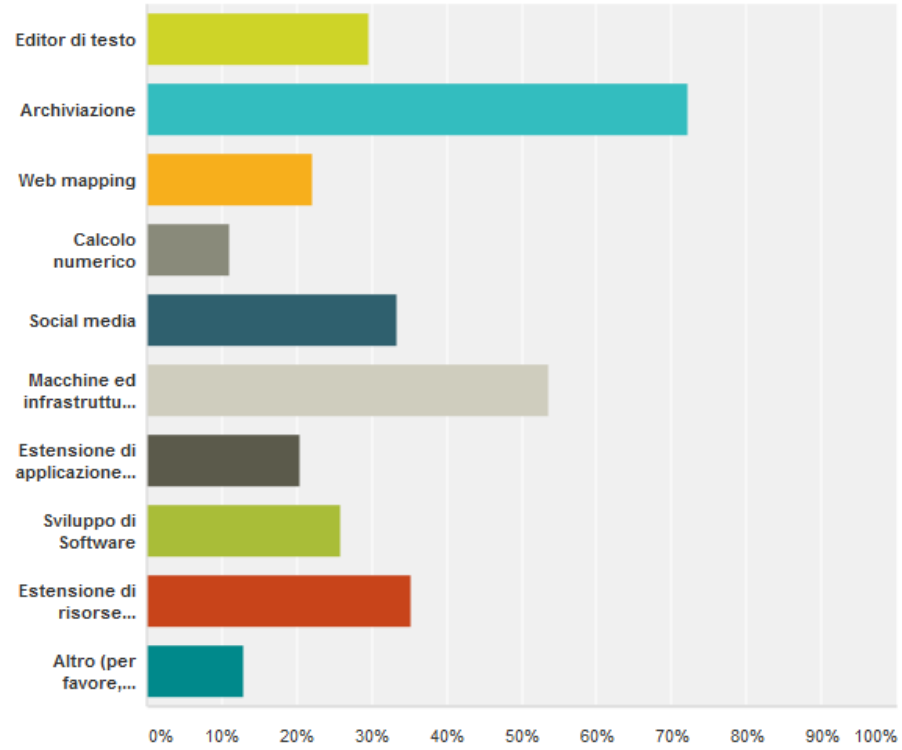
(se ha risposto no alla domanda 4) Perché non utilizza servizi Cloud nella sua impresa/organizzazione?

Answered: 40 Skipped: 60



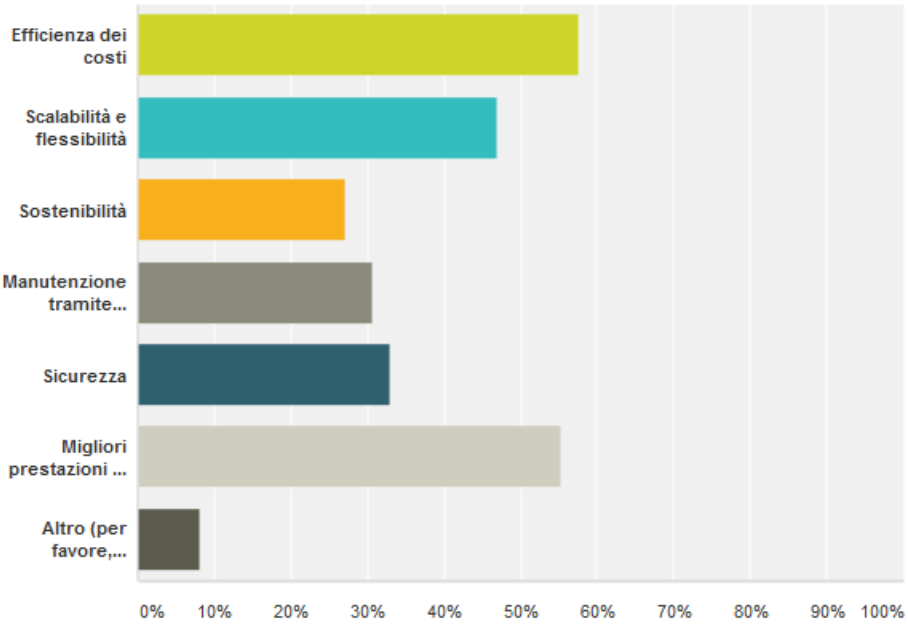
(se ha risposto si alla domanda 4) Quali servizi Cloud utilizza nella sua impresa/organizzazione?

Answered: 54 Skipped: 46



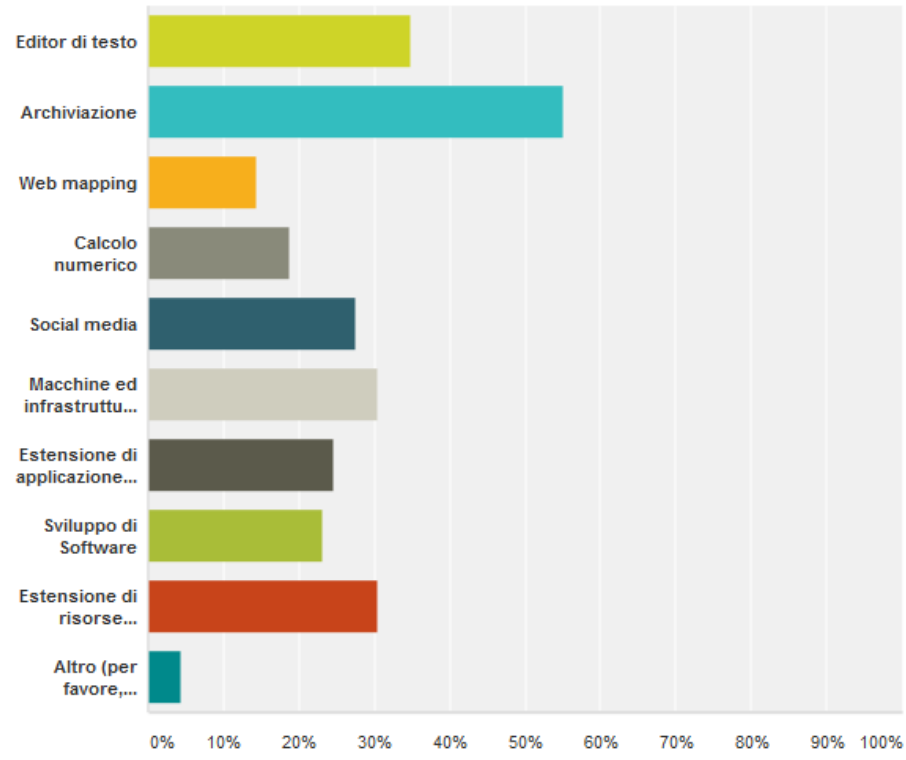
Quali vantaggi offre/può offrire il Cloud alla sua impresa/organizzazione?

Answered: 85 Skipped: 15



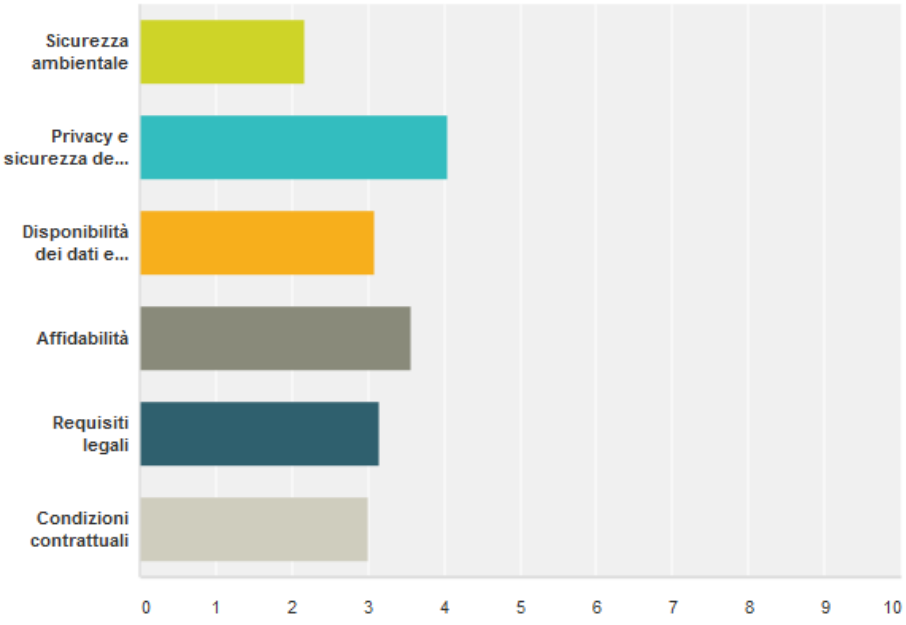
Quali servizi Cloud vorrebbe utilizzare in futuro nella sua impresa/organizzazione?

