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Master's thesis

Organizations Management

**The impact of setting up a cloud  
computing solution on an  
organization  
Case study: IOS**

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## Abstract

In the midst of all these changes and technological developments, the organization and in order to keep its place in the market, it has to adapt and run these changes for its best interest, and that can only be accomplished by understanding these technologies, and all of their dimensions.

This academic work will study one of these new technologies, which is cloud computing, and its impact on the organization, the elements that may get impacted the most, and the consequences of its adoption.

Keywords: cloud – computing – organization – technology – systems – Information.

## Résumé

Au milieu de tous ces changements et développements technologiques, l'organisation et pour garder sa place dans le marché doit adapter et faire jouer ces changements pour son intérêt, et ça se fait que par bien comprendre ces nouvelles technologies, avec tous leur dimensions.

Ce travail académique va étudier une de ces technologie, ce qui est le cloud computing, son impact sur l'organisation, les éléments qui peuvent s'impacter le plus, et les conséquences de son adoption.

Mots clés : cloud - computing – organisation – technologie – système – information.

## ملخص

في ظل هذه كل التغييرات و التطورات التكنولوجية، يجب على المنظمة ان تحسن التعامل و التناغم معها لكي تحافظ على مكانتها في السوق، و هذا لا يمكن ان يتحقق الا بالفهم التام لهذه التكنولوجيات الحديثة بمختلف ابعادها.

هذا العمل الاكاديمي سيدرس احدى هذه التكنولوجيات الحديثة، الحوسبة في السحاب، اثرها على المنظمة الاطراف التي تتاثر بها اكثر، و عواقب اعتمادها.

الكلمات المفتاحية: تكنولوجيا، منظمة- حوسبة - مؤسسة - نظام - معلومات

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# Summary

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## **Abbreviations and acronyms list**

IT: Information Technology

VM: Virtual Machine

SaaS: Software As A Service.

PaaS: Platform As A Service.

IaaS: Infrastructure As A service.

SLA: Service Level Agreement.

CRM: Customer Relationship Management.

ERP: Enterprise Resources Planning.

BI: Business Intelligence.

BPM: Business Process Management.

ITIL: Informational Technology infrastructure Library.

ISO: International Organization for Standardization

SRM: Supplier Relationship Management.

BMIT: Business Management of Information Technology.

# Introduction

As we know organizations are a set of systems affect their surrounding environment and gets affected with their environment, and any changes in it can impact the outcome of any operation and decision in the organization, no matter how small it is or how irrelevant, from the simplest operation or process to the most complicated processes and strategic decisions.

And in today's market competition is fierce and the environment is changing, which drove organizations into taking new measures such as cutting any unnecessary activities and go back to work on their core activity while outsourcing the rest, and making the customer their prime focus.

Technologies evolved at a very fast pace in the last decade, which is something new to organizations, a thing that they have to adapt with and work on making it go to the best interest, many edge cutting inventions and innovations came to be known, some of them appeared then disappeared and replaced by new ones in few years only, what we want to say here is that we are witnessing the fastest technology advancement era, and it doesn't make sense that all this doesn't impact the organization.

Information technologies were always used by organizations to better serve their customers, to make life easier for employees, to improve work environment, to treat the suppliers better and make their job easier...etc. which made IT departments very sensitive

And as a result of decades of evolutions in the Tech world and organizations trying to open up to the world through the web, a new concept appeared and came to be known as "Cloud computing" and since its appearance many companies all over the world generally and in Algeria specifically are migrating into it and many cloud computing service providers are in markets now.

So

- General question: what are the impacts of cloud computing on the organization?
- Secondary questions:
  - Is migrating into cloud beneficial for an organization?
  - Is the good of cloud computing more than the bad of it?

- Is migrating into cloud computing a good decision for an Algerian organization?
- What parts of the organization does it impact and which does it improve the most and which makes worst?
- What are its disadvantages?

# Chapter one

## ❖ Part 01: Literature review :

Preparing for this research we tried to find as many articles, publications, thesis...etc. as we can in order to enrich and diversify our sources, one thing we notices is that this topic it not studies as it should be by the academic world, meaning there were not academic publications studying it, most of what we found was published by actors in the professional world of cloud, and they were mostly concentrating on the technical side of it, and the academics publications were from the tech world which means they were from computer science schools, and didn't shed a lot a lot of light on the organizational dimension, which made it even harder to study the impact of cloud on an organization.

Nonetheless we managed to find to pick some valid sources in the form of publications that studies the business or organizational side of the cloud such as:

- Michael hugos, Derek hultzky (2011), "business in the cloud: what every business needs to know about cloud computing", published by wiley publishing, INC.
- Katrina Stanoevska-Slabeva, Thomas wozniak (2010), "Grid and cloud computing: a business perspective on technology and applications" published by Springer.
- Judith Hurwitz, Fern Halper (2010), "cloud computing for dummies" published by wiley publishing, INC.

Raising the issue we talked about already again, we had to you some publications, published by actors in the cloud market to understand some parts of this technology there were not covered by the academic world:

- Intel IT Center (2013), "virtualization and cloud computing: steps in evolution from virtualization to private cloud infrastructure as a service" Published by Intel.
- Red hat, (2017), « red hat enterprise virtualization 3.6: virtual machine management guide », Published by redhat.
- VMware (2006), "virtualization overview: white paper", Published by Wmware

Amongst our sources we had some articles that talked about the cloud such as:

- Grace lewis (2010), “basics about the cloud”, Software engineering institute: Garnegie Mellon University.

This talked about the basic concepts of the cloud, their definitions, and the classifications, it also talks about adoption decision by the organization, and whether it is a good idea or not, depending on the company and its resources.

Another article we used in this research is:

- Colin ting Si Xue, Felicia Tiong Wee Xin, (2016) “Benefits and challenges of the adoption of cloud computing in business”, International journal on cloud computing: Services and architecture, Vol.06, No.06, December 2016.

This article talked about many aspects of the cloud, they mentioned the basics of the cloud (definition, classifications...etc.), then they went talking about the benefits of cloud on businesses and its risks on businesses, thus trying to give a clear vision about cloud in business.

We also had to use other types of resources like dictionaries to get some definitions like our use of Cambridge dictionary or Oxford dictionary; we also used many international organizations such as ISO, ITIL...etc. as a reference in some relevant parts of this study.

## ❖ **Part 02: cloud fundamentals.**

In this part we will discover together a part of the cloud computing, understand concepts that are strange to our major, and that is the reason why it will take a big part of this thesis contrary to the familiar organizational part.

### ➤ **Virtualization :**

you can't talk about cloud computing without understanding virtualization, because of its importance in this topic, and in the working processes of cloud computing, in fact it played a major role in the way data center work all together, and in this part we will discover it.

## 1. Definition of Virtualization:

Virtualization is a computer architecture technology by which multiple virtual machines VMs are multiplexed in the same hardware machine, the purpose of virtualization is to enhance resource sharing by many users and improve computer performance in terms of resource utilization and application flexibility.<sup>1</sup>

In simpler words virtualization is a method to make taking advantage of the full capabilities and computing power of a physical box possible by running many VMs in a single box.

## 2. Virtual Machines VMs:

According to *Redhat* a virtual machine is a software implementation of a computer and consolidates computing tasks and workloads, in traditional computing environments workloads usually run individually administered and upgraded servers, virtual machines reduce the amount of hardware and administration required to run the same computing tasks and workloads.<sup>2</sup>

When running only a single application in one physical box only a part of its computing power is being used but when running many applications using VMs you are allowing the use of its full power.

## 3. Benefits of virtualization:

We can find in the *Redhat guide to virtualization* many benefits related to: cost, performance, and security.

### ✓ Cost:

While virtualization is expensive to introduce it often save many in the long term by many features in it like:

- Reducing energy cost: cause it negates much of the power drawn for machine operation and cooling.
- Reducing maintenance: provided adequate planning is performed before migrating physical systems into virtualized ones, less time is

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<sup>2</sup> Red hat, (2017), « red hat enterprise virtualization 3.6: virtual machine management guide », page 04.

spent maintaining them, which means needs to be spent on parts and labor.

- Extended life for installed software: Older versions of software may not be able to run directly on more recent physical machines. By running older software virtually on a larger, faster system, the life of the software may be extended while taking advantage of better performance from a newer system.
- Less space: Consolidating servers onto fewer machines means less physical space is required for computer systems.

### ✓ **Performance:**

Modern virtualization technology has improved the speed of virtual machines, now they can run typical server applications nearly as efficiently as bare-metal systems<sup>3</sup>

High availability is migrating the application into another server once something is wrong with it because the application is not related to the physical server.

### ➤ **Cloud computing Fundamentals :**

#### **1- Definition of cloud computing :**

Defining cloud computing depends on the angle we're looking from cause the definition changes with the change of the perspective if we define it by the origin of the word like *John W.Rittinghouse, James F.Ransome (2010)* Says the term cloud has been used historically as a metaphor for the internet<sup>4</sup> So based on this definition the term Cloud computing is the use of computing power on the internet. And for a more technical definition *Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010)* "the cloud is a set of hardware, networks, storage, services, and interface that enables the delivery of computing as a service, cloud services include the delivery of software, infrastructure, and

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<sup>3</sup> Jiri Herrmann, Yehuda Zimmerman (), "Virtualization Getting Started Guide: an introduction to virtualization concepts", published by redhat, pages: 2.1 ; 2.2.

