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to grow a sustainable and comprehensive ecosystem

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Abstract

Entrepreneurs involved in different technology fields often have difficulty developing sensible business models out of the technologies that they trying to commercialise. Entrepreneurs in cloud computing are no exception. This analytical report aims at investigating what elements must be taken into account in order to create a successful business model for cloud-computing-based products and services; and what are the main challenges faced in this process. To address these questions, we review the literature on the creation of business models for the cloud and we analyse different alternatives for the development of innovative business models. We explore the different business model alternatives and provide clues regarding the types of companies that each business model may be suitable for. Moreover, we look at specific areas within Alexander Osterwalder's business model canvas in order to determine how entrepreneurs can be most innovative regarding their business model approaches.

Keywords:

Cloud Computing, Business Model, Revenue Model, Pricing Mechanism, Cost Structure, Computing Paradigm, Service Delivery Model, Virtualisation, Internet-based Delivery Model,

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** R: Document, report (excluding the periodic and final reports)*
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OTHER: Software, technical diagram, etc

EXECUTIVE SUMMARY

The present document is the first of a two-part report on *"Recommendations for Cloud Computing business modelling, analysis and acceleration"*. This part focuses on identification and analysis of key business model patterns, existing value chains, and main business opportunities for entrepreneurs. The second and final part of the report will focus on recommendations for entrepreneurs.

This document aims to provide guidance for entrepreneurs in the field of cloud computing: we focus on the current and foreseeable market size for cloud computing; current trends and opportunities in cloud computing for entrepreneurs; the risks entrepreneurs may encounter when developing entrepreneurship projects; differences in business model possibilities and what each possibility entails; we classify business models according to the St. Gallen categorisation; and we provide a methodology, based on Alexander Osterwalder's work on business model innovation classification, for entrepreneurs' self-assessment and action plan.

As a result of this analysis, we conclude that the cloud computing market is a growing one, and cloud computing offers tremendous opportunities for entrepreneurs, especially in the fields of edge computing, artificial intelligence engineering, multi-cloud and joint cloud provider offerings, serverless application architecture, automated cloud orchestration and optimisation, secure access service edge (SASE), data privacy and cloud migration and cloud management and cost containment.

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INTRODUCTION: CLOUD COMPUTING FROM A BUSINESS PERSPECTIVE

Cloud computing has been defined as *"a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction"*[1].

In terms of cloud computing service provision, we have different options, such as:

- Infrastructure as a Service– IaaS,
- Platform as a Service– PaaS,
- Software as a Service– SaaS,
- Management & Monitoring as a Services– MMaaS,
- Testing as a Service– TaaS,
- Storage & Database as a Service– SDaaS,
- Security as a Service–SeaaS,
- Integration as a Service– InaaS
- etc.

Cloud computing ontology, as proposed by L. Youseff, M. Butrico, and D. Silva, is depicted as five layers and shown in Fig. 1. This structure shows how different areas in the cloud are dependent on each other[2].

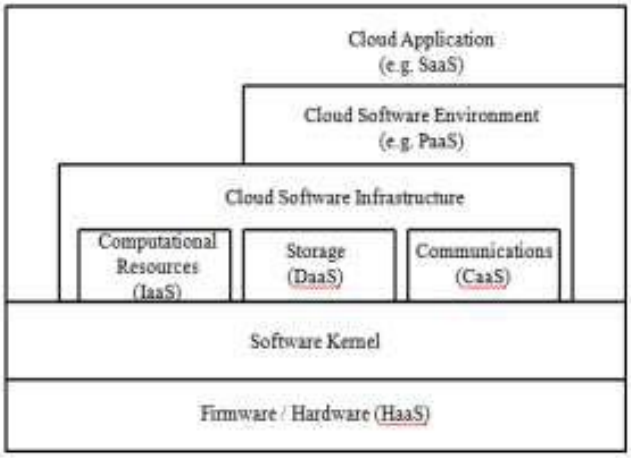


Figure 1 Cloud computing ontology

Through cloud computing, firms are able to rent computing power (both hardware and software) and storage from a service provider, and to pay on demand, as they already do for other inputs as energy and electricity. This is very significant for all industries using hardware and software, and therefore it impacts business creation; macroeconomic performance; job creation in all industries; job reallocation in the ICT sector; and public finance accounts, through direct impact on public sector spending and the indirect one on the tax revenues[3].

[1] P. Mell and T. Grance, "The NIST definition of Cloud computing," NIST Special Publication, 2011.

[2] L. Youseff, M. Butrico, and D. Silva, "Toward a unified ontology of Cloud computing," In Grid Computing Environments Workshop, 2008, GCE'08, pp. 1–10, IEEE, 2008.