Answered: 69 Skipped: 31



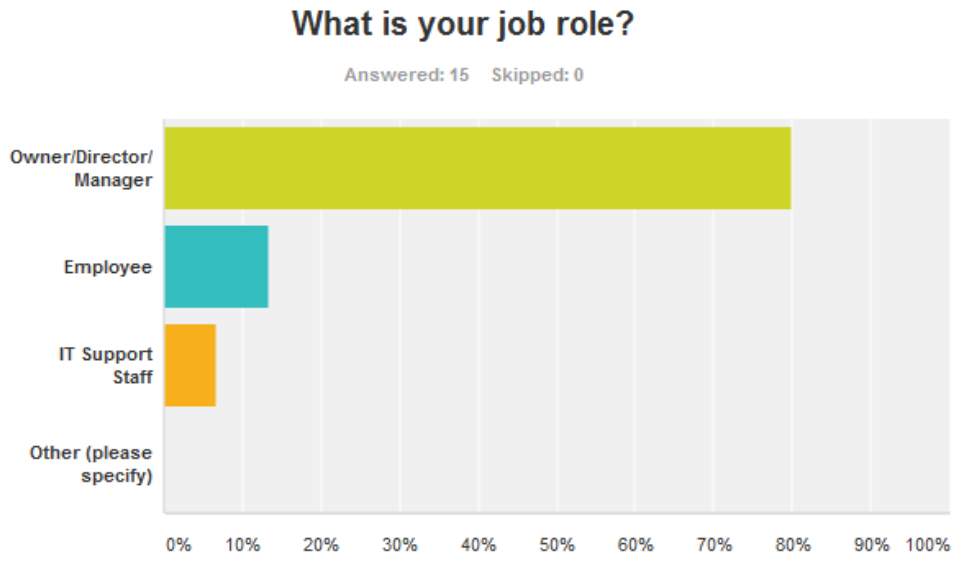
Per favore, esprima il suo livello di preoccupazione in merito all'adozione dei servizi Cloud nella sua impresa/organizzazione

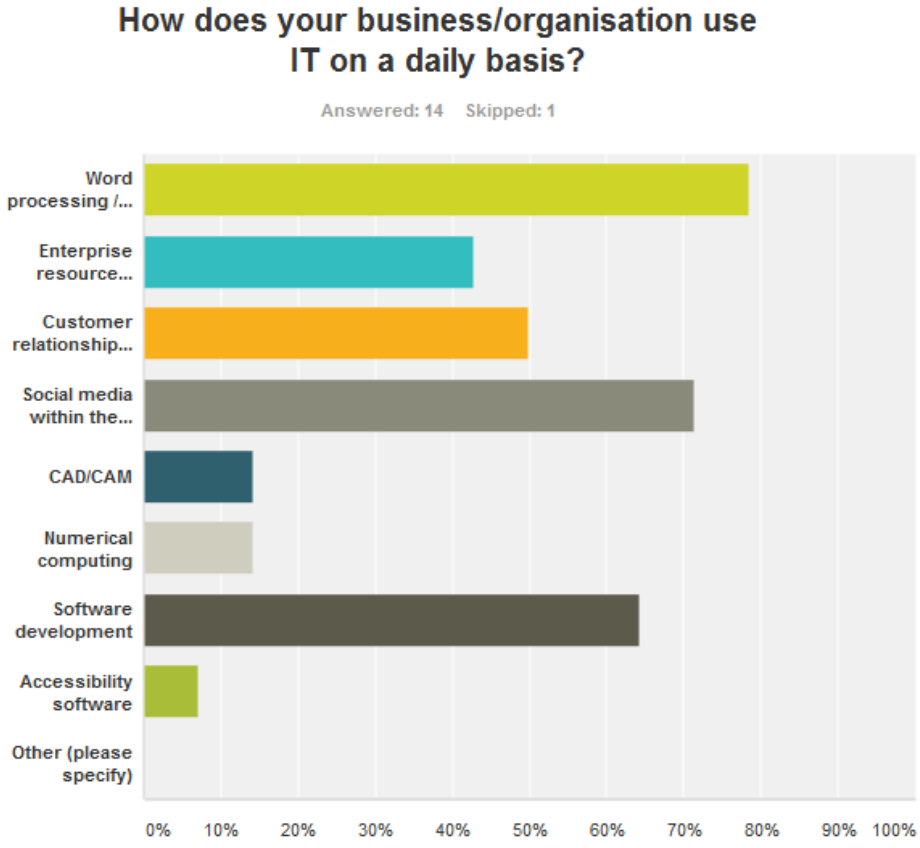
Answered: 78 Skipped: 22

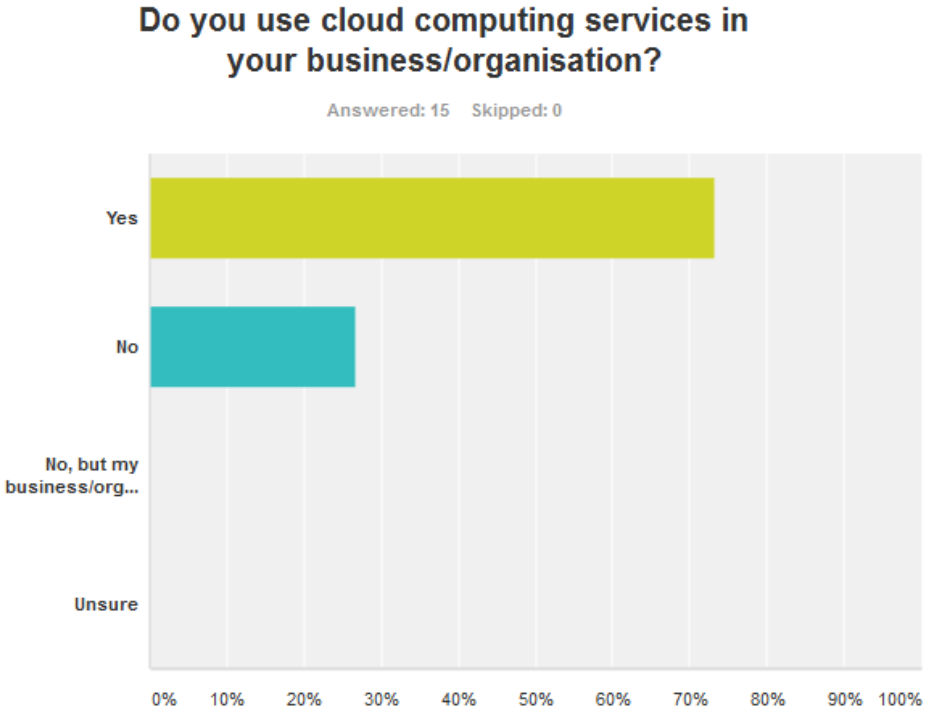


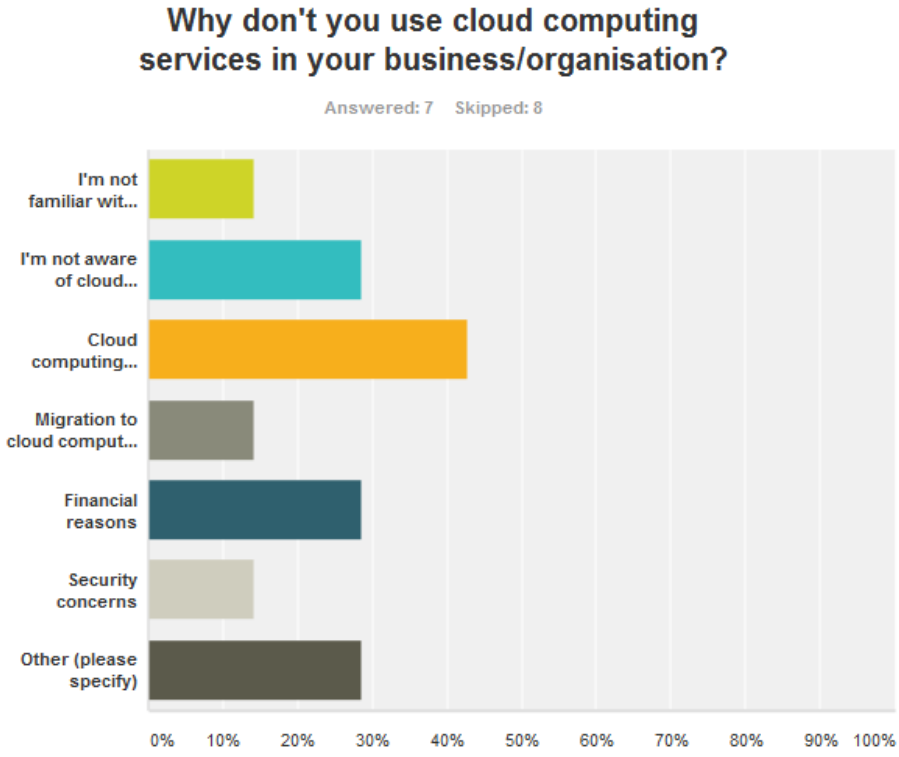

Quali delle seguenti capacità e competenze, necessarie per implementare con successo servizi Cloud, sono disponibili nella sua impresa/organizzazione?
Answered: 76 Skipped: 24
Competenze imprenditori...
Competenze tecniche
Analisi dei fabbisogni...
Capacità di gestione dei...
Negoziazione dei contratt...
Comprensione dei protocol...
Capacità di integrazione...
Sviluppo e gestione di...
0
1
2
3
4
5
6
7
8
9
10

5.4 Survey results: Portugal



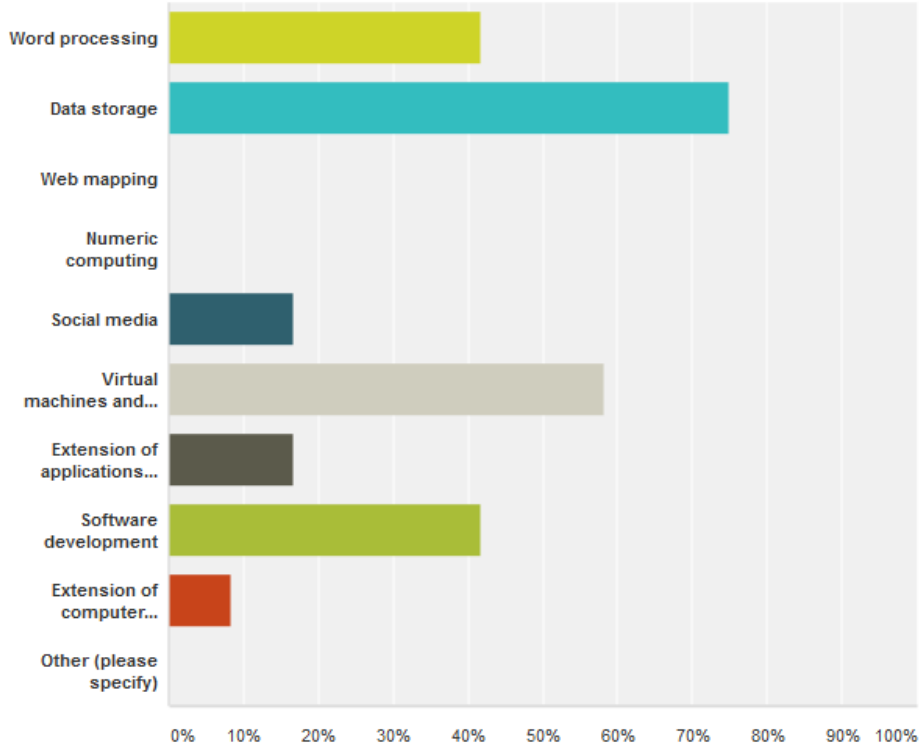



Do you use cloud computing services in your business/organisation?
Answered: 15 Skipped: 0
Yes
No
No, but my business/org...
Unsure
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%