<sup>4</sup> John W.Rittinghouse ; James F.Ransome (2010), "Cloud Computing: Implementing, management, and security" Published by CRC Press, Page: xxv

storage over the internet”<sup>5</sup>. Also the definitions vary from the end user to the provider, for example, on one hand we have *Merill lynch* as an end user defining is as “The idea of delivering personal (eg: email, word processing, presentations) and business applications (eg: sales force automation, customer services, accounting.) From centralized servers.”<sup>6</sup> On the other hand we have Amazon’s definition as a provider like the following “Cloud computing is the on-demand delivery of compute power, database, storage, Applications, and other IT resources through a cloud service Platform via the internet with a pay-as-you-go pricing”<sup>7</sup>.

Finally We have the definition given by *Vequero et al (2008)*, that analyzed no less than 22 definitions “cloud are a large pool of easily usable and accessible virtualized resources (such as hardware; development platforms, and/or services) these

resources can be dynamically reconfigured to adjust to a variable load (scale), allowing also for an optimum resource utilization, this pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by infrastructure provider by of customized SLAs”.

It is worth mentioning too that cloud is an evolution of virtualization just to connect the dots between this part and an the previous one

## **2- Types of cloud “Classifications”:**

The classification of cloud computing also depends on the perspective, the first classification is based on the access which means who can access the cloud, and the second one is based on capabilities provided.

- **The access based classification:**

In this classification we have three types of cloud “Public, Private, Hybrid”

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<sup>5</sup> Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010), “Cloud computing for dummies”, Published by Wiley Publishing,INC. Page: 09

<sup>6</sup> Katrina Stanoevska-Slabeva, Thomas wozniak (2010), “Grid and cloud computing: a business perspective on technology and applications” published by “Springer”, Page: 48

<sup>7</sup> Amazon Web Services (consulted 05/30/2018), « What is Cloud computing ? », Amazon’s official website, (online), url : [https://aws.amazon.com/what-is-cloud-computing/?nc1=h\\_ls](https://aws.amazon.com/what-is-cloud-computing/?nc1=h_ls)

### ✓ **Public cloud:**

The access in public cloud is for everyone and it's outside the company's walls, one definition of public cloud is the one given by *Micheal hugos, Derek Hulitzky (2011)* "Public cloud are owned and operated by third parties and located in data centers that operate outside of the companies that use them, multiple companies share these resources, they are each assigned their own virtual computing capabilities based on a common set of physical resources.

Public clouds are provided by companies like: Amazon, IBM, Google, Microsoft...etc."<sup>8</sup>

### ✓ **Private cloud:**

In private cloud the access is limited the company that uses it like explained by *Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010)* "Private cloud is a highly virtualized cloud data center located inside the company's firewall; it may also be a private space dedicated to a company within a cloud vendor data center designed to handle its workloads".<sup>9</sup>

We can give an example for private cloud here in Algeria, the cloud servers set up by "ELIT" a SONALGAZ affiliated company, their cloud is designed to handle only the workloads of the companies affiliated to SONALGAZ, so here said cloud was set up inside the company and handles it's workloads, in the contrary OVH a vendor of cloud that provides private cloud services in the form servers dedicated to a specific customer.

### ✓ **Hybrid cloud:**

Hybrid cloud is a combination between public and private cloud or as *Microsoft* defines it, a hybrid cloud is a computing environment that combines a public and a private cloud and gives businesses the ability to seamlessly scale their on-premises infrastructure up to the public cloud to handle any overflow – without giving third-party datacenters access to the entirety of their data. Organizations gain the flexibility and computing power of the public cloud for basic and non-

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<sup>8</sup> Micheal hugos, Derek Hulitzky (2011), "business in the cloud: what every business needs to know about cloud computing", published by wiley publishing, INC; Page: 103

<sup>9</sup> Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010), "Cloud computing for dummies", Published by Wiley Publishing, INC. Page: 88

sensitive computing tasks, while keeping business-critical applications and data on-premises, safely behind a company firewall.<sup>10</sup>

To explain more let's say "ELIT" the example we mentioned in the private cloud part, has a lot of resources and decides to open up to the market as a cloud vendor, here it becomes a hybrid cloud because it has private cloud plus the new part of public cloud.

- **The capabilities based classification:**

This classification is based on the capabilities provided to the company, in the cloud services it gets, and we have in it three types: Software as a Service "SaaS", Platform as a Service "PaaS", and Infrastructure as a Service "IaaS", each one of these types has its purpose and its features.

- ✓ **Software as a service "SaaS":**

Software as a service can be defined like the following "software that is deployed on a network which is usually the internet", with SaaS a provider licenses an application to a customer either as a service on demand through a subscription in a pay-as-you-go model or "increasingly" at no charge when there is an opportunity to generate revenue from streams other than the user, such as advertisements or user lists sales.<sup>11</sup>

So to summarize SaaS are applications hosted and developed by a provider then delivered to the customer ready for use it might be free or charge or a paid service depending on the monetization model followed by the service provider.

For a better understanding let's take the example of CRMs, they are applications hosted and developed by a provider delivered to the company ready for use and it might pay for it or free of charge

Odoo an ERP/CRM application is a good example of SaaS it's an application where the company pays a fee per user and uses it without knowing anything about the technical details going on behind the scenes.

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<sup>10</sup> Microsoft Azure (consulted 05/30/2018), « What is hybrid cloud ? », Microsoft Azure's official website, (online), url : <https://azure.microsoft.com/en-us/overview/what-is-hybrid-cloud-computing/>

<sup>11</sup> Ben Kepes (2011), "Understanding the cloud computing stack", Published by Diversity limited; Page: 05

### ✓ Platform as a Service “PaaS”:

PaaS is similar to SaaS but the service is an entire application development environment not just the use of an application<sup>12</sup>, in PaaS the provider delivers what you might call a solution stack, an integrated set of software that provides everything a developer needs to build an application for both software development and runtime<sup>13</sup>.

### ✓ Infrastructure as a Service “IaaS”:

Infrastructure as a Service is the delivery of computer hardware “servers, networking technology, storage, and data center space” as a service it may also include the delivery of operating systems and virtualization technology to manage the resources<sup>14</sup>.

So the idea here is allowing the company to rent hardware capabilities instead of buying and setting them.

One form of IaaS is delivering virtual machines VMs.

### 3- Cloud characteristics:

Looking over the cloud we can find many characteristics related to it and differentiating it, we can mention for example:

- Elasticity.
- Scalability.
- Self-service.
- The pay-as-you-go model.
- Mobility.
- Collaboration.
- Security.

We will explain a few of these notions not all of them because diving into the details we take a big amount of space and time considering that it is a large

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<sup>12</sup> Ronald L.Kurtz , Russel Dean Vines (2010), “cloud security : a comprehensive guide to secure cloud computing”, Published by Wiley Publishing ; Page: 39

<sup>13</sup> Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010), “Cloud computing for dummies”, Published by Wiley Publishing,INC. Page: 20

<sup>14</sup> Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010), “Cloud computing for dummies”, Published by Wiley Publishing,INC. Page: 18

area and we are not concerned with most of it since we are not computer science students.

✓ **Scalability:**

Scalability means that the consumer has the ability to scale into larger number of users whenever needed, but most importantly doing all that without impacting the current users, the data stored and without any service disruptions.

✓ **Self-service:**

In the cloud customers don't have to go through a long process to get the services needed they simply have to order the amount they want of the service they want, a simple process that we can't do with the data centers model where departments when they want to implement an application, they have to request the service from the data center; which receives many of these requests from many departments of the company, and has to sort them and evaluate the existing resources and the need to purchase new hardware, then after purchasing new hardware the data center's staff has to configure it for the new application.<sup>15</sup>

✓ **The pay-as-you-go model:**

The pay as you go model is used in cloud computing to refer to the payment mode which is paying for the actual resources whether it is storage space or computer power or any other service, used on in other words pay for use rather than pay for the entire infrastructure.<sup>16</sup>

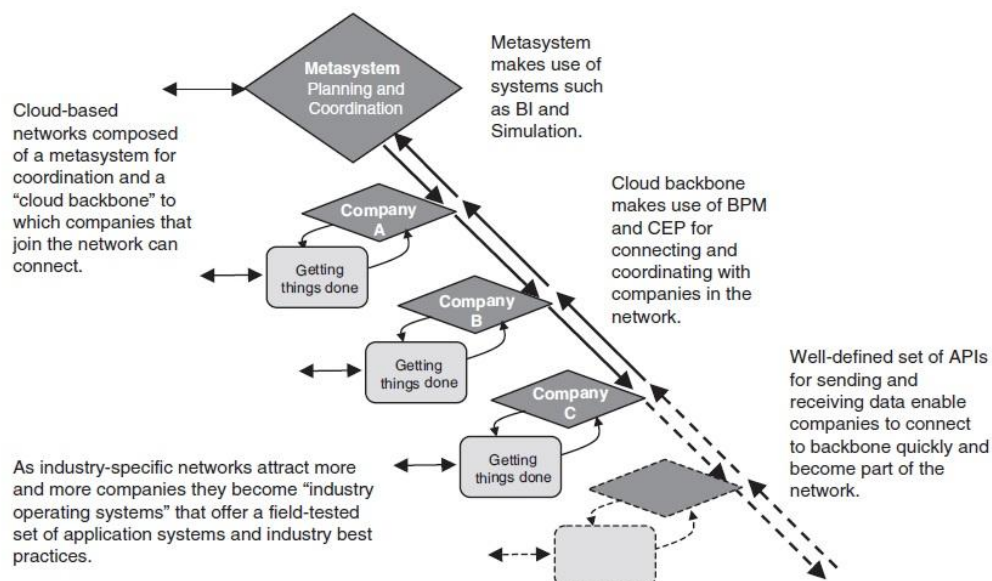
**4- The cloud-based model:**

The business environment is totally changing with the presence of the cloud technology in the markets not only it allows to do collaborative work within the company and its parts but it allows collaborative work between companies in the industry thus creating a pool of aggregated and cumulated expertise, good business practices, experiences, and ways to get tasks done.