[3] Etro, Federico (2011). The economics of cloud computing. The IUP Journal of Managerial Economics, IX(2), 7–22

1.1 Technical and economic strengths of cloud computing

Among others, cloud computing offers the following technical and business-related advantages when compared to other, more traditional solutions[4]:

- Flexibility, as it allows for on-demand services and pay-per-use.
- The possibility to pick and choose among a wide variety of platforms and services.
- Scalability in terms of the computing infrastructure one wants to adopt.
- Time saving, as maintenance must not be done onsite. This allows for more efficient provision of services. Moreover, the user does not need to take care of this, which leads to a reduction in personnel and infrastructure costs.
- Virtualisation, which allows users to share infrastructure, thus reducing costs.
- Service level agreements which guarantee users quality of service. Compensation for non-compliance is associated with this characteristic
- Data is backed up safely. Recovery mechanisms allow users to quickly access data in case of emergencies.
- In terms of storage, cloud computing allows users to have as much data as required.

Moreover, each specific modality of cloud computing provision has its own particular strengths:

1.1.1 Advantages of Software as a Service:

- Global availability of SaaS applications through Internet.
- As most of the people are familiar with using the Internet, SaaS tends to have high adoption rates with lower learning curve.
- Lower initial costs: Unlike traditional software application, SaaS applications are not purchased.
- SaaS applications are based on subscription. No license fees, therefore, lower IT costs including hardware, software, and the persons needed to manage it.
- No burden of upgrades on customers: The traditional model for business applications required an upgrade and new investment in underlying technology and IT resources to take advantages of new features. Because the SaaS provider manages all updates, there are no patches for customers to download and install. This also removes the version compatibility that is found in traditional software that gets deployed on servers.
- Multitenant architecture: SaaS vendors with true multitenant architectures can scale indefinitely to meet customer demand.

1.1.2 Advantages of Platform as a Service

- Pre-built infrastructure – The infrastructure to run applications will be over the Internet. Developers do not need to worry about the storage and hosting and can focus on innovation and development.
- Faster development – PaaS vendors provide the pre-built functionality through APIs and user interfaces, so that users can avoid building everything from scratch. Hence, time to develop gets reduced.

[4] Amol C. Adamuthe, Vikram D. Salunkhe, Seema H. Patil, Gopakumaran T. Thampi,"Cloud Computing – A market Perspective and Research Directions", International Journal of Information Technology and Computer

- Richer functionality – Developers can enhance the overall functionality of the application by including the pre-integrated functionality such as search, analytics and reporting etc.
- Broad delivery option – PaaS solutions can be built to enable SaaS delivery to multiple OSs and devices such as mobile environments with little or no custom coding.
- Low budget – Building on-premises or traditional applications have always been expensive and complicated. PaaS is offered on demand with pay as-you-go pricing. Customers are not required to do the capital investment.
- Scalability of applications – Deployed applications can scale over many thousands of users without any changes to the application.

1.1.3 Advantages of Infrastructure as a Service

- IaaS allows for quick scaling up and scaling down of resources.
- IaaS provides a good environment for testing new applications. Once it has been tested, an application can be approved, refined, or discarded.
- IaaS allows the user not to have their own IT infrastructure, thus giving them more time to engage in core business activities.
- IaaS providers can use different cloud servers simultaneously, their platforms are more likely to be reliable, and less sensitive in increases and decreases in usage.

1.2 Weaknesses or challenges of cloud computing

When analysing the possibilities of cloud computing, the weaknesses and challenges associated with its implementation must also be kept in mind. The main ones are:

- Lack of standards and homogeneity: Each provider has their own services, with different pricing schemes. Therefore, it is often difficult to make comparisons among the different options in the market.
- Different laws apply in different countries, and it is often confusing when it comes to determining which laws apply where.
- Data-related issues, such as security and confidentiality, ownership of the data, recovery and backup, etc.
- The need for a minimum internet quality connection, which may not be available at all times.

Horizon 2020 project H-CLOUD, operating within the EC initiative *Horizon Cloud – The Forum for Strategy Focused Cloud Stakeholders*, of which *HUB4CLOUD* is also a part, made a three-way categorisation of the challenges that cloud computing faces:

1. Cross-Sectoral Demand side challenges

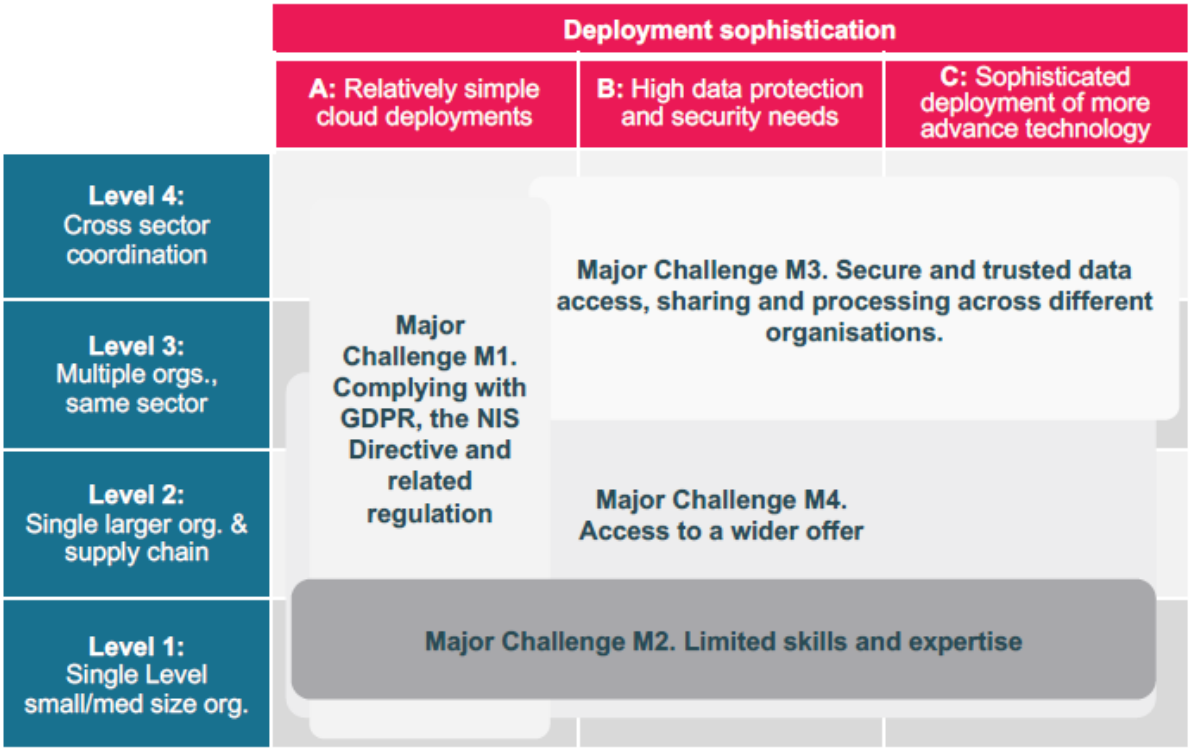


Figure 2 Common Demand Side Challenges[5]

2. Demand-side sector-specific challenges for different sectors and SMEs:

    a. Public Administration sector
    b. Transport sector
    c. Energy sector
    d. Agriculture sector
    e. Healthcare and Human Health Research sector
    f. Manufacturing sector
    g. Demand challenges for SMEs

3. Supply-side challenges for specific relevant themes:

    a. Federated cloud
    b. Edge computing
    c. Green cloud
    d. Landscape
    e. Technology and infrastructure

1.3 Reasons for failure in adopting CC

In spite of the many advantages provided by cloud computing, implementing cloud computing solutions can also be challenging. The first challenge that a company may face is having to adapt all existing software solutions to the cloud. Moreover, the cost associated to this move may prove

[5]Mark Dietrich, Federico M. Facca and Phil Jones, “Cloud Computing in Europe: Landscape Analysis, Adoption Challenges and Future Research and Innovation Opportunities” (2020).

to be too high. These types of challenges, or having overlooked them at an initial stage of the transition period, can lead to different types of failures. Here is a classification of such failures, as put forth by McKinsey[6]:

- Pilot stall: This occurs when initial cloud computing projects are not as successful as initial planned. This leads to companies not to continue to pursue the cloud computing path.
- Cloud gridlock: A company's IT department may be required to make arrangements for local systems to be moved to the cloud in a secure and efficient manner. However, this may be one in a long list of projects for the IT department. In some cases, this can lead to either slow down the process; or, in some extreme cases, to bring the cloud computing project to a grinding halt altogether.
- No value from "lift and shift": Sometimes, companies try to simply replicate local infrastructure outside their own facilities. This may result in not only generating extra work, but also in failing to provide any added value for the company.
- Cloud chaos: IT departments are usually in charge of migrating to the cloud. However, they tend to need some form of oversight and guidance in order to do so. If IT departments are not guided through the process, companies run the risk of failure.

1.4 Current state of cloud computing from a business perspective

In recent years, cloud computing has been on the rise both in professional and personal environments. What is more, the COVID-19 pandemic has pushed this tendency even further.

When asked, companies in 2021 have expressed that optimising the cloud is one of their priorities when it comes to cloud computing. Another cloud-computing-related issue for companies is migrating more workloads to the cloud.

According to respondents to a Flexera survey, Amazon Web Services is the strongest cloud computing provider in the world, followed closely by Azure. Google Cloud, a growing service, comes third[7].