Why don't you use cloud computing services in your business/organisation?
Answered: 7 Skipped: 8
I'm not familiar wit...
I'm not aware of cloud...
Cloud computing...
Migration to cloud comput...
Financial reasons
Security concerns
Other (please specify)
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

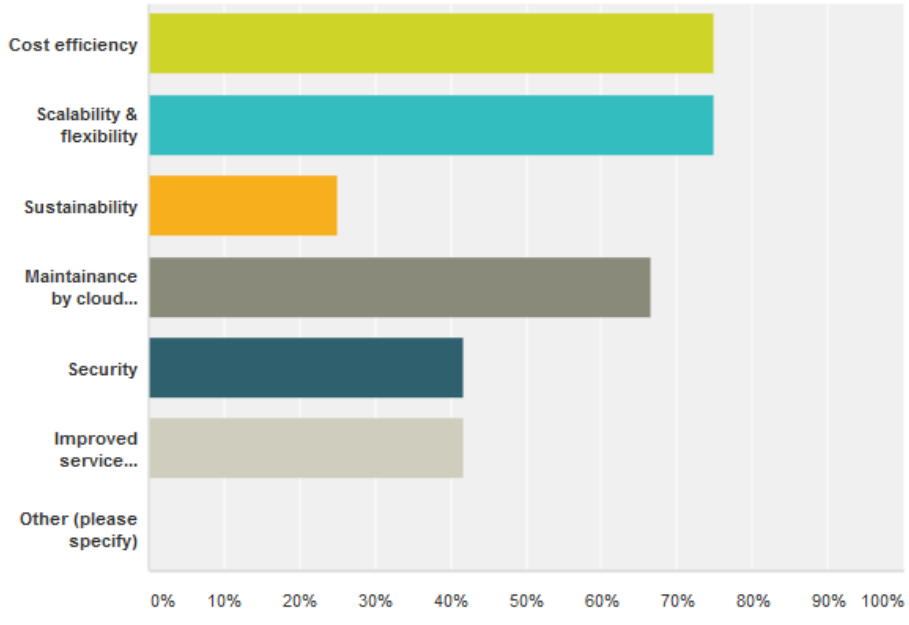
Which cloud computing services do you use within your business/organisation?

Answered: 12 Skipped: 3



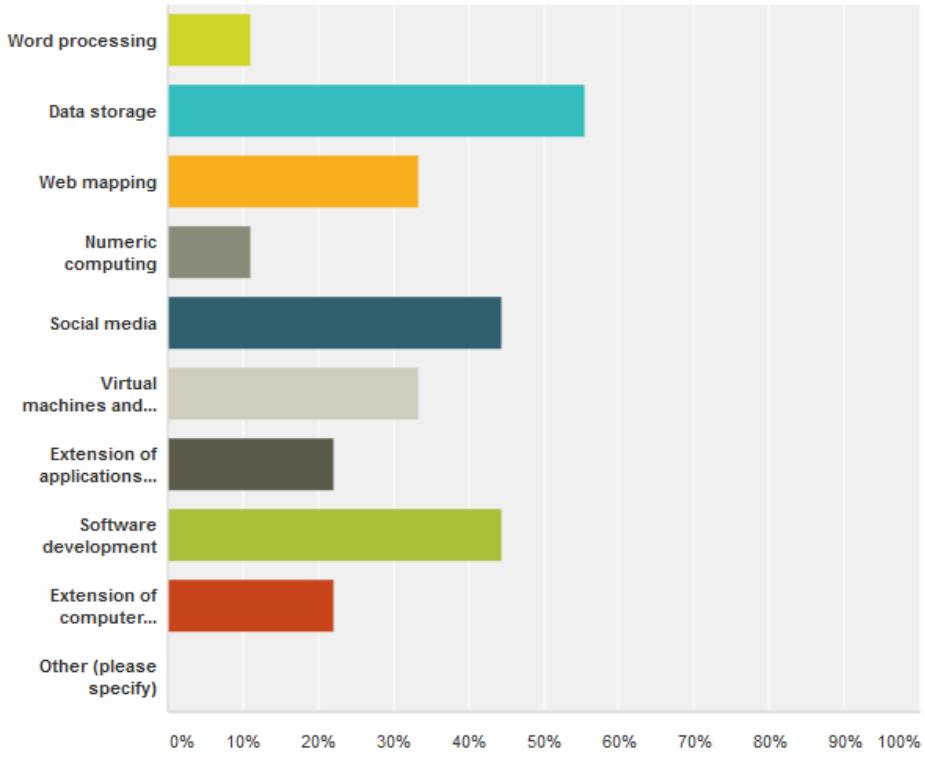
What benefits does the cloud offer to your business/organisation?

Answered: 12 Skipped: 3



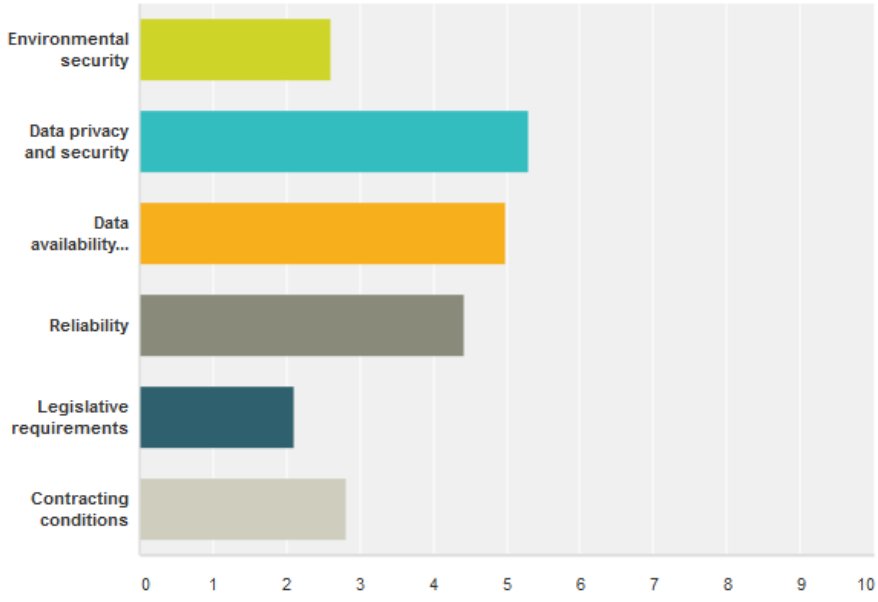
Which cloud services do you aspire in the future to use in your business/organisation?