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<sup>15</sup> Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010), "Cloud computing for dummies", Published by Wiley Publishing, INC. Page: 10

<sup>16</sup> Techopedia (consulted 05/30/2018), "definition of the pay as you go model" Techopedia website, online, url : <https://www.techopedia.com/definition/26951/pay-as-you-go-payg>



**Figure 0.1:** From the author of “business in the cloud”

This pool of information was made possible the network of companies in the meta-system illustrated previously.

And as we saw it makes use of BPM and CEP to connect companies in the industry and within years of said companies doing business, planning, and coordinating taking information and putting feedback the pool gets larger.

➤ **Open source software:**

Open source software is an important element in the evolution of cloud and its functioning and we will discover it in the following part:

**1- Definition**

According to the “open source initiative” open source software’s distribution terms must comply with these criteria:

- ✓ Free distribution
- ✓ Source code
- ✓ Derived work
- ✓ Integrity of the author’s source code
- ✓ No discrimination against persons or groups
- ✓ No discrimination against fields of endeavor
- ✓ Distribution of license

- ✓ License must not be specific for a product
- ✓ License must not restrict other software
- ✓ License must be technology neutral<sup>17</sup>

To summarize open source software are computer software with free access to the source code for the public available for modification and for use, also it's usually free of charge.

## **2- Role in the cloud:**

Open source software are now used in every scale of the cloud hierarchy and it's becoming as core to cloud as it has been for web services<sup>18</sup>(Q) , and it plays a major role in managing VMs

Cloud providers use open source software to manage their cloud, form example here in Algeria, we know that Mobilis and Actel use an open source solution which is OpenStack, and the role of this solution is to build and manage the cloud.

The Algerian company naftal, Created a cloud based on a Vmware solution, we have also nasa's solution Rackspace wich were later used by Amazon.

## **3- Examples of open source software used in the cloud:**

To give examples of open source software software used in cloud we'll do it the classification, we'll give one example of each cloud type.

- SaaS: for SaaS cloud there is a variety of applications that are open source; known to the public many of us use them in our daily life we'll mention: OpenProject, trello, Zimbra...etc
- PaaS: for the PaaS we have many open source platforms such us linux, ubento all are platforms that we can build on cloud solutions and use to run them.
- IaaS: for IaaS cloud we can mention open stack which is an open source software or a set of software, that help the user deploy cloud computing infrastructure.

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<sup>17</sup> The open source initiative (last consulted 05/30/2018), "the definition of open source", the open source initiative website, url: <https://opensource.org/osd>

<sup>18</sup> Rowan Wilson (2014) « Open source and the cloud », Open source software watch, online, url: <http://oss-watch.ac.uk/resources/opensourceandcloud>

## ➤ **Security on the cloud:**

Security is a very important matter when it comes to any system cause as we know every system has security liabilities but in cloud this issue is raised more than any other system and in this part we will see aspect of the cloud.

### **1- Information security standards:**

Many standardization organizations like the ISO worked on preparing a set of standards to follow in order to ensure good practices in information systems security in general and in the cloud too.

In this part we'll mention two of them, which are:

#### ✓ **ITIL**

According to Axelos ITIL is "ITIL advocates that IT services are aligned to the needs of the business and support its core processes. It provides guidance to organizations and individuals on how to use IT as a tool to facilitate business change, transformation and growth.

ITIL is mapped in ISO 20000 Part 11. This recognizes the way that ITIL can be used in to meet the requirements set out for ISO 20000 certification and the interdependent nature with ITIL. This is the first such mapping that ISO (the International Organization for Standardization) has allowed to be part of their standards"<sup>19</sup>

#### ✓ **ISO 27001/27002**

It's an ISO/IEC norm that regulates or defines the best practices in information systems and technology area.<sup>20</sup>

### **2- Cloud security services:**

Cyber security in general and securing a cloud are very large topics and there are a lot of services and solutions you can use to secure a cloud but here in this research we will only mention a few of them.

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<sup>19</sup> Axelos (consulted 05/30/2018) , "what's ITIL best practice ?", AXELOS's website, URL: <https://www.axelos.com/best-practice-solutions/itil/what-is-itil>

<sup>20</sup> ISO (consulted 05/30/2018), « ISO/IEC 27001:2013 », ISO's website, online, URL : <https://www.iso.org/obp/ui#iso:std:iso-iec:27001:ed-2:v1:en>

- ✓ Authentication: it's the process of evaluating the authenticity of identity proving credentials to obtain access into resources (e.g. data base) under a specific policy and it's constituted of two parts, the credential which is proof of identity, and evaluation which is assessing the correctness of the association between credential and claimed identity<sup>21</sup>
- ✓ Authorization: a process that enables access to computer resources, once a user's identity and authentication are established, authorization levels determine the extent of system rights a user can hold, in other words it determines what parts of the system a user can access.
- ✓ Auditing: organizations use auditing and monitoring to maintain operational assurance, they can be used by the cloud customer or provider depending on the assets architecture and deployment.
  - A system audit a one time or periodic event to evaluate security
  - Monitoring is an ongoing activity that examines the system or the user
- ✓ Accountability: it's the ability to determine the actions and behaviors of a single user within the cloud system and identify him<sup>22</sup>

### **3- Security-As-A-Service:**

According to *Tim Mather; Subra Kumaraswamy, Shahed Latif (2009)* security as a service is a subscription based business model that delivers security through the cloud.

And there are two types of providers merging, the first one is information security vendors who are changing their delivery methods to include services delivered through the cloud, the second type is start-up information security companies.<sup>23</sup>

Amazon provides a service like this where for example if you have a website and you use amazon services your website becomes the backend while amazon is the frontend eliminating all the threats before they even reach you.

<sup>21</sup> Professor Bulter (2011) "course of computer and information science: computer and network security authentication", university of Oregon, Page: 02.

<sup>22</sup> Ronald L.Kurtz , Russel Dean Vines (2010), "Cloud security : a comprehensive guide to secure cloud computing", Published by Wiley Publishing ; Pages: 64-65

<sup>23</sup> Tim Mather; Subra Kumaraswamy, Shahed Latif (2009), "Cloud security and privacy: an enterprise perspective on risks and compliance", Published by O'Reilly. ,Page: 217

✓ Services offered:

Providers in this model offer a variety of services to improve information security such as:

- Email filtering.
- Web content filtering.
- Vulnerability management.
- Identity management.<sup>24</sup>

#### 4- Cloud security challenges:

Like the case of every technology cloud computing has many flaws and risks of many kinds “fraud, theft, external attacks, misuse of the system...etc.” The need to be paid attention to and deal carefully with them, and they are somewhat similar to other technologies’, amongst these risks we can mention:

- ✓ Back door: in this type of attacks the goal is to gain access through a backdoor (e.g. a modem)
- ✓ Spoofing: here the intruders use IP spoofing to convince a system that it’s dealing with a known authorized party.
- ✓ Replay: the attacker intercepts and saves old messages then sends them later impersonating a side of the conversation to gain access.
- ✓ Social engineering: the attackers use social skills to obtain access by getting information “passwords, PIN number...etc.” from people in the organization through phone calls, messaging, impersonating other people or other organizations.
- ✓ Password guessing:
- ✓ Trojan horses and malwares: it’s a program that performs unknown and unwanted functions, and it can take many forms:
  - An unwanted program within a legitimate program.
  - A legitimate program altered by pacing unauthorized code in it.
  - Any program that performs unwanted actions disguised as a normal program.<sup>25</sup>

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<sup>24</sup> Tim Mather; Subra Kumaraswamy, Shahed Latif (2009), “Cloud security and privacy: an enterprise perspective on risks and compliance”, Published by O’Reilly. ,Page: 220-222

### ❖ Part 03 : Organization.

So far we have understood a lot about the cloud technology comparing to where we started, and now to link it with the organizational side we have to define the major concepts in the organization we will be using, but this part will not take as much as the first one, because we already know them and we are familiar with them since they are part of our major, so they will be brief and summarized definitions only.

#### ➤ Definition of organization.

We can find many definitions of the term organization, according to the Cambridge dictionary an organization is “A group whose members work together for a shared purpose in a continuing way” and according to the Cambridge dictionary too the business definition is “a company or other group of people that works for a particular purpose”

An organization can also be defined as “Social entities that are goal directed, designed as deliberately structured and coordinated activity systems, and are linked to the external environment” .<sup>26</sup>

In conclusion an organization is a system made of subsystems of resources “human, financial, material” working, planning, and coordinating for the purpose of achieving a specific goal.

#### ➤ Communication in an organization.

In this part we will get into one of the most important concepts in the organization which is communication, we chose to study this part alone and not include it in the internal environment part which will come after this, because of it being of such big role in the organization in general and in IT specifically.

#### ❖ Definition:

Communication can be defined as “the process of transmitting information and common understanding from one person to another”<sup>27</sup>

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<sup>25</sup> Ronald L.Kurtz , Russel Dean Vines (2010), “Cloud security : a comprehensive guide to secure cloud computing”, Published by Wiley Publishing ; Pages: 142-143

<sup>26</sup> Cambridge dictionary (consulted 05/30/2018), “Definition of Organization”, online, URL: <https://dictionary.cambridge.org/fr/dictionnaire/anglais/organization#dataset-business-english>

We can say that communication is a process that requires a number of elements “a sender, a receiver, a message, a medium or channel, and feedback” the message has to be coded by the sender and decoded by the receiver.

#### ❖ **Types of communication:**

There are many classifications of communication in this one it’s based on the communication channel, and it gives us 4 communication types:

- Physical presence “one to one, meetings”
- Personal interactive “phone”
- Impersonal interactive “email, social media”
- Impersonal static “letters, reports”

Each of these types has a specific purpose and a proper situation to use.(Q)

Another classification is:

- Formal communication.
- Informal communication.