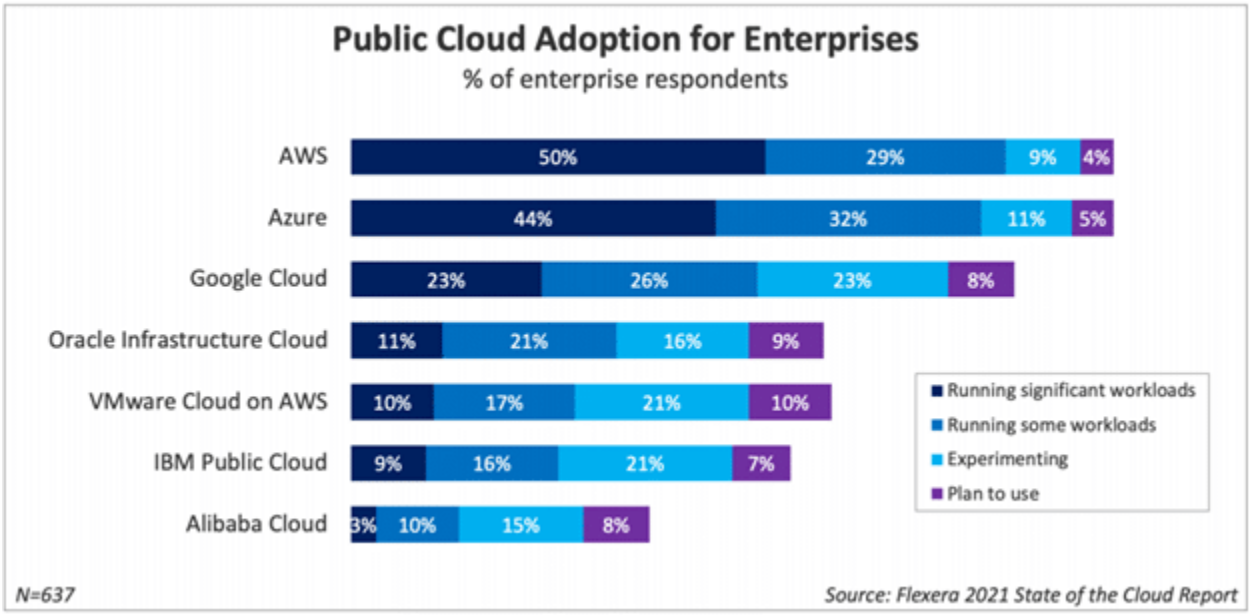


Figure 3 Public Cloud Adoption for Enterprises

6 https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/how-cios-and-ctos-can-accelerate-digital-transformations-through-cloud-platforms#

7 https://www.flexera.com/blog/cloud/cloud-computing-trends-2021-state-of-the-cloud-report/

The following is a visual representation of cloud computing adoption. It must be noted that, on average, enterprise cloud adoption remains low, at around 20 percent:

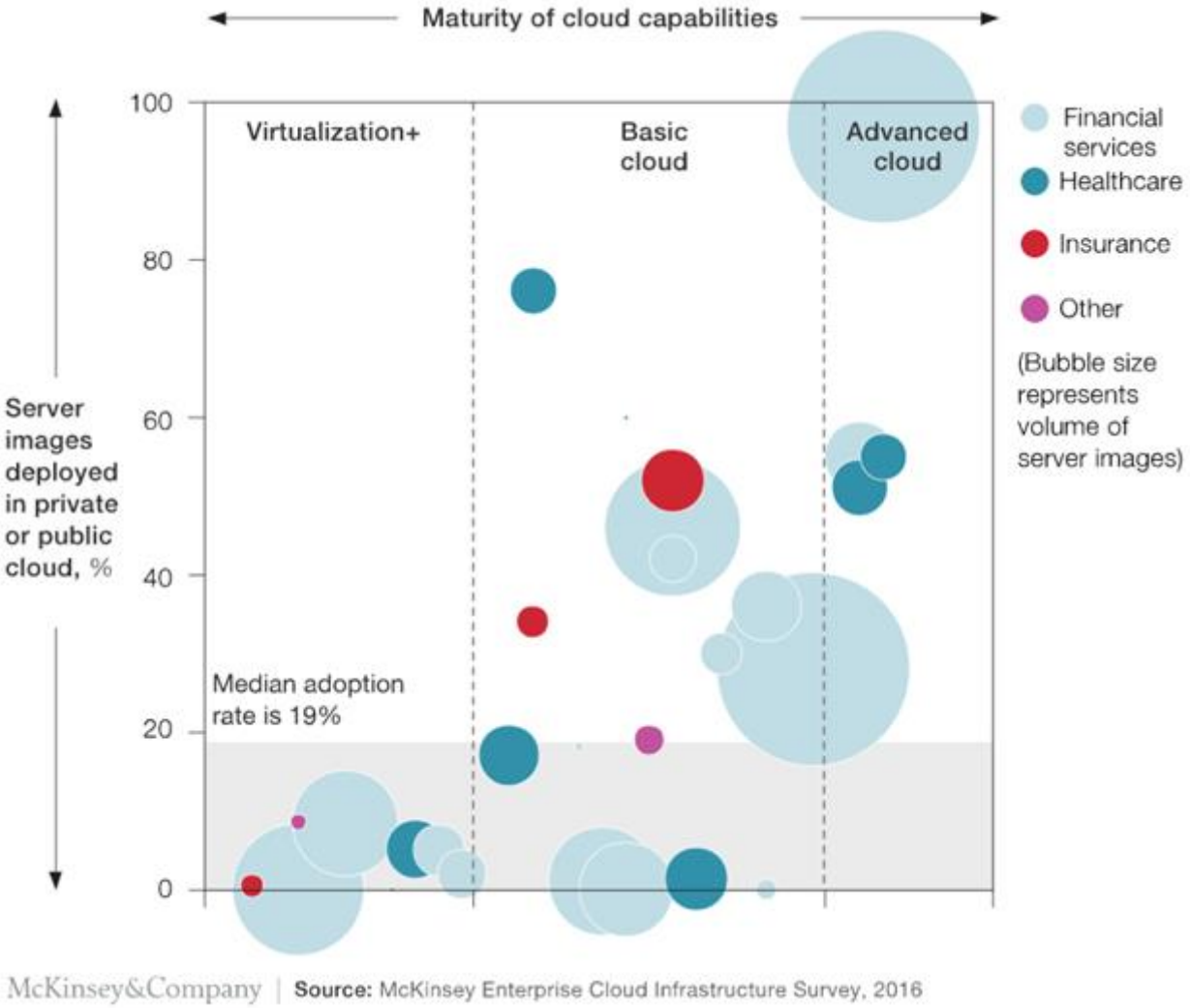


Figure 4 Volume of server images deployed, by industry, compared to maturity of cloud capabilities[8]

1.5 Cloud computing trends

There is an overall tendency toward cloud computing. However, there are on-premises computing applications and processes which will continue to be used. Therefore, cloud, off-cloud and hybrid IT solutions will most likely coexist in the foreseeable future.

In any case, cloud computing solutions will have to be flexible, scalable and demand based. Moreover, users will demand control over used data as well as overall security.

The following are some trends or predictions for cloud computing. This also shows how cloud computing should be better for business in the future.

[8] https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/how-cios-and-ctos-can-accelerate-digital-transformations-through-cloud-platforms#

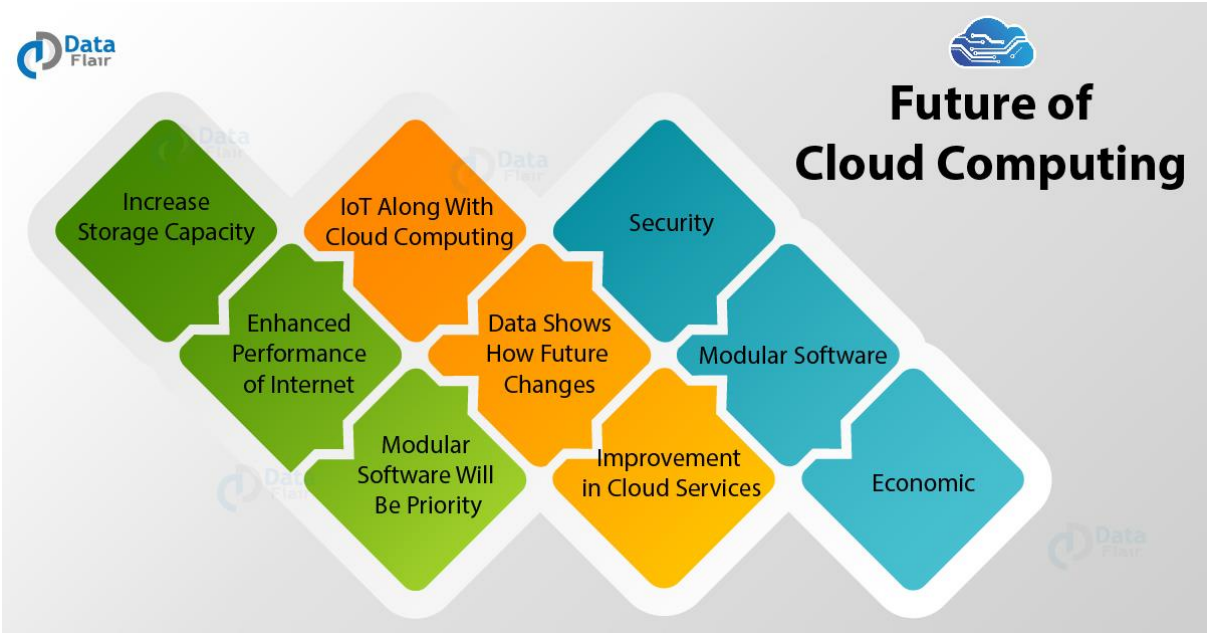


Figure 5 The future of cloud computing[9]

Increased Storage Capacity, thus allowing users to store larger quantities of data.