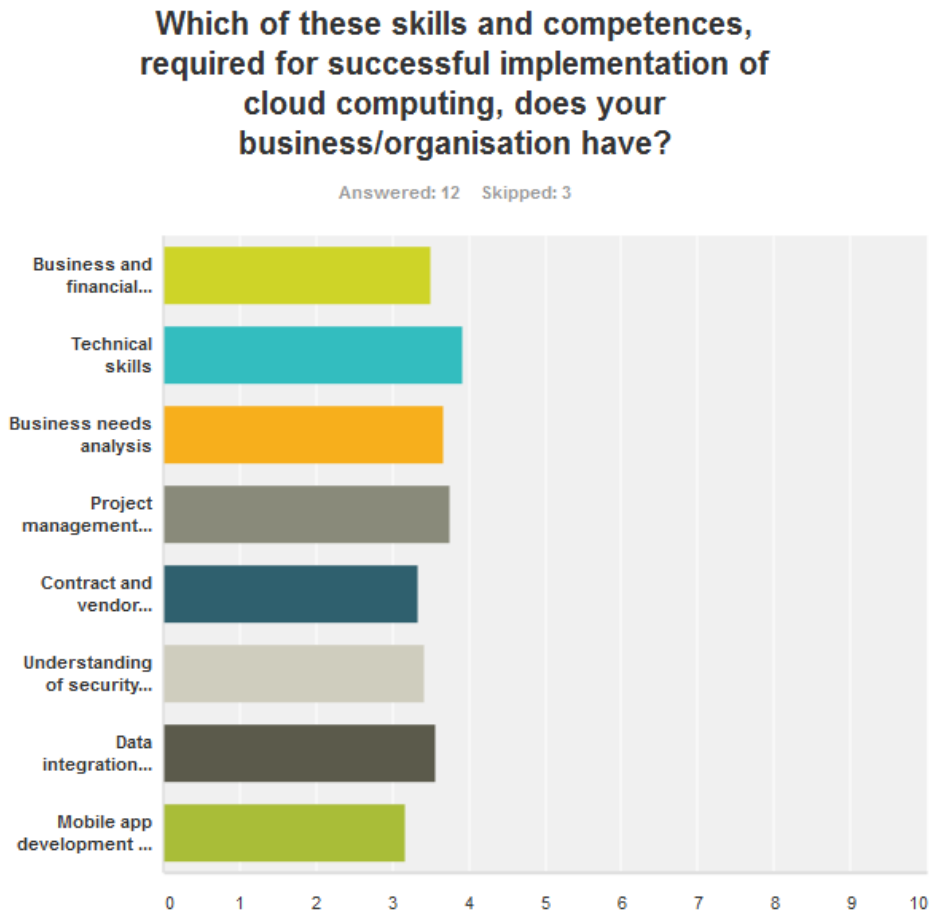
Answered: 9 Skipped: 6



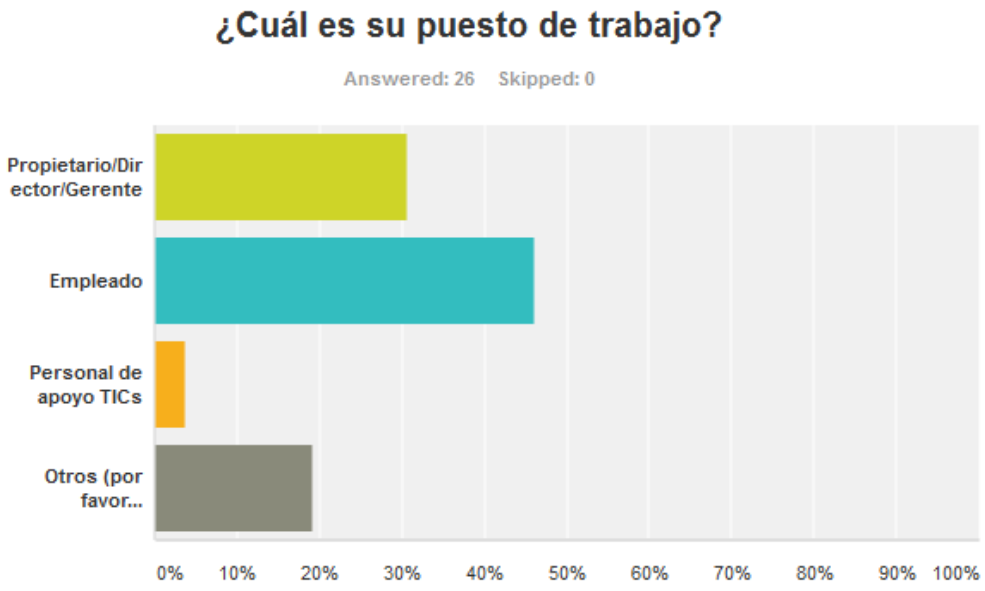
Please rank your primary concerns regarding the adoption of cloud computing into your business/organisation

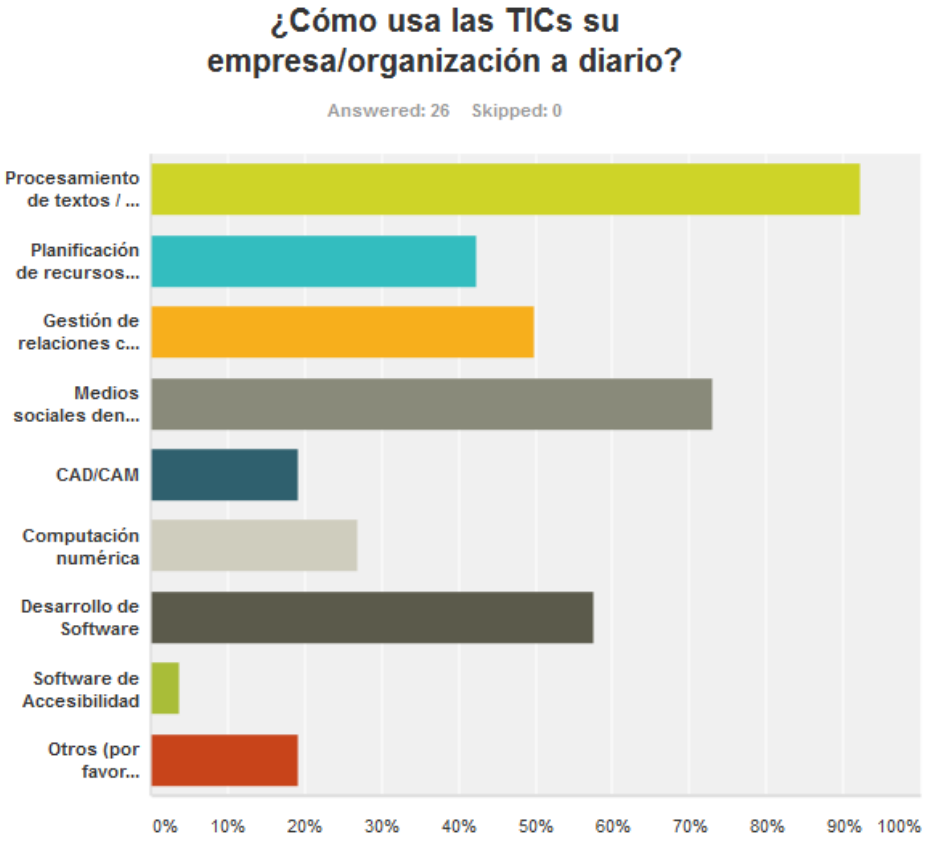
Answered: 13 Skipped: 2




Which of these skills and competences, required for successful implementation of cloud computing, does your business/organisation have?
Answered: 12 Skipped: 3
Business and financial...
Technical skills
Business needs analysis
Project management...
Contract and vendor...
Understanding of security...
Data integration...
Mobile app development ...
0
1
2
3
4
5
6
7
8
9
10

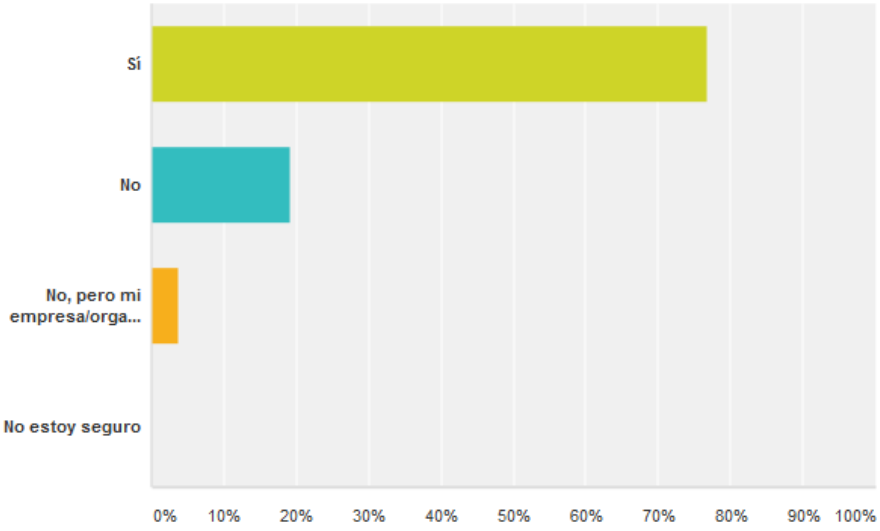
5.5 Survey results: Spain





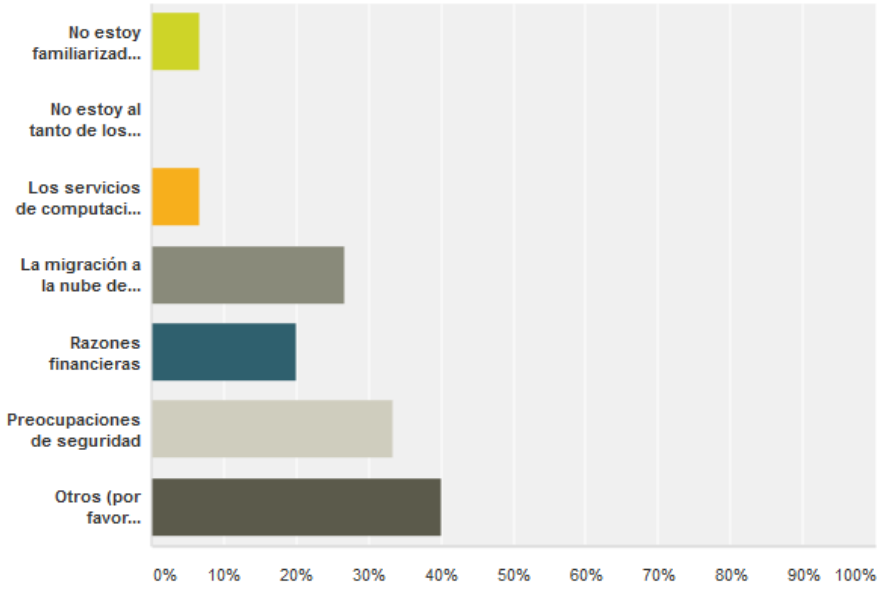
¿Utiliza los servicios de computación en la nube en su empresa/organización?

Answered: 26 Skipped: 0



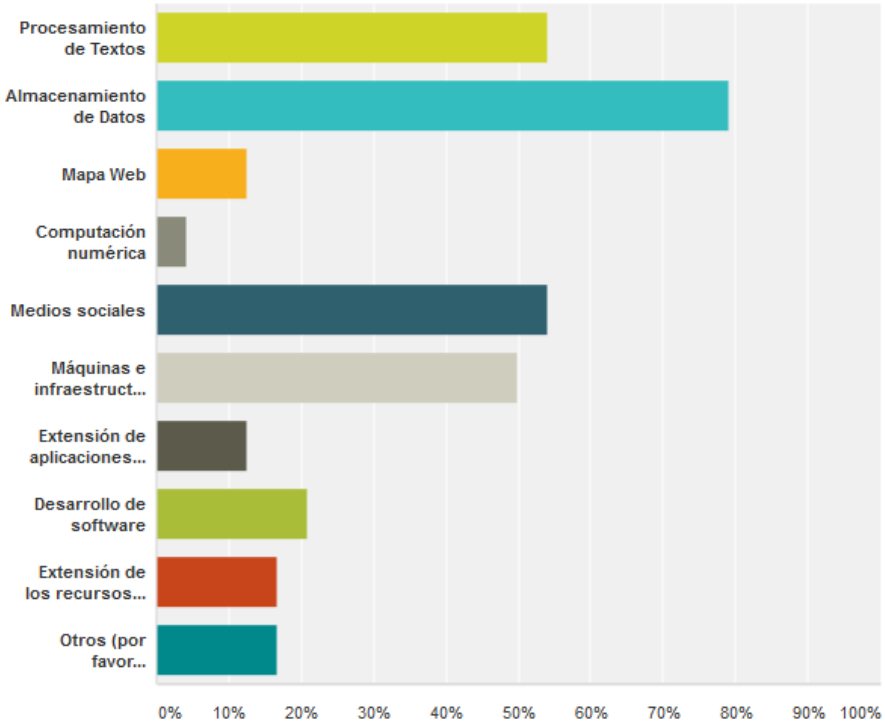
¿Por qué no usa los servicios de la computación en nube en su empresa/organización?