Under the formal communication we find two types of communication:

- Downward communication.
- Upward communication.

We can find in other classifications horizontal and vertical communication.

#### ❖ **Communication barriers:**

There are many barriers that might interrupt a communication each one related to a communication dimension we will mention here the ones in related to the process itself and the physical barriers.

- ✓ Process barriers:
  - Sender barrier: it happens when the sender fails to deliver the message.

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<sup>27</sup> Fred C. Lunenburg (2010), “Communication: The process, barriers, and improving effectiveness”, schooling Vol.01, No.01, Page: 01

- Encoding barrier: when there is a problem in the encoding like a language deference barrier.
- Medium barrier: some mediums are not right for some messages, for example a message with the purpose of expressing anger is best delivered face to face rather than with a letter.
- Receiver barrier:
- Feedback barrier:
- ✓ Physical barriers:

In a communication, physical objects such as walls, long distance between parties of the communication, or any other distraction or disturbance can affect the message and its meaning.<sup>28</sup>

### ➤ **Internal environment in an organization**

Internal environment has always been impacted by what happens around the organization, this part is dedicated to understand internal environment, and its main elements.

#### ❖ **Collaborative work:**

Collaborative work can is one of the elements of the organization, and happens in the internal environment we will see what is collaborative work in this part.

#### ✓ **Definition:**

Collaborative work can be defined as “working together in a seamless team to common objectives that delivers benefits for all through mutually beneficial alignment”<sup>29</sup>(Q)

So we can say that collaborative work is is the team work done to accomplish tasks given to team members in order to achieve a common and specific goal.

#### ✓ **Collaborative virtual environment:**

A collaborative virtual environment is defined as “a computer based, distributed, virtual space, in such places people can meet and interact with

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<sup>28</sup> Fred C. Lunenburg (2010), “Communication: The process, barriers, and improving effectiveness”, schooling Vol.01, No.01, Page: 04.

<sup>29</sup> Construction excellence (2011), « collaborative working : the principles », Published by Construction excellence, Page 02.

others, with agents or with virtual objects, collaborative virtual environments might vary in their representational richness, from 3D graphical spaces, to 2D environments, to text based environments, access to collaborative virtual environments is by no means limited to desktop devices, but might as well include, mobiles or wearable devices...etc.”<sup>30</sup>

#### ❖ **Productivity:**

According to Cambridge dictionary we have these definitions of productivity “then rate at which a person, a company, or a country, does useful work” and “the ability to do as much work as possible in a particular period of time”

#### ❖ **Organizational change:**

Organizational change is another important concept for an organization’s survival, and needs to be handled carefully

So what is organizational change? And what is organizational change management?

#### ✓ **Definition**

One definition of organizational change “it is a series of events making a modification in the form, quality, or state of an organization’s component during a specific period of time”<sup>31</sup>.

Another definition of the term “change in an organization takes place in response both to business and economic events and to processes of managerial perception, choice and actions, managers in this sense see events taking place that to them signal the need for change”<sup>32</sup>, in other words change is a set of actions taken by an organization’s management, in response to changes in their environment; or in the processes.

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<sup>30</sup> Elizabeth F. Churchill, David N. Snowdon, Alan J. Munro (), “collaborative virtual environments: digital places and spaces for interaction”, Published by Springer, Page 04.

<sup>31</sup> From the courses of « change management » we had in class the third semester.

<sup>32</sup> Asil Alkaya, Erdem Hepaktan (2003), “organizational change”, Vol.10, No1. Page 04

## ✓ **Change management**

To understand change management we have 4 basic definitions to keep in mind:

- The task of managing change.
- An area of professional practice.
- A body of knowledge.
- A control mechanism.<sup>33</sup>

Or we can see it as a set of actions taken by the management to drive the change process and control it in order to achieve the aimed results, and make sure that the resistance doesn't get out of hand.

### ❖ **External environment:**

external environment is all that surrounds the organizations, whether it is competition, governmental organizations, non-governmental organizations, international organizations, or any other entities, which the organization have no control over, here we will get to know its main elements

### ❖ **Customer relationship:**

#### ✓ **Definition**

Customer relationship is simply, any form of relationship between an organization and its customers.

#### ✓ **Customer relationships management**

Customer relationship management is the way a business interacts with its customer, and customer relationship management helps gather information needed in order to provide improved services and support to its customers it also allows the business to better meet the needs of its current customers and identify new ones.

#### ✓ **CRM Systems**

It is the use of technology to assist in the execution of the activities and actions of customer relationships management mentioned before.<sup>34</sup>

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<sup>33</sup> Fred Nickols (2016), «Change management 101», Page: 01

### ❖ **Supplier relationship:**

#### ✓ **Definition:**

It is also simply like the name obviously states it, any type of relationships between an organization and its suppliers.

#### ✓ **Supplier relationship management:**

According to entrepreneur magazine's encyclopedia supplier relationship management is "affiliations with companies that supply your business with goods and services". "SRM is not something can be simply bolted on it is an organization wide philosophy that needs to be embraced by all"<sup>35</sup>

### ❖ **Stake holders**

According to the Cambridge dictionary a stake holder is "a person such as an employee, customer, or citizen who is involved with an organization, society...etc. therefore has responsibilities towards it, and an interest in its success"<sup>36</sup>, in other words a stakeholder is any person or group of people, who impact an organization with their actions and are impacted by the organization's actions.

In some contexts it might be referring to shareholder which a person or an organization who owns shares in an organization.

### ❖ **IT in an organization:**

IT department is the engine that runs technology in the organization and it most definitely has a big role in our topic so we have to mention it and define it.

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<sup>34</sup> Ontario ecommerce (2014), «E-commerce toolkit series: CRM booklet », published by ontario ecommerce, page 01.

<sup>35</sup> Entrepreneur's encyclopedia (consulted 05/30/2018), "definition of SRM", online, URL: <https://www.entrepreneur.com/encyclopedia/supplier-relationships>

<sup>36</sup> Cambridge dictionary (consulted 05/30/2018), "definition of stakeholders", online, URL: <https://dictionary.cambridge.org/fr/dictionnaire/anglais/stakeholder>

✓ **What is IT?**

IT is an acronym for information technology which is the process that allows organizations to use technology in order to gather, store, process, communicate, and analyze data and information flows.<sup>37</sup>

✓ **BMIT:**

Business management of information technology is a framework of business accountabilities and processes, designed to enable business managers, to better articulate their technology requirements, and proactively plan, prioritize, and monitor, short and long term technology programs.<sup>38</sup>

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<sup>38</sup> Chris Gillies (2008), "Business management of information technology: a practical guide for senior finance executives and business managers", Published by CPA Australia, page 03

# Chapter two

**❖ Methodology:****✓ Research strategy:**

This work was based on many levers and in each one of them we discovered a part of the topic, we got to know the basic concepts of the cloud technology first, and we gave a clear vision about it which took a big part since it is all new to us as management students and not computer science students, we got to know the use of this technology in an organization, because it is useless to know the technology without knowing what it is used for, then we clarified some organizational concepts that might be impacted by this technology which did not dig deep into because we already know most of them by studying them in class, and finally we linked the technology and its use to the organizational elements impacted by it, using the prerequisites we have, the points we learned from the publications used in the research, and most importantly the internship, because analyzing the impact wouldn't be possible without what we lived and saw during this internship, the observation we did each and every day in the companies we were welcomed at, plus the interview that were very helpful in this analyze.

**✓ Case Study:**

in order to accomplish this research we studied the case of two companies, the first one is the hosting company (Intergrateur Open Source), where we couldn't study this topic objectively because IOS is a cloud solutions and services provider, that's why we needed access into one of their clients, which is Formini a company the buys cloud services from IOS.

Even that IOS was a cloud provider, it was not excluded from the research, because they used a lot of cloud based solutions and applications.

**✓ Data collection and analysis:**

In this research we chose to make it a qualitative research, so the most obvious data collection method here is interviews but it was not the only way, but we used other methods such us:

- 1- The interviews: we conducted 4 interviews, each one of them had a purpose, and each one of the studied side of the issue, and gave a different perspective, the first interview was with the manager of the

company IOS to give us the provider's perspective and the technical aspects, the second one was with the manager of the company Formini and the third one was with an employee of Formini, these two were done to give us the customer's perspective, and to get an insight on how does cloud impact when used in a work environment, the fourth and last one was conducted with an end customer, to study the impact on the company image from the perspective of the customers.

- 2- Observation: by spending a lot of time in these companies, we have come to observe how the employees use these applications, and we came up with useful data this way.
- 3- Demonstration: this method includes our first hand experiences with these applications and solutions, which is a good way to collect data about our topic.

### ❖ **Presentation of the hosting company:**

In this part we will have an insight of the hosting company IOS (Integrateur Open Source) and get to know it, which will help you, get to know the work environment we were in the whole time of the internship.

We will see in this part the following points:

- 1- Presentation of (Integrateur Open Source).
- 2- IT department.
- 3- Hardware and Software framework.
- 4- The company's hierarchy.
- 5- Project planning.

### ✓ **Presentation of the company (Intergateur Open Source)**

The company Integrateur Open Source was created in 2012, with the ambition of holding participations with IT companies, with high technical content in innovative fields, in markets with high development.

Then IOS is a service provider in the IT sector, under the form of an IT consulting company that also offers services of setting up advanced networks, and data treatment.

In the development of IOS, the company projects in the future that they will be engaging in a many steps of a resources modernization plan, in order to ensure its sustainability and its competitive strengths in this emerging market in Algeria.