Enhanced Performance of Internet, thanks especially to IoT.

Modular Software Will Be a Priority, due to the complexity and size of applications.

Internet of Things Along with Cloud Computing, with communications among different machines and real-time data analytics as collateral trends.

Improvement in Cloud Services, in the sense that it will become more user-friendly and applicable for different types of users.

Security is key if cloud computing is to grow in the future. Whether offered by small or large organisations, they will have to secure the users' data and confidentiality; and prevent cyber-attacks.

Economic, by reducing costs of purchasing hardware, as this cost will be shared by larger number of users. Moreover, human labour costs will be reduced due to the fact that machines will be doing most of the work.

Given these trends, entrepreneurs looking to maximise the outcome of their projects should try to:

- Find opportunities where cloud computing can allow them to provide services in a more efficient manner, either because they can have larger revenues or because the margins are larger than using other alternatives.
- Combine an efficient technology with a sensitive business strategy. In other words, their proposition should make sense from technological and business point of view.
- Make their business model, their offering, relations with customers, etc. related to their project cloud-compliant.

[9] https://data-flair.training/blogs/future-of-cloud-computing/

1.6 Cloud computing market size

All estimates indicate that cloud computing spending will grow in the coming years. According to Gartner, Inc., this growth will be from $257.5 billion in 2020 to $304.9 billion in 2021. That is an increase of 18.4% in just one year! Moreover, this market is expected to grow up to $362.3 billion in 2022[10].

As can be seen in the table below, more than one third of the total spending foreseen by the end of 2021 comes from Software as a service (SaaS). This is the biggest cloud computing market segment, and it looks like it will remain that way.

Infrastructure as a Service (IaaS) comes second, with Platform as a Service (PaaS) and Business Processes as a Service (BPaaS) coming in third and fourth places in terms of their respective shares of the cloud computing spending pie.

The four previously mentioned segments make up 94.8% of all expected spending in cloud computing. Therefore, it is quite clear where the big market opportunities lie.

	2019	2020	2021	2022
Cloud Business Process Services (BPaaS)	45,212	44,741	47,521	50,336
Cloud Application Infrastructure Services (PaaS)	37,512	43,823	55,486	68,964
Cloud Application Services (SaaS)	102,064	101,480	117,773	138,261
Cloud Management and Security Services	12,836	14,880	17,001	19,934
Cloud System Infrastructure Services (IaaS)	44,457	51,421	65,264	82,225
Desktop as a Service (DaaS)	616	1,204	1,945	2,542
Total Market	**242,696**	**257,549**	**304,990**	**362,263**

BPaaS = business process as a service; IaaS = infrastructure as a service; PaaS = platform as a service; SaaS = software as a service
Note: Totals may not add up due to rounding.

Source: Gartner (November 2020)

Table 1 Forecast of Cloud Computing Spending (US$ Billions)[11]

When it comes to the European market, it should be pointed out that, in general terms:

- The European IaaS and PaaS market is dominated by US providers.
- The European SaaS market is more fragmented and less locked-in.
- Even if most of the money is in the SaaS segment, a big effort is being put into empowering (smaller) European IaaS/PaaS providers and also into guaranteeing a level

[10] https://www.gartner.com/en/newsroom/press-releases/2020-11-17-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-grow-18-percent-in-2021

[11] https://www.gartner.com/en/newsroom/press-releases/2020-11-17-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-grow-18-percent-in-2021

playing field with strong norms on data protection, privacy, etc.

- The ongoing shift towards Edge Computing, where it matters again where a server is physically situated, is perceived as a game-changing opportunity for Europe, with regional Cloud (and also IoT) providers being allowed to participate.

1.7 Competitive advantages of cloud computing for entrepreneurs

Leaders at large organisations are particularly excited because cloud computing tools provide increased visibility across divisions as well as up and down the value chain. Cloud gives the ability to start penetrating silos. Moreover, it enables collaborative management at multiple levels by providing a persistent layered view of critical data for different purposes: operational, support and administrative, and an abstracted layer for management.