Answered: 15 Skipped: 11



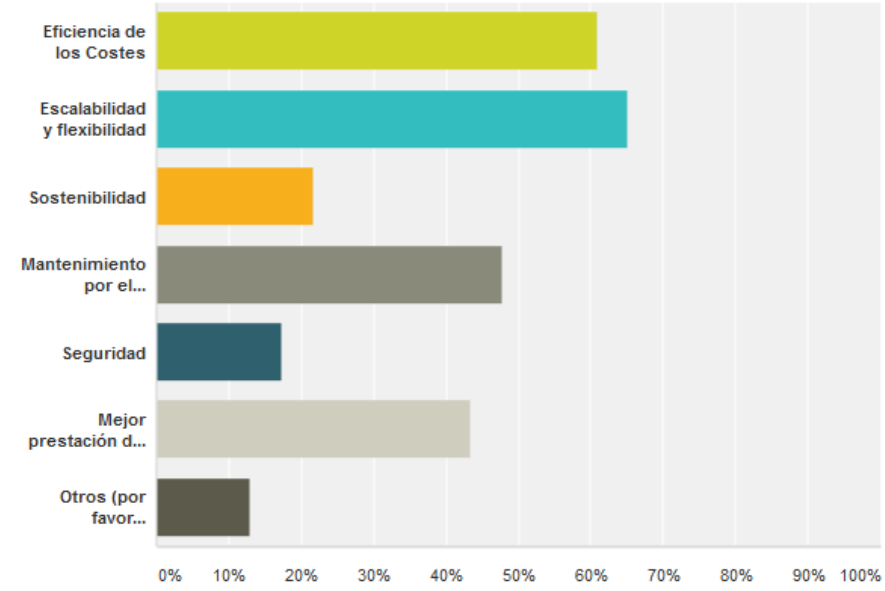
¿Qué servicios de computación en la nube usa en su empresa/organización?

Answered: 24 Skipped: 2



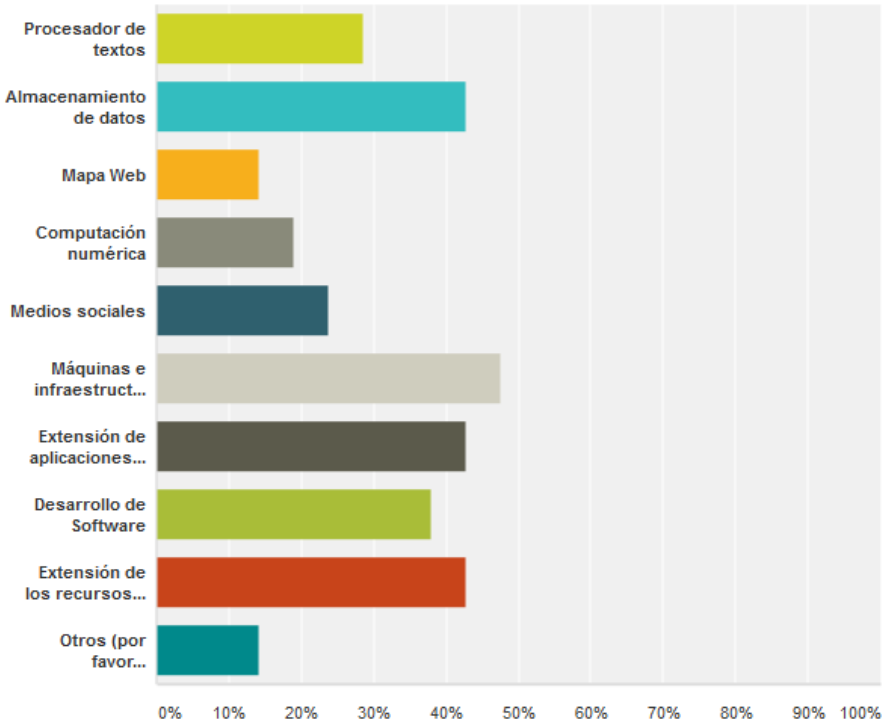
¿Qué ventajas ofrece la nube a su empresa /organización?

Answered: 23 Skipped: 3



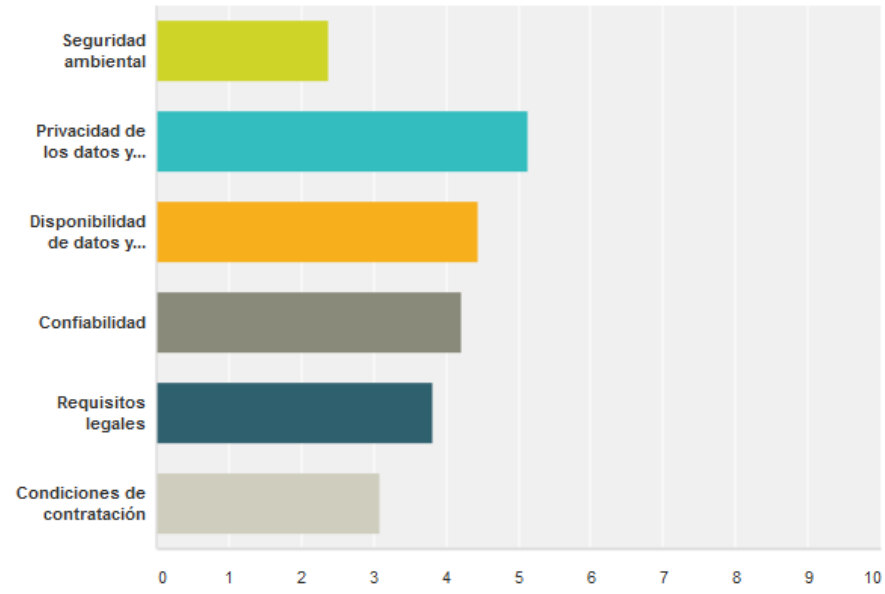
¿Qué servicios de la nube aspira en el futuro a utilizar en su empresa/organización?

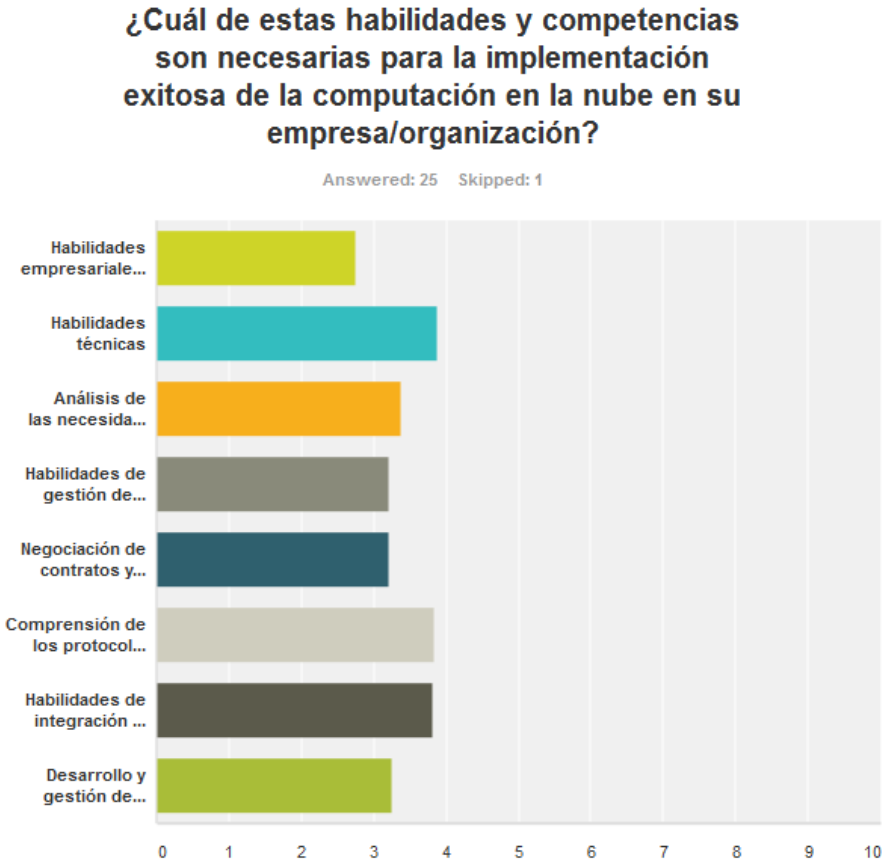
Answered: 21 Skipped: 5



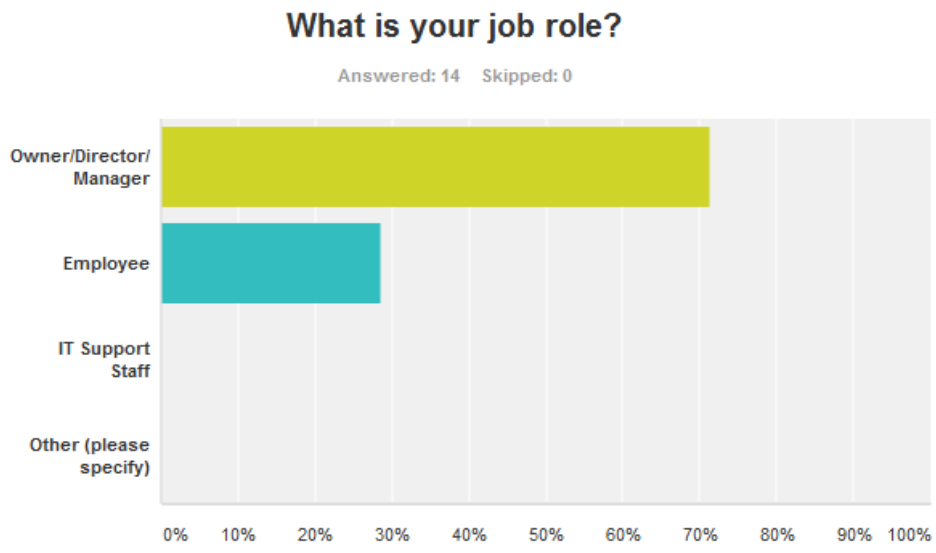
Por favor, ordene sus principales preocupaciones en relación con la adopción de la computación en la nube en su empresa/organización