### ✓ **IT department**

The IT department is strongly present amongst all the departments with nearly 90% of the company's staff, which gave a more important role in the good functioning of the company, it has multiple missions and we can regroup the under the following points:

- Managing and administrating the Linux and the Windows servers.
- Managing the IT Park (servers and clients).

- Exploitation tasks (managing the billing, data and systems storage...etc.)
- User's assistance.
- Studying the new IT projects.
- Consulting in the new IT investments.

The IT department is managed by Mr. Mohamed GHABOUBA, the staff is divided into two entities: exploitation and administration, the last one is formed of 7 full time employees along with some service providers and interns (depending on the project).

✓ **The Hardware and Software of IOS.**

**1- Hardware:**

The hardware pool of IOS contains different machines, which are:

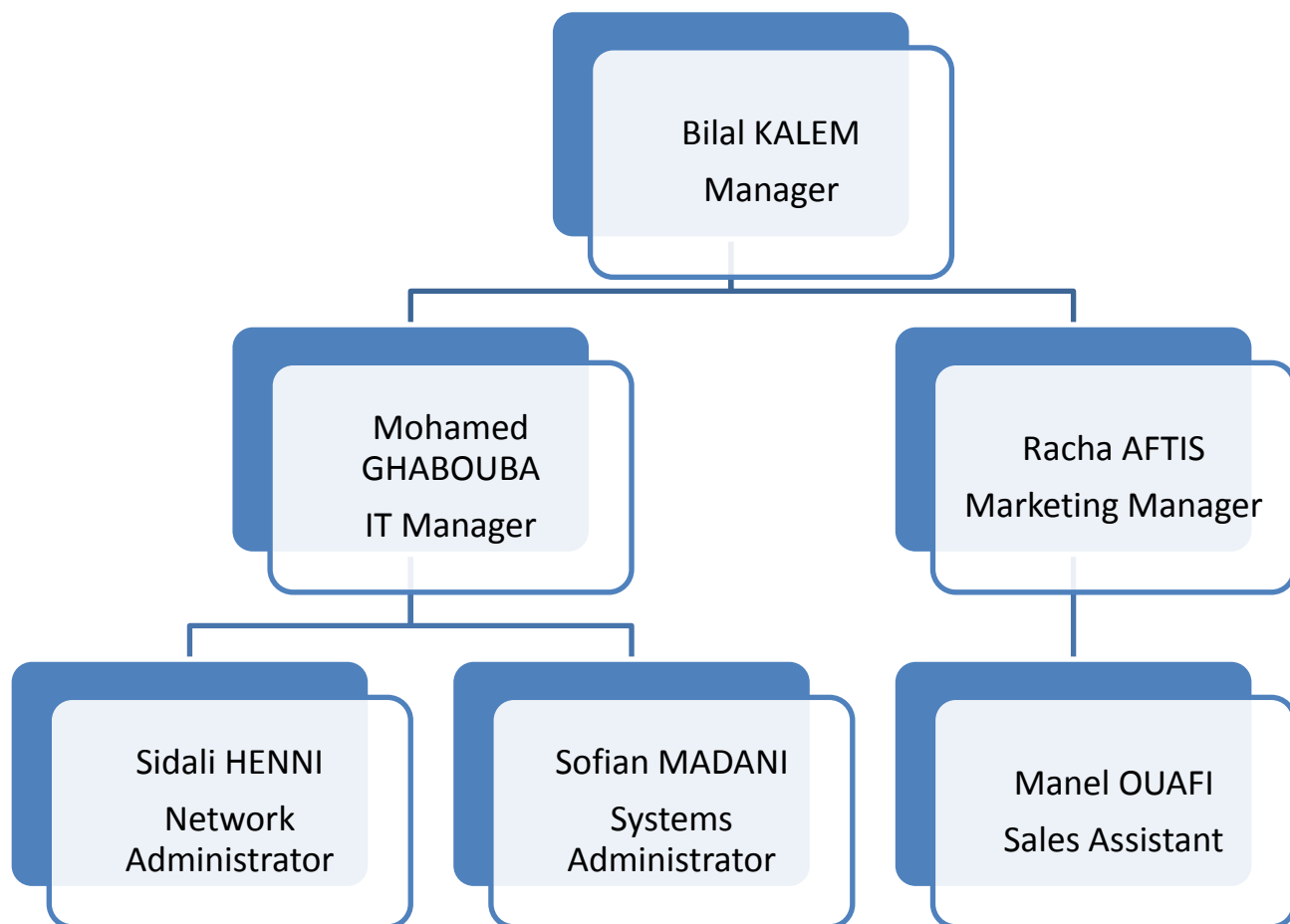
- 3 DELL PowerEdge 2900 Servers
- 2 HP ProLiant g8 Servers
- 9 Servers dedicated for outside providers.
- 10 servers (Client).
- 1 printer.
- 1 D-Link Router.
- 1 Cisco SG200-26 Ports Switch
- 20 Work posts (Desktop and laptop)

**2- Software:**

An IT services company such as IOS has a large range of software, ergo there is a long list of software, so this one will be exclusive only for most used ones.

- ERP/CRM: customer relationship management
- OpenProject: Project management.
- ESXI/Vcenter
- RHEV
- GLPI.
- MS Office 2013.
- Outlook 2013.

✓ The company's hierarchy.



**Figure 0.2:** from the hosting company

# Chapter three

## ❖ The interviews:

The impacts	Interview quotes
Impact on communication.	<p><b>“Interviewer:</b> did “slack” help you with being connected all the time with what’s happening in the company?</p> <p><b>Interviewee:</b> yes it did”</p> <p><b>“Interviewer:</b> did “slack” help you before better deal with an emergency situation?</p> <p><b>Interviewee:</b> yes, slack helped me a lot in my work.”</p> <p><b>“Interviewer:</b> did “slack” help you before better deal with an emergency situation?</p> <p><b>Interviewee:</b> yes, it helps get urgently needed information, and see what’s happening in a minimal time.”</p> <p>“...slack” is a companywide social network, only our employees who have access to it and we can talk in a public or a private conversation, now the access to information is very fluid, today I know what happened in the company even though I didn’t go their...”</p>
Impact on collaborative work.	<p>“...in the positive impact I can mention Google drive, Google sheet and all collaborative work applications I showed you Evernote and how it allows you to see real-time changes in the database’s information; all these applications were brought to us by the cloud...”</p> <p>“...OpenProject” helps get an answer the soonest in case a training gets postponed on the availability of the classrooms at the new date with the number of participants taken into consideration.”</p>

	<p>“...one of my rules as the manager is we don’t leave the customer wait, the information has to be shared in the company, as a team we all have the same answers at the same time, because we use collaborative work applications, so a contradictory information can’t circulate in the team.”</p> <p>“...with these applications there is no need to call on the phone all the time when all the work is on a shared file on Evernote for example or the shared information on slack.”</p>
Impact on change and change management.	<p>“...training the users is the phase that takes most of the time, it takes up to one year for the users to adapt to the cloud.”</p> <p>“...yes of course, there is always resistance to change, because people fear change, this is part of human nature, and this is where follow-ups, trainings, and explanation.”</p> <p>“...how did they deal with this resistance?</p> <p><b>Interviewee:</b> we do this not the customer, we include all stakeholders in the process, we ask for their opinions, meaning they participate in the project, we don’t work alone then we impose the project on them at the end, we don’t let them feel left out at least we have to ask for their opinion, even if we’re not going to use it. This was the first lever, the second one we use is training, explanation and simplification, we simplify things so they can accept them.”</p> <p>“..., I find them very ergonomic, and even our team adapted to them</p>

	<p>easily.”</p> <p>“...have you found any difficulties when changing into these applications? (At the beginning of the use)</p> <p><b>Interviewee:</b> no, not really”</p>
Impact on customer relationships	<p>“...this is related with the company’s image when it impacts the company’s image, the productivity, and the availability of the application, it impacts the relationship with the customers.”</p> <p>“...we can collaborate with the whole team and customers on an offer that better responds to their needs.” This is related to collaborative work and organization’s image too.</p> <p>“; for example if a customer asks me for information that I don’t know and my colleagues are out or traveling, I can get it through slack immediately” this one is related to organization’s image too.</p>
Impact on supplier relationships	<p><b>“Interviewer:</b> How can cloud impact a company’s supplier relationships?</p> <p><b>Interviewee:</b> it is hard to say what the direct impact on the supplier relationships is...”</p> <p>“... for example companies here in Algeria can’t answer this question “when will you pay the suppliers” yes the contract says 30 days but that impossible because they are not organized, but using these solutions ... allows the supplier to get paid in time...”</p> <p>“How did OpenProject impact the work of your trainers?</p> <p><b>Interviewee:</b> for example if a trainer a</p>

	<p>training program or postpones it, OpenProject help get another availability date with him or with another trainer.”</p>
<p>Impact on the organization’s image</p>	<p>“...here there is a positive and negative impact, in the positive impact I can mention Google drive, Google sheet and all collaborative work applications I showed you Evernote and how it allows you to see real-time changes in the database’s information; all these applications were brought to us by the cloud, yes collaborative work existed before but now Google, Microsoft and other companies are offering cloud based solutions that make a company’s life easier thus making the company more productive, thus making it offer a better service giving it a better image.</p> <p>In the negative impact, if the infrastructure was not well structured there will be negative impacts such as website slowing down or even stopping, messages might arrive late; system might crash even though this last one rarely happens...”</p> <p>“...virtualization there is what we call the high availability which means, in case a physical server stops for any reason, the VMs in it migrate automatically into another server without a human intervention.”</p> <p>“...what did you feel when that happened? (the system crashed)</p> <p><b>Interviewee:</b> it felt like a waste of time and that that company has no idea what it is doing in that area.”</p> <p>“..., a service that causes me delay and gives you that feeling that they are</p>