In order for cloud computing to make sense for customers, entrepreneurs need to address the need of CIOs and tech leaders to do three things[12]:

---

1. **Find opportunities where cloud computing can allow them to provide services in a more efficient manner**

What we mean by this is that entrepreneurs can find business opportunities in areas in which cloud computing allows for more efficient products, services, or processes than other technologies. This can be achieved in a variety of ways:

- Reaching the market earlier: The cloud can be instantaneous. By using it, entrepreneurs can reach their audience immediately, thus having an advantage over their competitors.
- Finding new ways to provide services: The cloud allows us to incorporate services that were restricted to few individuals or services, such as facial recognition, natural-language processing, quantum computing, and data aggregation. Entrepreneurs can take advantage of this and incorporate these new types of services into their portfolio. Moreover, they can make them part of their offering whenever relevant.
- Risk reduction: Cloud computing allows for security features which were not available to newcomers before, as they were way too expensive for them to implement in terms of the strength of the infrastructures, authentication procedures, and access to large data centres.
- Scaling possibilities: Thanks to cloud computing, service providers can offer virtually limitless scalability in terms of the services being provided.

The following figure produced by McKinsey offers a comparison of benefits between different cloud computing models:

[12] https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/how-cios-and-ctos-can-accelerate-digital-transformations-through-cloud-platforms

Increasing agility, automation, access to innovation, and scalability

Consumption model		Traditional	Lift-and-shift virtual machines	IaaS	PaaS	FaaS
App-lication maturity	Application architecture	Multi-tier	Multi-tier	Fault-tolerant machine images	Loosely coupled services, using containers	Event driven, serverless, fully stateless
	Automation of app-devel-opment oper-ating model	Traditional, bespoke develop-ment	Traditional, bespoke develop-ment	Move toward product-based, agile develop-ment	Move toward DevSecOps	Move toward proprietary, cloud-native development
Infra-structure maturity	Tenancy	Dedicated	Dedicated or shared	Dedicated or shared	Mostly shared and managed	Shared
	Hosting	Mostly on-premises, co-location	Off-premises[2]	Off-premises[2]	Off-premises[2]	Off-premises[2]
	Automation of infra-structure operating model	Basic auto-mation, but with people-dependent processes	Basic auto-mation, but with people-depen-dent processes; continuous integration	Fault-tolerant and resilient infrastructure (eg, mature auto-scaling); CI/CD[3]	Highly automat-ed; default use of native managed services (eg, stateless, self-healing); CI/CD[3]	3rd-party orchestration; no management needed from the customer; CI/CD[3]
Run-rate benefits & KPIs	% produc-tivity increase vs IT spend	Baseline	–5–0%	10–20%	20–30%	30–40%
	Time to market	Quarterly	Quarterly	Monthly to every 2 weeks	Every 2 weeks/ as needed	Daily/multiple times a day
	Change vs run ratio	30:70	30:70	40:60	50:50	70:30
One-time transition costs	% transition cost vs IT spend	Baseline	10%	10–20%	20–60%	80–120%
	IT payback period[1] (varies by workload type)	N/A	May not pay back	1–2 years	2–3 years	2–3 years

[1] IT benefits only (infrastructure and application development/maintenance); does not include business-acceleration benefits.
[2] Primarily off-premises; can be on-premises or edge for specific regulatory, security, or network-connectivity-constrained situations.
[3] Continuous integration/continuous delivery.

McKinsey & Company

Figure 6 Cloud benefits vary by consumption models

2. Combine an efficient technology with a sensitive business strategy

It simply makes sense that technology in itself does not solve business problems. And the opposite is also true. Therefore, there must by a symbiosis between technology and business sense. The basic entrepreneurship questions of *"what problem am I solving?"* and *"how am I providing a solution to that problem?"* also apply in the case of cloud computing.

From this point of view, we should ask ourselves the following questions:

- Which architectural model should I apply in order to satisfy the needs of my customers (virtual machines, IaaS, containerisation, transposing existing applications to the cloud…)?
- How am I addressing security compared to other options?
- Which Cloud Service Providers should I use?
- How can I migrate existing software applications? Should I do it?

3. **Make their entire business cloud compliant**

Cloud computing more and more implies that all processes are carried out in the cloud. In order to achieve this, entrepreneurs can make use of the following principles to create and commercialise products, especially in a work/business environment:

- Instead of providing a separate service, think of how that service can be compatible with other services. What constitutes one whole, finished product?
- Generate a product that is fun to use. How does the product make the customer's life easier?
- How the product is integrated with other aspects of business. A cloud computing business idea can be very good. However, if it is not integrated with other applications of the customer's portfolio, it may be discarded.
- Cloud solutions should be automated so that minimum interference is required.
- Security and trust must be a given.
- Agility is key. Slow systems are no longer acceptable, regardless of other related benefits.
- Make products and services intuitive and easy to use. CIOs are not the only users of cloud-based products and services.

1.8 Market opportunities for entrepreneurs that are opening up

1.8.1 Market opportunities from a business perspective:

When it comes to being an entrepreneur in the field of cloud computing in 2021, the number of possibilities in different areas is endless. Below is a list of general ideas for entrepreneurs, partially taken from profitableventure.com[13]:

Development of new tech.