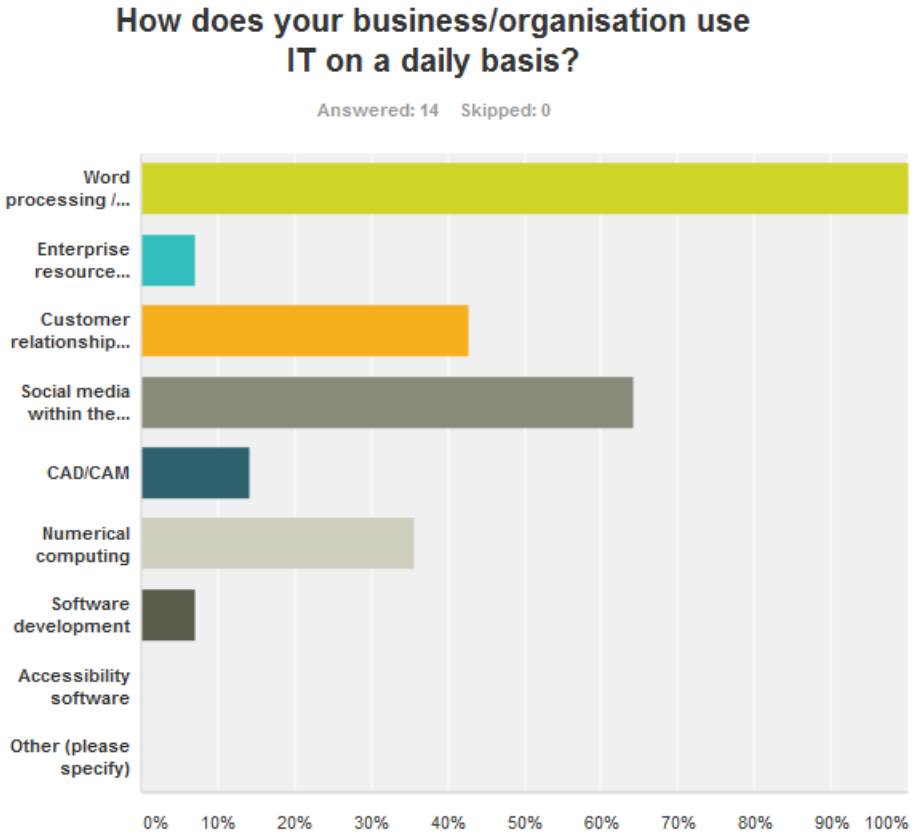
Answered: 25 Skipped: 1




¿Cuál de estas habilidades y competencias son necesarias para la implementación exitosa de la computación en la nube en su empresa/organización?
Answered: 25 Skipped: 1
Habilidades empresariale...
Habilidades técnicas
Análisis de las necesida...
Habilidades de gestión de...
Negociación de contratos y...
Comprensión de los protocol...
Habilidades de integración ...
Desarrollo y gestión de...
0
1
2
3
4
5
6
7
8
9
10

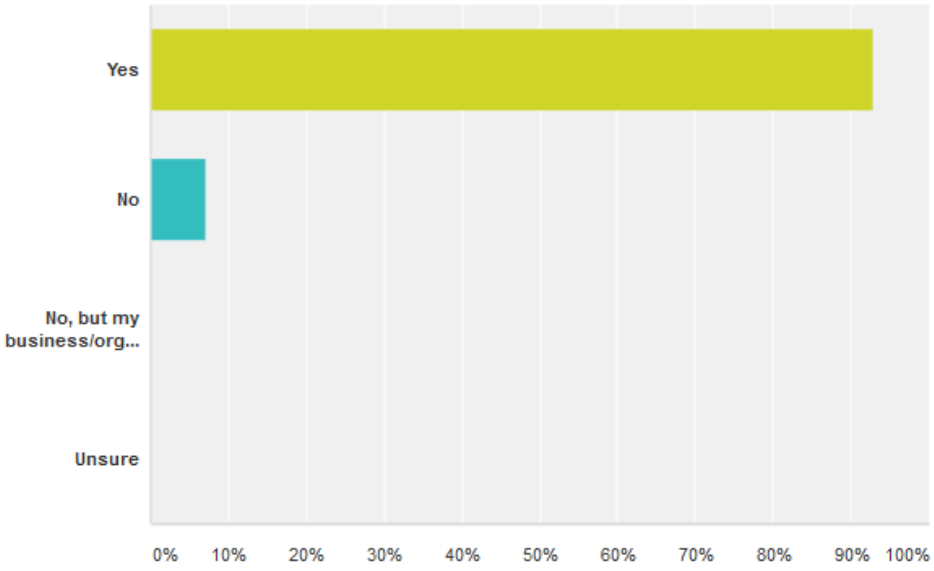
5.6 Survey results: UK





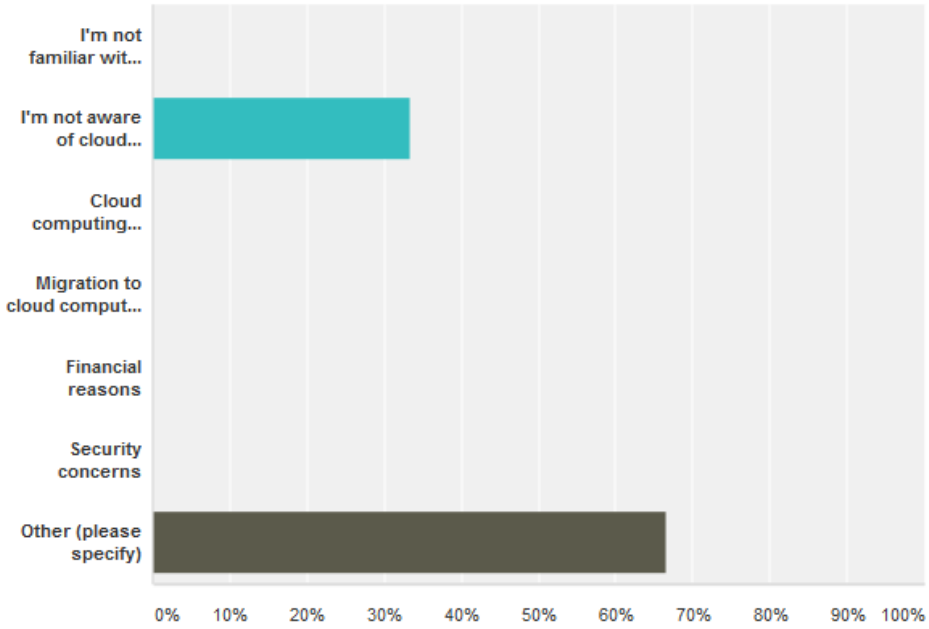
Do you use cloud computing services in your business/organisation?

Answered: 14 Skipped: 0



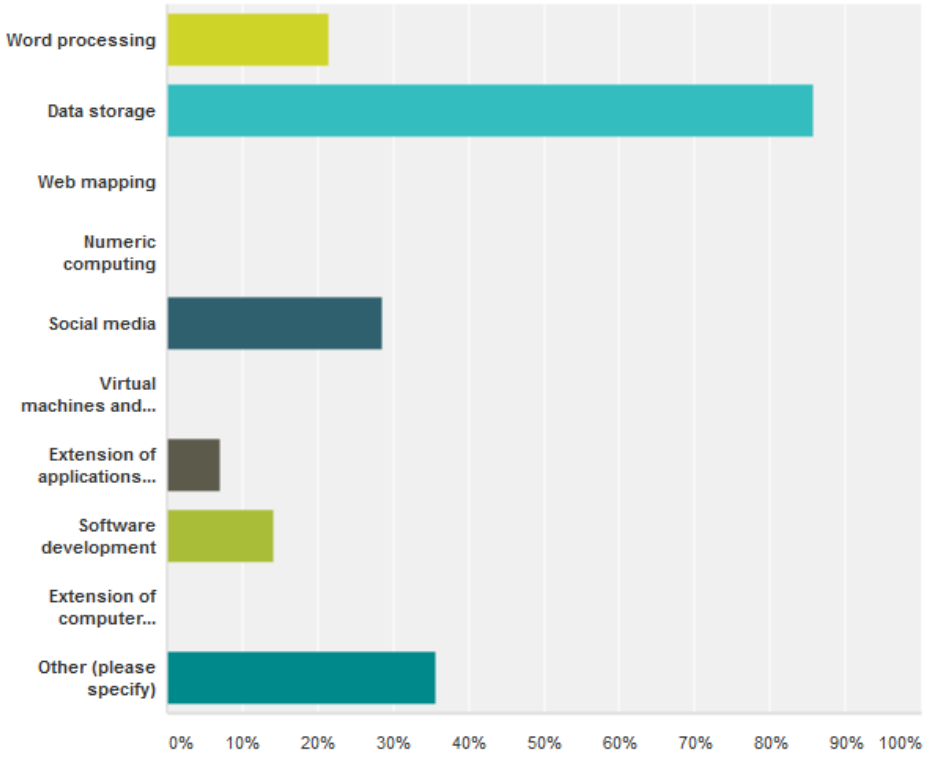
Why don't you use cloud computing services in your business/organisation?