	<p>incompetent, makes you believe that their service is of poor quality.”</p> <p>“what is your impression when a company is responsive to your inquiries?”</p> <p><b>Interviewee:</b> it makes me believe that I am valuable for them, and that they give importance to me as a customer.”</p>
Impact on information security.	<p>“...before cloud each company has its own infrastructure ... each one of these companies buys its own servers with its own budget...”</p> <p>“...Cloud came to centralize the infrastructure, and allow companies that doesn't have infrastructure to rent it.”</p> <p>“...in private cloud there is no problem but if we're talking about public cloud, there has to be trust between the provider and the customer, and if that trust is gone then we have a big problem, if a trusted company gets attacked that trust is gone; and it possibly will lose its customers.”</p> <p>“the threats are the same dangers on the old local infrastructure with the difference that in cloud it cloud go farther especially in a public cloud, because it is multitenant which means many entities are using the same platform, but the dangers are the same hacking, attacks...etc.”</p> <p><b>Interviewer:</b> can you give us examples?</p> <p><b>Interviewee:</b> maybe the website can stop or slow maybe the messaging stops ...etc. but when you're in a public cloud you have to keep in mind that behind a cloud provider an</p>

	<p>infrastructure to prevent these situations and to protect their servers, so these thing probably will not happen...”</p> <p>“...The challenges are as said ... maintaining that trust with the customers, a cloud provider has to follow international security standards, if they don’t they will lose their customers and their reputation.”</p> <p>“...my machine “hard-drive” stopped working because of an incident that occurred, and the contained files couldn’t be restored because the hard drive was affected, but all the files related to “Fromini” were stored on the cloud thanks to these applications.”</p>
Impact on access to information.	<p>“... access to information is easy and secured because here only people who have access to our slack that can see what happens from anywhere, anytime.”</p> <p>“...isn’t one of the problems connectivity? Because usually we use internet to access such applications. <b>Interviewee:</b> yes indeed, because it is centralized but I think not having access to internet is outdated everyone is connected now everywhere, now even on airplanes we have access to internet.”</p>

<p>Impact on productivity.</p>	<p>“...Now Google, Microsoft and other companies are offering cloud based solutions that make a company’s life easier thus making the company more productive...”</p> <p>“...would you describe the use of these applications as time saving?”</p> <p><b>Interviewee:</b> yes, but you have to take the time to well organize them from the beginning.”</p> <p>“...do these applications help you and the team be more productive?”</p> <p><b>Interviewee:</b> yes, of course.”</p> <p>“...I gain a lot of time using these applications, especially Evernote by using it we’re better organized.”</p>
<p>Legal standpoint in Algeria.</p>	<p>“...There are no clear and precise laws that organize the use of cloud here in Algeria, for now we’re working with the laws that protect intellectual property, meaning the law that applied on the cloud is the same as the law applied on the rights of a song...”</p> <p>“...There is no precise and clear law that says this is the cloud, it has to define the cloud first...”</p> <p><b>Interviewer:</b> how can an intellectual property law protect information?</p> <p><b>Interviewee:</b> it can’t, and that’s what I’m saying there is now law for cloud here in Algeria.”</p> <p><b>Interviewer:</b> then a cloud provider can access a client’s information.</p> <p><b>Interviewee:</b> that’s when the contract’s role comes to play... We’re using a contract to clarify what a provider can and can’t do.</p> <p>The contract here can protect the customer, but that’s not enough the</p>

	<p>law the one that can truly determine the roles in the cloud, because a law is stronger than a contract.”</p> <p>“If a customer doesn’t protect himself with a contract here his information aren’t secured, but if there was a law his information is protected even it’s not mentioned in the contract, right?”</p> <p><b>Interviewee:</b> yes, exactly.”</p>
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Table 0.1: from the interviews (full transcript is in the annexes)

## ❖ **Part two: study results.**

We finally arrived at the end of this research where we will see the result we got from this whole study, combining all the parts we saw and all the experiences and observations we got from the field, adding the interviews, will give us a somewhat clear image about the impact of the cloud computing technology on the organization.

We will be talking about these impacts according to a classification; we will mention every impact under the element it impacted in the organization as we mentioned them in the part where we defined the organization and its elements.

### ✓ **Impact on communication.**

Cloud computing helped organizations with communication, according to the interviews and to our observation of the work environment during the time internship

- For example if we compare between two companies one that uses cloud based applications and one that does not, in the one does not use them in order to communicate with a fellow employee you have either to go that and be present with him physically or call on the phone, two options that time consuming and may encounter many berries such as an employee being away on a business trip or taking a sick day or bad cell reception, but in the case of an organization that uses cloud applications, for example slack everyone can communicate with everyone at any given time through a private or public conversation.
- File/information exchange was made much more responsive thanks to cloud applications one example of that is Evernote, instead of physically moving and using a device such as a flash drive to get a file from one computer to and other or taking the time to send it via email, using Evernote every one who has authorization to access to the organizations Evernote account can have the file immediately after creating it and can see real-time changes.

- All communications from upper management to the employees or the other way around cannot go unnoticed on organizations social media applications such as slack.

✓ **Impact on collaborative work.**

The impact on collaborative work can be somewhat similar to the one on communication, but with some differences.

- Using a Evernote, when an employee work on a file let's say that contains clients information, if said employee makes any mistakes anyone that has access can detect the mistake and either correct it or alert them of the mistake.
  - in the case of OpenProject, each person who is in charge of something can be up to date about the availability of the resources, let's take the example of the company Formini, if the person in charge is appointing trainings into classroom can be up to date on what are the classrooms available for a specific period of time, or the one in charge of appointing trainer into training programs can see what trainers are available for a specific period of time, all that was made possible by the collective effort of each one entering modifications an updates from the task that he is in charge of.
  - Using an cloud based project management tool like Trello, everyone know their tasks and everyone knows where everyone advanced in their task, cause each employee is in charge of a task or a set of tasks and they have to give updates, which impact the time taken to accomplish the project, and prevents anyone from interfering or working on task that does not belong to him.
- ✓ **Impact on change and change management.**
- Like any other change in an organization, changing into cloud computing results in a resistance, which is something we didn not witness in companies where we did the internship, due to many factors, the first one being that age range of these companies is young, and since they are companies active in the IT industry employee much have minimum requirements of knowledge in technology applications, which mean they were always familiar with these applications an the accept and adapt with any new technologies.

- From the previous point we understand that resistance to change into cloud is linked to two factors
  - 1- The age of employees, the older they are the less accepting of these technologies because they lived long time in the safe zone of using traditional methods, and any they deal with any attempt to get them out of the safe zone as a threat.
  - 2- How familiarized with these applications and with IT business they are, cause even if the employee is young, if he is not familiarized with the use of technology, he will find difficulties using them maybe not as much as older but still they will resist it.
- Implementing a cloud solution takes time as we saw when we talked about the implementation phases, which can help with resistance to change, because if during that long period the company implicated its employees, they would accept it by the end of the implementation.
- Dealing with resistance will impact on trainings scheduling in the organization, because of it being an effective tool to reduce this resistance, which means scheduling training programs for all employees on how to use the new applications.
- ✓ **Impact on customer relationship.**
  - Even though using cloud computing didn't have a direct impact on customer relationships, some of the impacts changed how the organization deals with its customers.
  - The impact on communication affected customer relationships, by communicating better inside the company information move faster which allows being more responsive to client inquiries.
  - Also better communicating inside the company makes every project well understood by everyone which results in a better quality of the offer they give to the customer.
  - By doing collaborative work as well as it should be, let's say in a project that uses trello, where everyone knows what they are doing, they organization will have better quality products delivered.
  - Because of the centralized servers in cloud computing, everyone in the company have access to customer's information everywhere, anytime.

✓ **Impact on supplier relationship.**

- The impact of cloud was not direct on customer relationships too, as we saw in the interview it was hard to come up with a direct impact, but we saw the example of payments made on time by cloud based applications and that is one impact of cloud.
- In the case of the company Formini, if we consider the trainer as suppliers since the product is training programs, we see that using applications such as OpenProject, the trainer can be punctual with the company and its clients; they can have all the information needed to deliver their product easily using this application.

✓ **Impact on the organization's image.**

- As we saw cloud impacted the organization's image, it prevented some problems that made the organization look unreliable and has poor service quality, such as system crashing, cloud prevented them by working with the high availability method, which is basically if a server crashed the VM's on that server migrate automatically into a new one, keeping the system up and running at all times.
- Working on a better offer for the clients thanks to better communicating or better collaborative work using cloud based applications, will have a good impact on service and product quality thus improving the image.

✓ **Impact on IT in the organization.**

- Cloud had two main impacts on IT departments,
  - 1- The first one is that it made companies less relaying on inside IT departments because it outsourced it to another company ( a cloud provider).
  - 2- The second impact is if there is still an IT department in a company, cloud made its job way easier, because before for example to get storage space it had to go through a long process, that we talked about already (assessing how much space needed, getting approval to by new hardware, getting the hardware, installing it ...etc.) now with cloud they can get storage space with a click of a button.

✓ **Impact on information security.**

- Comparing cloud with other technologies organizations used before from the security and threats dimension, we found they are exposed to the same security threats,
- One difference in the cloud and specifically in the public cloud, the fact that information is stored at another company's servers, which can be challenging especially if there are no clear laws to protect the organization, and to prevent the cloud provider from accessing the information.
- There has to be a notion of trust between the organization and the cloud provider, which is exactly why said provider has to invest heavily in securing its servers, because if any breach happens the trust is gone so is the provider.
- Cloud also impacted the security of the information by protecting it from the damages that can happen to the hardware, for a better understanding of this point we will give an example, an excel file that contains customers information was stored in the hard drive of a computer in the organization, if any damage occurs to the hard drive that information will be lost, but let's say a backup version was stored on Google drive (which is a form of cloud), no matter what happens to the hard drive the information will be always safe and retrievable.