Answered: 3 Skipped: 11



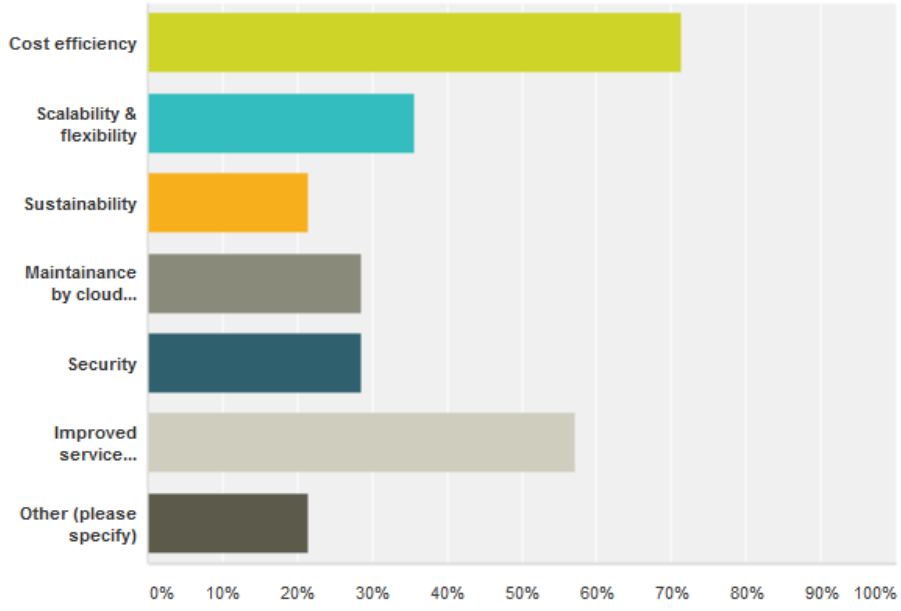
Which cloud computing services do you use within your business/organisation?

Answered: 14 Skipped: 0



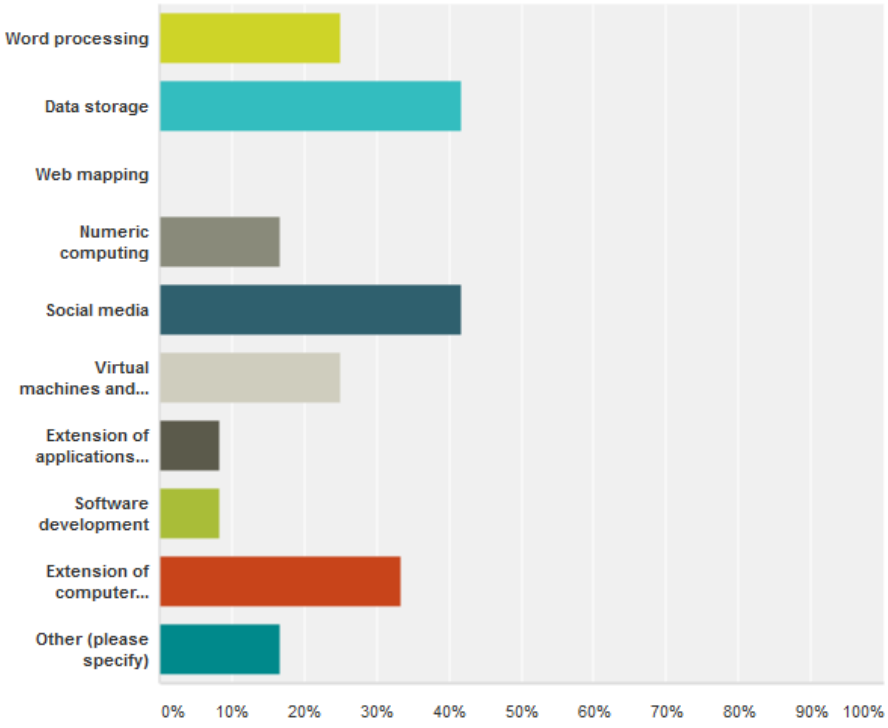
What benefits does the cloud offer to your business/organisation?

Answered: 14 Skipped: 0



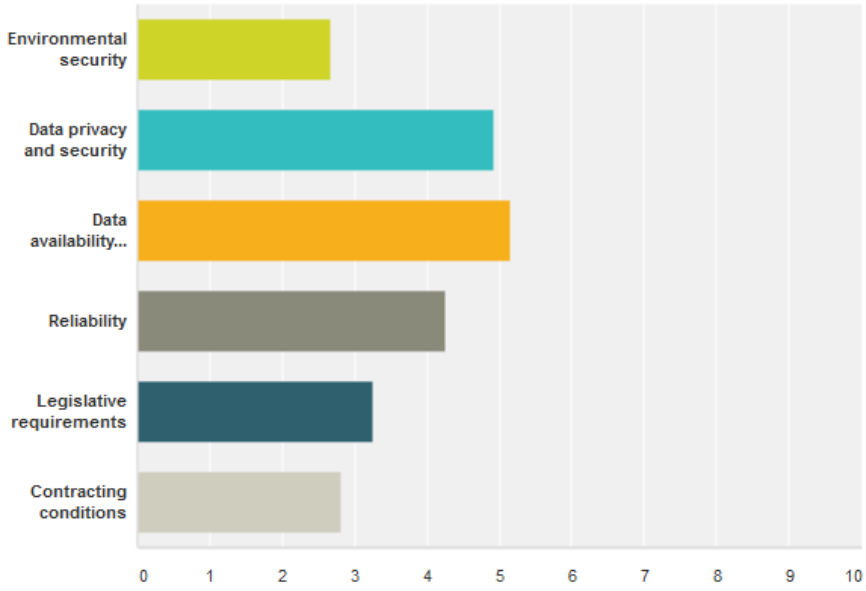
Which cloud services do you aspire in the future to use in your business/organisation?

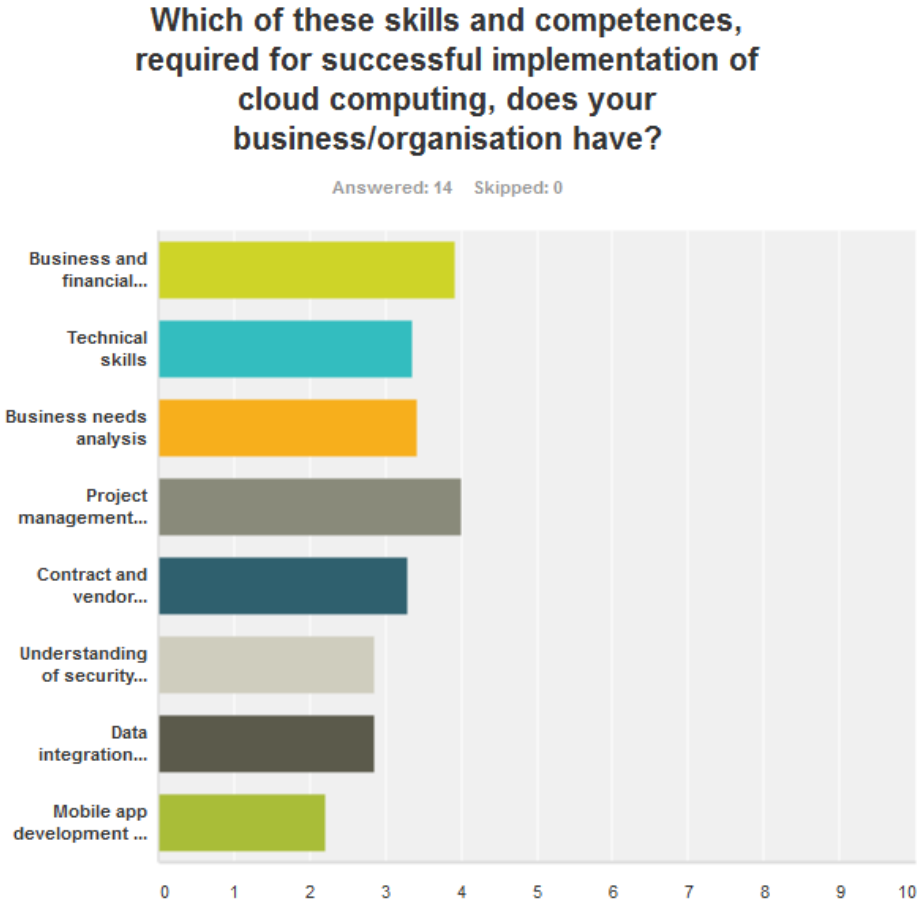
Answered: 12 Skipped: 2



Please rank your primary concerns regarding the adoption of cloud computing into your business/organisation

Answered: 13 Skipped: 1




Which of these skills and competences, required for successful implementation of cloud computing, does your business/organisation have?
Answered: 14 Skipped: 0
Business and financial...
Technical skills
Business needs analysis
Project management...
Contract and vendor...
Understanding of security...
Data integration...
Mobile app development ...
0
1
2
3
4
5
6
7
8
9
10

5.7 Survey analysis and comments

Q1: What is your job role?	Germany	Greece	Italy	Portugal	Spain	UK
Owner/Director/Manager	21%	36%	10%	80%	31%	71%
Employee	46%	27%	58%	13%	46%	29%
IT Support Staff	25%	36%	16%	7%	4%	0%

Q2: In which sector does your business/organisation operate?	Germany	Greece	Italy	Portugal	Spain	UK
Telecommunication	11%	0%	29%	0%	12%	0%
ICT	26%	11%	20%	50%	12%	0%
Consulting	4%	11%	4%	7%	0%	50%
Services	18%	11%	10%	14%	12%	29%
Healthcare	0%	0%	2%	0%	0%	0%
Retail	4%	0%	10%	22%	0%	0%
Manufacturing	0%	23%	15%	0%	0%	7%
Food	0%	0%	2%	0%	0%	0%
Banking	4%	0%	5%	0%	0%	0%
Transport / Logistics	7%	0%	3%	0%	0%	0%
Public sector	26%	44%	0%	7%	64%	14%
Total	100%	100%	100%	100%	100%	100%

Q3: How does your business/organisation use IT on a daily basis?	Germany	Greece	Italy	Portugal	Spain	UK
Word processing / MS Office	100%	100%	82%	79%	92%	100%
Enterprise resource planning (ERP)	32%	18%	31%	43%	42%	7%
Customer relationship management (CRM)	57%	18%	47%	50%	50%	43%
Social media	82%	45%	37%	71%	73%	64%
CAD/CAM	14%	64%	21%	14%	19%	14%
Numerical computing	7%	55%	27%	14%	27%	36%
Software development	61%	45%	38%	64%	58%	7%
Accessibility software	14%	27%	18%	7%	4%	0%

Q4: Do you use cloud computing services in your business/organisation?	Germany	Greece	Italy	Portugal	Spain	UK
Yes	75%	82%	49%	73%	77%	93%
No	18%	18%	29%	27%	19%	7%
No, but in future	4%	0%	7%	0%	4%	0%
Unsure	3%	0%	15%	0%	0%	0%

Q5: Why don't you use cloud computing services in your business/organisation?	Germany	Greece	Italy	Portugal	Spain	UK
I'm not familiar with cloud computing services	43%	0%	33%	14%	7%	0%
I'm not aware of cloud computing benefits	29%	50%	15%	29%	0%	33%
Cloud computing services bring no benefits for my business/organisation	14%	50%	10%	43%	7%	0%
Migration to cloud computing services is too complex	0%	50%	5%	14%	27%	0%
Financial reasons	57%	25%	10%	29%	20%	0%
Security concerns	57%	50%	23%	14%	33%	0%
Doesn't apply to me	0%	0%	28%	29%	40%	67%

Q6: Which cloud computing services do you use within your business/organisation?	Germany	Greece	Italy	Portugal	Spain	UK
Word processing	81%	25%	30%	42%	54%	21%
Data storage	76%	75%	72%	75%	79%	86%
Web mapping	14%	50%	22%	0%	13%	0%
Numeric computing	5%	0%	11%	0%	4%	0%
Social media	76%	25%	33%	17%	54%	29%
Virtual machines and infrastructure	43%	25%	54%	58%	50%	0%
Extension of applications through Cloud APIs	19%	0%	20%	17%	13%	7%
Software development	76%	0%	26%	42%	21%	14%
Extension of computer resources (e.g. CPU, RAM, …)	5%	13%	35%	8%	17%	0%

Q7: What benefits does the cloud offer to your business/organisation?	Germany	Greece	Italy	Portugal	Spain	UK
Cost efficiency	81%	11%	58%	75%	61%	71%
Scalability & flexibility	67%	67%	47%	75%	65%	36%
Sustainability	10%	22%	27%	25%	22%	21%
Maintainance by cloud provider	48%	33%	31%	67%	48%	29%
Security	24%	56%	33%	42%	17%	29%
Improved service delivery	90%	11%	55%	42%	43%	21%

Q8: Which cloud services do you aspire in the future to use in your business/organisation?	Germany	Greece	Italy	Portugal	Spain	UK
Word processing	91%	0%	35%	11%	29%	25%
Data storage	68%	40%	55%	56%	43%	42%
Web mapping	23%	20%	14%	33%	14%	0%
Numeric computing	5%	0%	19%	11%	19%	17%
Social media	91%	20%	28%	44%	24%	42%
Virtual machines and infrastructure	86%	80%	30%	33%	48%	25%
Extension of applications through Cloud APIs	36%	20%	25%	22%	43%	8%
Software development	77%	40%	23%	44%	38%	8%
Extension of computer resources (e.g. CPU, RAM, …)	18%	20%	30%	22%	43%	33%

Q9: Please rank your primary concerns regarding the adoption of cloud computing into your business/organisation (1 – lowest, 5 – highest concerns)	Germany (Average)	Greece (Average)	Italy (Average)	Portugal (Average)	Spain (Average)	UK (Average)
Environmental security	1.52	3.00	2.17	2.60	2.39	2.67
Data privacy and security	3.58	3.17	4.06	5.30	5.13	4.92
Data availability and business continuity	3.76	3.50	3.10	5.00	4.45	5.15
Reliability	3.84	1.80	3.57	4.43	4.22	4.25
Legislative requirements	4.50	4.60	3.16	2.10	3.82	3.25
Contracting conditions	4.87	3.33	3.00	2.82	3.08	2.82

Q10: Which of these skills and competences, required for successful implementation of cloud computing, does your business/organisation have? (1 – Not at all, 5 – Very high)	Germany (Average)	Greece (Average)	Italy (Average)	Portugal (Average)	Spain (Average)	UK (Average)
Business and financial skills	3.31	3.14	3.24	3.50	2.75	3.93
Technical skills	3.96	3.33	3.58	3.92	3.88	3.36
Business needs analysis	3.27	3.00	3.40	3.67	3.38	3.43
Project management skills	4.23	3.50	3.44	3.75	3.21	4.00
Contract and vendor negotiation	4.12	3.17	3.46	3.33	3.21	3.29
Understanding of security protocols	3.15	3.17	3.55	3.42	3.84	2.86
Data integration skills	2.88	2.83	3.43	3.58	3.83	2.86
Mobile app development and management	4.15	2.17	3.12	3.17	3.25	2.21

6. Didactic Units

An analysis of the training need in the area of Cloud Computing has been finally carried out by the partnership, on the basis of the results of the surveys, on the discussions with experts, on the analysis of available Cloud services and providers, existing studies and analyses at national and European level.
Different training needs have identifies and grouped into "didactic units". Each didactic units represents a stand-alone group of contents, leading to specific Learning Outcomes. Four categories of didactic units have been identified, on the basis of the contents and on the objectives:

- Introductive concepts
- Cloud models and architectures
- Cloud security
- Cloud service and technologies

In the following paragraphs, the didactic units are briefly described.

6.1 Cloud basics

- **Introduction to cloud computing**

EQF level: 4
Students are expected to acquire theoretical knowledge/skills and competences on: terms and basic concepts; virtualization methods; Cloud service users (owners, administrators, consumers); basic cloud applications (on-demand computing power and data storage); cloud computing power sharing (advantages and problems); cloud storage sharing (advantages and problems).

- **Basic concepts**

EQF level: 4
Students are expected to acquire knowledge/skills and competences on: cloud computing elementary blocks; virtual servers, fail-safe resilient architectures, no-setup hosts, pay-for-use systems; adaptive computing power and data storage; implementation mediums; storage services and technologies, non-relational and relational model comparison; service testing methodologies.

6.2 Cloud models and architectures

- **Cloud Models**

EQF level: 4
Students are expected to acquire knowledge/skills and competences on: software as a Service (SaaS) delivery model; platform as a Service (PaaS) delivery model; infrastructure as a Service (IaaS) delivery model; public/private/hybrid/community deployment models, service Level Agreements (SLAs)

- **Cloud providers**

EQF level: 4
At the end of this unit the student will acquire knowledge of the main cloud providers, i.e., entities that offer cloud computing services, including i) cloud infrastructure, ii) cloud platform, iii) cloud software, iv) cloud storage, and v) cloud security vendors and also on national providers and their main point of strength.

- **Cloud models**

EQF level: 4

Students are expected to demonstrate comprehensive knowledge/skills and competences on: Software as a Service (SaaS) delivery model, Platform as a Service (PaaS) delivery model, Infrastructure as a Service (IaaS) delivery model, Public/private/hybrid/community deployment models, Service Level Agreements (SLAs).

- **Cloud architecture**

EQF level: 5

Students are expected to master the three main cloud computing architecture paradigms: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). With IaaS hardware resources are made available in a virtualized way in the cloud; with PaaS cloud computing platforms, i.e. hardware and software tools, are provided; in SaaS, the software applications are directly accessible by the users over the cloud.

6.3 Cloud security

- **Security basics**

EQF level: 4

Students are expected to acquire factual knowledge/skills and competences on: authentication, authorization, and accounting; monitoring, auditing and logging; network security; security groups and virtual server images; cloud-based services and cloud-hosted solutions common security risks; counter-attack strategies and methods; risk analysis.

- **Cloud security**

EQF level: 5

Students are expected to acquire specialized knowledge/skills and competences on: Authentication, authorization, and accounting; network security; Cloud services security; Virtual Machine Platform Protection; Trusted Cloud Resources ;Permanent Data Access Loss Protection The Security Lifecycle; Risk analysis and proactive mitigation

6.4 Cloud services and technologies

- **Cloud business services and applications**

EQF level: 4

Students are expected to have an overview of: cloud-based business solution, storage services, virtual resources and databases, cloud-based e-commerce solutions; cloud-based marketing solutions; cost benefits for the SMEs, business models; showcases of Cloud applications for SMEs

- **Cloud services and applications for public administrations and citizens**

EQF level: 4

Students are expected to have an overview of: cloud services for public administrations, collaborative resources, online tools and document sharing for public administration, storage services, virtual resources

and interoperability among the administrations, services to the citizens; cost-benefits for the public administration; showcases of Cloud applications in the public administration

- **Cloud services and applications for education**

EQF level: 4

Students are expected to have an overview of: cloud services for education; collaborative resources and tools, document sharing and collaborative editing; storage services, Cloud training resources, online didactic resources, remote tools and experiments; cloud computing services, virtual machines; showcases of Cloud applications in education.

- **Cloud services and applications development**

EQF level: 5

Students will have to demonstrate specialized competences in the development of services and applications in the cloud, including the widest spread paradigms, frameworks and programming languages for setting up a cloud application. They will also master development techniques ranging from the more physical levels, i.e. Infrastructure as a Service (IaaS) and Platform as a Service (PaaS), to the higher levels, i.e. Software as a Service (SaaS).

- **Cloud virtualization**

EQF level: 5

The focus of this module is the virtualization of servers and of computational resources in the cloud. At the end of the unit the student will acquire a deep knowledge on how to set up, configure and use a virtualized computing environments, being aware of all virtualization technologies, backup, security and reliability issues.

- **Cloud storage**

EQF level: 5

The most wide-spread application of cloud computing is the remote storage of user data. After completing this module, students will acquire a relevant knowledge on technologies for data storage in the cloud, based on several case studies (e.g., Dropbox, Google drive) as examples of cloud storage services, as well as data security and privacy issues.

7. Conclusions and Recommendations

SMEs are important economic organisation in Europe and could be motor of innovation in the European economy but need support i.e. cooperation with research and education institutions in this context. Such cooperation is important to ensure the survival of these companies and encourage them to grow. In today's business world, SMEs are competing with a larger number of companies, many of these are multinationals; they have a greater number of staff and a wider pool of skills. SMEs should be helped to acquire the relevant strategic skills as quickly as possible to remain ahead of the competition by using latest technologies such as Cloud Computing for business and learning because most of them would like to use Cloud services.