✓ **Impact on access to information.**

- We can say that access to information is the side that was most impacted by the cloud, because of its centralized server system, in cloud the system is a centralized server connected to the users with a network (usually it is the internet) and this same network connects them to each other, and everyone has access to the system (within the limits of his authorization) meaning everyone has access to the information everywhere at any time.
- On the downside the network connecting the organization and the servers (especially if we are talking about public cloud) is usually the internet, if an employee is in a location where there is no internet, he will have no access to the servers or the information.

- But looking at how the world is now it is rare to find a place where there is no internet coverage, as it was made clear to us in one of the interviews “...now we even have internet on planes...”, here in Algeria and many other 3<sup>rd</sup> world countries yes there are still places where there is no coverage, but it is getting better day after day.
- ✓ **Impact on productivity.**
  - All our interviewees think that cloud based applications made them more productive.
  - These applications can make you do more tasks in a less time, for example instead of moving to get information or calling, you can access the information directly, considering how many time do you have to do this operation you will find out that it is buying you a lot of time.
  - If we consider the case where there is no internet and the employee has no access to the information, here the productivity is impacted negatively, because work will stop when any information is needed.
  - All the applications we saw used in the hosting companies make the workflow run faster, more tasks get done in less time making these companies more productive.
- ✓ **Legal standpoint in Algeria.**
  - During our research we found out there are a lot of legal challenge in this market here in Algeria, for example there is no law that clearly defines the cloud or regulates it, or states what providers and customers can and cannot do.
  - The absence of a law protecting the organization and its information made it harder to trust any cloud provider, because like this any provider can access your information with any legal consequences.
  - So the legal issue turned into an information security problem, as already talked that, putting your information at another entity’s servers is already a challenge, because there is nothing stopping them from accessing them, let alone having no law preventing this access.
  - What we talked about providers accessing clients information, was in the case a public cloud, or private cloud outside the organization’ control, which means if the organization decides to set up their own cloud servers, they will not have these problems.

- It does not seem to be any prospect of a law any time soon here in Algeria, and the law makers don't seem to be interested in regulating this space for the time being.
- Clients now are using contracts to protect themselves as a temporary measure, which they use by adding clauses indicating, what can provider and what he can't do.
- The contracts are a good fix for now, but it is only temporary and could be played around, and there is a real need for a law to regulate this sector

# Conclusion

In conclusion we would like to mention first that we tried to study a new and very large topic, with limited time and resources which would not give justice, we might have missed a lot of dimensions in this topic, but we would like think that the ones we studied are accurate as we could get them with what was available.

Even though we faced a lot of obstacles on the way, such as the limited time, the shortage of publications in this topic which is normal considering that it is a new technology, and it only picked the interest of the academic world very recently, and this interest was not from the management and organizational dimension it was mostly from technology and computer science dimension, the location of the internship was a challenge too because this technology is particularly new to the Algerian market.

After analyzing the impacts, and linking the dots between what we read theoretically and what we saw in the field at the hosting companies, our use of the applications based on the technology in question, and of course the interviews we could safely say that we can answer the questions we had about the cloud from the beginning within the limits of what we studied and the results we got.

First it is worth mentioning that during this research we discovered that most organizations use cloud applications, without even knowing that they are on the cloud, even more most people already use the technology of cloud computing in their daily life also without realizing it, and that is because applications such as: Google drive, Google sheet, Gmail...etc. are all cloud based applications, but of course there is the other part of cloud that requires resources to set up, such as: a project in organization to create its own private cloud, and this research we studied both of them.

We saw that cloud technology when implemented and adopted in an organization, it impacts mostly every part of it, weather this impacts is a direct one or indirect, and of course there are part that were impacted more than others for example the information security, access to information, collaborative work, and communication were impacted more than any other part, and there were side impacts such as the organization's image that was

touched as a result the impact applied on the other parts, there are also some parts that witnessed a positive impact and others a negative impacts.

We found out that migrating into the cloud for organizations all over the world is mostly beneficial, with some exceptions of course, any system or any technology has flaws, but in the case of the cloud technology the benefits are more cover the flaws, especially if the implementation was well planned and well maintained, and we provide all the conditions needed for the good functioning of this technology.

Speaking about the conditions for the good functioning of the technology, we are going to speak about these conditions here in Algeria, these conditions here are less available than the rest of the world, which makes the downside of this technology here bigger than the downside in the rest of the world, cause if we look at what are these conditions, we can pick out of the top of our minds, the legal status of the technology and the internet coverage, the legal status here is still unclear, and law makers do not seem interested in regulating it any time soon, and there are still some places here with bad internet coverage and bad cell reception which as we saw can be in obstacle in the way of the good functioning of this technology, nonetheless we still think that migrating into the cloud would be a good decision for an Algerian organization, because even though the downside is bigger than in the rest of the world, but its good side is bigger.

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# Annexes

### ❖ **The full transcript of the Interviews**

- ✓ The first interview is with the company “IOS” director.

**Interviewer:** What are the phases of implementing a cloud solution?

**Interviewee:** When you say implementation you have to keep in mind that before that there is a study of needs, will this cloud be private, public, or hybrid, why? Cause there are security issues or challenges in the firewall will we close it or will we open it for external access, so there is a study of organization, and a study of needs for example how many gigabytes of RAM will they need how many gigabytes of hard disk space will they need and the CPU too, so the study will be for all this, a part for organization of the cloud and another for needs and resources, once we finish the study we can in 2 days implement the solution with “open stack” for example, then we have the biggest challenge which is training the users of this cloud, because what’s a cloud? It’s a dashboard that everyone connects to it even the ones that are not familiar with all these concepts “virtualization, cloud...etc” so training the users is the phase that takes most of the time, it takes up to one year for the users to adapt to the cloud

**Interviewer:** so we have the study phase then implementation...

**Interviewee:** the testing phase which is a small test on some of the equipment the we generalize it then the use phase which contains the training phase, so the use and the training start together,

**Interviewer:** What’s the legal status of cloud in Algeria?

**Interviewee:** there are no clear and precise laws that organize the use of cloud here in Algeria, for now we’re working with the laws that protect intellectual property, meaning the law that applied on the cloud is the same as the law applied on the rights of a song, which makes it not clear, there is no precise and clear law that says this is the cloud, it has to define the cloud first...

**Interviewer:** how can an intellectual property law protect information?

**Interviewee:** it can’t, and that’s what I’m saying there is now law for cloud here in Algeria.

**Interviewer:** then a cloud provider can access a client’s information.

**Interviewee:** that's when the contract's role comes to play, cause now what we're doing? We're using a contract to clarify what a provider can and can't do.

**Interviewer:** so they add clauses to the contract that prevents the provider from doing that.

**Interviewee:** yes, the contract here can protect the customer, but that's not enough the law the one that can truly determine the roles in the cloud, because a law is stronger than a contract.

**Interviewer:** what you want to say is if a customer doesn't protect himself with a contract here his information aren't secured, but if there was a law his information is protected even it's not mentioned in the contract, right?

**Interviewee:** yes, exactly.

**Interviewer:** Is cloud more secure than technologies used before it?

**Interviewee:** what are the technologies used before cloud?

**Interviewer:** can you tell us what companies used before the appearance of the cloud?

**Interviewee:** before cloud each company has its own infrastructure, I will give you an example "sonatrach" is a company that has a lot of other companies affiliated to it and each one of these companies buys its own servers with its own budget, so we can't compare these two, in the contrary the cloud came to centralize the infrastructure, and allow companies that doesn't have infrastructure to rent it.

**Interviewer:** but in the cloud the fact that you will be putting you information at another party's servers might be less secure.

**Interviewee:** here we're talking about public cloud.

**Interviewer:** we are talking about cloud in general public and private.

**Interviewee:** okay, in private cloud there is no problem but if we're talking about public cloud, there has to be trust between the provider and the customer, and if that trust is gone then we have a big problem, if a trusted company gets attacked that trust is gone; and it possibly will lose its customers.

**Interviewer:** What are the potential threats and security challenges on the cloud?

**Interviewee:** the threats are the same dangers on the old local infrastructure with the difference that in cloud it cloud go farther especially in a public cloud, because it is multitenant which means many entities are using the same platform, but the dangers are the same hacking, attacks...etc.

**Interviewer:** can you give us examples?

**Interviewee:** maybe the website can stop or slow maybe the messaging stops ...etc, but when you're in a public cloud you have to keep in mind that behind a cloud provider an infrastructure to prevent these situations and to protect their servers, so these thing probably will not happen, I can't say they cannot happen, but the possibility is very low, because the providers invested heavily in security.

The challenges are as said the maintaining that trust with the customers, a cloud provider has to follow international security standards, if they don't they will lose their customers and their reputation.

**Interviewer:** How can cloud impact a company's image "reputation"?

**Interviewee:** there is a positive and negative impact, in the positive impact I can mention Google drive, Google sheet and all collaborative work applications I showed you Evernote and how it allows you to see real-time changes in the database's information; all these applications were brought to us by the cloud, yes collaborative work existed before but now Google, Microsoft and other companies are offering cloud based solutions that make a company's life easier thus making the company more productive, thus making it offer a better service giving it a better image.

In the negative impact, if the infrastructure was not well structured there will be negative impacts such as website slowing down or even stopping, messages might arrive late; system might crush even though this last one rarely happens.

**Interviewer:** on the positive side, doesn't cloud help so the system doesn't go down?

**Interviewee:** yes, in virtualization there is what we call the high availability which means, in case a physical server stops for any reason, the VMs in it migrate automatically into another server without a human intervention.

**Interviewer:** How can cloud impact productivity?

**Interviewee:** we already talked about this.

**Interviewer:** How can cloud impact a company's customer relationships?

**Interviewee:** like I said before, this is related with the company's image when it impacts the company's image, the productivity, and the availability of the application, it impacts the relationship with the customers.

**Interviewer:** How can cloud impact a company's supplier relationships?

**Interviewee:** it is hard to say what is the direct impact on the supplier relationships, but let's take an example, salesforce is the most used "ERP" there are other ones but let's take this one as an example, salesforce is available on the cloud and it's an application that helps the suppliers, how it does that ? for example companies here in Algeria can't answer this question "when will you pay the suppliers" yes the contract says 30 days but that impossible because they are not organized, but using these solutions whether its salesforce's or oracle's, they allow the supplier to get paid in time, an example for that is Lafarge which are one of our clients, when we sign a contract with them we get paid 60 days after, because it's not a human that does that, it's the system, so yes in a way cloud impacted the supplier relationships.

**Interviewer:** How can the cloud impact collaborative work in an organization?

**Interviewee:** we talked about this already.

**Interviewer:** How can cloud impact access into information?

**Interviewee:** this one is a good question, I will show you "slack" which is one of cloud solutions that I personally like, "slack" is a companywide social network, only our employees who have access to it and we can talk in a public or a private conversation, now the access to information is very fluid, today I know what happened in the company even though I didn't go there because I read

the exchanges between employees, so access to information is easy and secured because here only people who have access to our slack that can see what happens from anywhere, anytime.

**Interviewer:** isn't one of the problems connectivity? because usually we use internet to access such applications.

**Interviewee:** yes indeed, because it is centralized but I think not having access to internet is outdated everyone is connected now everywhere, now even on airplanes we have access to internet.

**Interviewer:** Based on your experiences with customers is there resistance to changing into the cloud? And how did they deal with it?

**Interviewee:** yes of course, there is always resistance to change, because people fear change, this is part of human nature, and this is where follow-ups, trainings, and explanation.

**Interviewer:** how did they deal with it?

**Interviewee:** we do this not the customer, we include all stakeholders in the process, we ask for their opinions, meaning they participate in the project, we don't work alone then we impose the project on them at the end, we don't let them feel left out at least we have to ask for their opinion, even if we're not going to use it.

This was the first lever, the second one we use is training, explanation and simplification, we simplify things so they can accept them.

**Interviewer:** Who are your customers?

**Interviewer:** some examples of our customers "TDA, Algerie telecom, Mobilis, some ministries, and some other clients in the private sector"

**Interviewee:** What are the cloud services you provide to your customer "Formini"?

**Interviewer:** we deal with their "ERP" and the cloud of Formini is provided, managed by IOS, also we provide them with project management applications such as "OpenProject" which they use to manage the resources in their projects these projects being the training programs they offer, they also use

slack and other applications but these are public applications we do not provide them.

**Interviewee:** objectively what is the downside of cloud in Algeria?

**Interviewer:** short answer the downside is the network bandwidth, meaning the network that connects offices between cities, if you are not a big company like "sonarach or sonalgas" it will cost you a lot.

**Interviewee:** how can you describe the cloud market and its use in Algeria?

**Interviewer:** the use of cloud is very shy in Algeria, it's not as good as in other countries, because companies still don't trust it, what I just said applies on public cloud, but private cloud's use is better and it is in progress.

✓ The second interview is with the manager of Formini:

**Interviewer:** which of these applications do you use? "Slack, Evernote, OpenProject"

**Interviewee:** I use all three of them

**Interviewer:** do you use other applications in your work?

**Interviewee:** yes, I do.

**Interviewer:** if yes, what are these applications?

**Interviewee:** in fact, we manage the company Formini using an ERP, also all the team Google Drive, Google Sheets, Google docs et Google agenda to share work related documents, and to plan the appointments.

**Interviewer:** what did you use before "Evernote"?

**Interviewee:** i use "Evernote" since a long time, even before I use the Google applications.

**Interviewer:** did “slack” help you with being connected all the time with what’s happening in the company?

**Interviewee:** yes it did

**Interviewer:** did “slack” help you before better deal with an emergency situation?

**Interviewee:** yes, it helps get urgently needed information, and see what’s happening in a minimal time.

**Interviewer:** how did “OpenProject” impact the work of your trainers?

**Interviewee:** for example if a trainer cancels a training program or postpones it, OpenProject help get another availability date with him or with another trainer.

**Interviewer:** how did OpenProject the resources management? “Classrooms for example”

**Interviewee:** “OpenProject” helps get an answer the soonest in case a training gets postponed on the availability of the classrooms at the new date with the number of participants taken into consideration.

**Interviewer:** have you found any difficulties when changing into these applications? “At the beginning of the use”

**Interviewee:** I use them since a long time, I find them very ergonomic, and even our team adapted to them easily.

**Interviewer:** when using these applications do you believe that the conversations and information stored in it are more secure?

**Interviewee:** yes

**Interviewer:** can you mention an incident where the use of these applications helped you save information?

**Interviewee:** my machine “hard-drive” stopped working because of an incident that occurred, and the contained files couldn’t be restored because the hard drive was affected, but all the files related to “Fromini” were stored on the cloud thanks to these applications.

There were some files related to my personal work that I couldn't restore and they were gone, I took that as a lesson.

**Interviewer:** would you describe the use of these applications as time saving?

**Interviewee:** yes, but you have to take the time to well organize them from the beginning.

**Interviewer:** do these applications help you and the team be more productive?

**Interviewee:** yes, of course

**Interviewer:** did the use of these applications help you better respond to your customers needs?

**Interviewee:** yes; for example we can collaborate with the whole team and customers on an offer that better responds to their needs

**Interviewer:** do you believe that these applications help you in collaborative work? And how?

**Interviewee:** yes, having the information as fast as possible In a company makes a difference with our customers one of my rules as the manager is we don't leave the customer wait, the information has to be shared in the company, as a team we all have the same answers at the same time, because we use collaborative work applications, so a contradictory information can't circulate in the team.

**Interviewer:** according to your experiences, are there any negative impacts of these applications?

**Interviewee:** yes, every system may contain security flaws, and a lot of Algerian companies don't trust cloud.

**Interviewer:** if you could summarize what are the elements cloud impacted in your company what would they be?

**Interviewee:** organization, precision, clarity, transparency, and sense of belonging.

✓ The third interview was with an employee of Formini:

**Interviewer:** which of these applications do you use? “Slack, Evernote, OpenProject”

**Interviewee:** I use slack and Evernote.

**Interviewer:** do you use other applications in your work?

**Interviewee:** no

**Interviewer:** what did you use before “Evernote”?

**Interviewee:** i used “slack”

**Interviewer:** did “slack” help you with being connected all the time with what’s happening in the company?

**Interviewee:** yes it did

**Interviewer:** did “slack” help you before better deal with an emergency situation?

**Interviewee:** yes, slack helped me a lot in my work.

**Interviewer:** have you found any difficulties when changing into these applications? “At the beginning of the use”

**Interviewee:** no, not really.

**Interviewer:** when using these applications do you believe that the conversations and information stored in it are more secure?

**Interviewee:** yes

**Interviewer:** can you mention an incident where the use of these applications helped you save information?

**Interviewee:** I once lost a customer’s contact information, but I was able to retrieve it using “slack”

**Interviewer:** would you describe the use of these applications as time saving?

**Interviewee:** yes, I gain a lot of time using these applications, especially Evernote by using it we're better organized.

**Interviewer:** do these applications help you and the team be more productive?

**Interviewee:** yes.

**Interviewer:** did the use of these applications help you better respond to your customers needs?

**Interviewee:** yes; for example if a customer asks me for information that I don't know and my colleagues are out or traveling, I can get it through slack immediately

**Interviewer:** do you believe that these applications help you in collaborative work? And how ?

**Interviewee:** yes, cause with these applications there is no need to call on the phone all the time when all the work is on a shared file on Evernote for example or the shared information on slack

**Interviewer:** according to your experiences, are there any negative impacts of these applications ?

**Interviewee:** no

✓ The fourth interview was with a customer.

**Interviewer:** have you ever used a company's services and their system crashed?

**Interviewee:** yes it happened before.

**Interviewer:** what did you feel when that happened?

**Interviewee:** it felt like a waste of time and that that company has no idea what it is doing in that area.

**Interviewer:** did it affect the service quality?

**Interviewee:** yes of course, a service that causes me delay and gives you that feeling that they are incompetent, makes you believe that their service is of poor quality.

**Interviewer:** can you trust a company that its system crashes constantly?

**Interviewee:** no I can't, you can't trust a company with such a bad service.

**Interviewer:** if you have an alternative would you use this company's services again or change into the competitor?

**Interviewee:** yes definitely, but here in Algeria some services that witness such incidents are delivered by companies that have no competition.

**Interviewer:** what is your impression when a company is responsive to your inquiries?

**Interviewee:** it makes me believe that I am valuable for them, and that they give importance to me as a customer.

**Interviewer:** does it impact your customer experience?

**Interviewee:** of course it does, when a company responds to your needs and inquiries fast and in the correct way, it improves the customer experience.

**Interviewer:** what is your impression when a company gives you offers that meet your needs and expectations?

**Interviewee:** as I said before it improves the customer experience and it makes you trust them, which leads to being loyal to them.

**Interviewer:** what's your impression when a company is precise/ punctual in its timing? (E.g. delivery dates)

**Interviewee:** it gives a good image of the company and plays a role in the delivered service quality.