- Presentation software
- Universal payment gateway
- Keyless door unlocking devices
- Admin software
- Cloud automation
- Printing technology

Moving traditional markets to the cloud

[13] https://www.profitableventure.com/cloud-computing-based-business-ideas/

- Telecommunications
- Call centre
- Photography
- Storage
- Dedicated server hosting
- Log management
- Systems administration
- Real estate
- Teleconferencing
- Voice over Internet Protocol (VoIP)

1.8.2 Market opportunities from a technology perspective:

In terms of the main CC areas in which opportunities for entrepreneurs are opening, we should mention the following:

Edge computing

Edge is a logical development of cloud computing, and the former will slowly but surely take away a percentage of the latter's market, according to Forrester's predictions[14]. Moreover, AI and 5G are areas in which edge computing will flourish. However, it must be noted that innovative business models will have to be employed in order to achieve success in these areas, as entrepreneurs will have to enter unchartered territory[15].

Artificial Intelligence

Artificial intelligence (AI) provides the perfect ingredients for cloud computing, to drive business activity, harness the value of data, and deliver intuitive experiences to customers or users. When we talk about AI in this case, we refer to technologies that make up some of its subfields, such as machine learning and deep learning neural networks, which are those that ignite the most dynamic applications, such as predictive analytics, natural language and computer vision[16].

These AI tools are being used to add more value and increase the functionality of existing cloud computing platforms. With AI technologies mounted on Cloud computing infrastructures, organisations can, as we said, better manage their data, find valuable information for making business decisions and optimize the efficiency of their processes.

Multi-Cloud

A multi-cloud is a solution that combines cloud services from different providers. This is a relatively new business concept, and it comes as a result of providers deciding that it may be in their best interest to join forces in order to compete against the industry's giants[17]".

Serverless architecture

A serverless architecture is a way to create and run applications and services without having to manage infrastructure. One of the main advantages of serverless architecture is that users only pay whenever their code is running. If there are no active feature executions, the user is not charged. For example, if a user's code runs once a day for 2 minutes, they will be billed for 1 unit of execution and 2 minutes of computation.

Serverless architecture is definitely a growing trend, as it was one of the five fastest-growing PaaS

14 https://www.techrepublic.com/article/5-edge-computing-predictions-for-2021/

15 https://www.zdnet.com/article/in-2021-edge-computing-will-hit-an-inflection-point/

16 https://www.ibm.com/cloud/blog/ai-vs-machine-learning-vs-deep-learning-vs-neural-networks

17 https://insights.cloudconventions2021.com/view/content/Vq82X

services in 2020, according to the Flexera 2020 State of the Cloud report[18].

Cloud Automation and Orchestration

When we talk about cloud automation, we are referring to the process of replacing manual tasks with automated ones using the cloud; cloud orchestration goes a step further and implies the coordination of automated tasks to achieve faster and more efficient results. Organisations can automate tasks that require more than one system, thus being more productive.

Both automation and orchestration lead to cost savings, more regulated processes and higher levels of agility.

Secure Access Service Edge (SASE)

SASE, an emerging approach to infrastructure, offers a cohesive but incremental approach to creating a new context in IT. Very briefly, SASE is implemented over software-defined wide area networks (SD-WAN), integrating cybersecurity capabilities. Services can be managed in cloud deployments and delivered on premises or through the cloud itself, depending on user requirements[19].

Among other advantages, SASE provides unified security and a zero-trust environment, provides unified security and a zero-trust environment, reduces operating expenses, improves performance and reduces latency. All these components make for great business opportunities for entrepreneurs.

Data Privacy and Cloud Migration

Data is not always just transferred directly to the cloud. It needs to be encrypted and moved safely. This provides for cybersecurity and data management business opportunities related to cloud computing.

[18] https://www.flexera.com/about-us/press-center/flexera-releases-2020-state-of-the-cloud-report.html

[19] https://www.netskope.com/security-defined/what-is-sase

2 CLOUD COMPUTING VALUE CHAINS: UNDERSTANDING BUSINESSES AND VALUE CREATION IN THE CLOUD

The value chain as a concept was first introduced by Michael Porter. According to Porter, the value chain is a *"system of independent activities, which are connected by linkages. Linkages exist if the way, in which one activity is performed, affects the cost or effectiveness of other activities"*[20]. Linkages show how one activity affects other activities, which in turn provides information regarding how the value chain reflects a competitive advantage and added value with regard to competitors[21]. A distinction is made here between primary or main activities and support or secondary activities. Products or services should go through all activities of the value chain and, at each activity, the products or services should be more valuable. Moreover, the whole value chain provides more value than adding all separate individual activities[22].

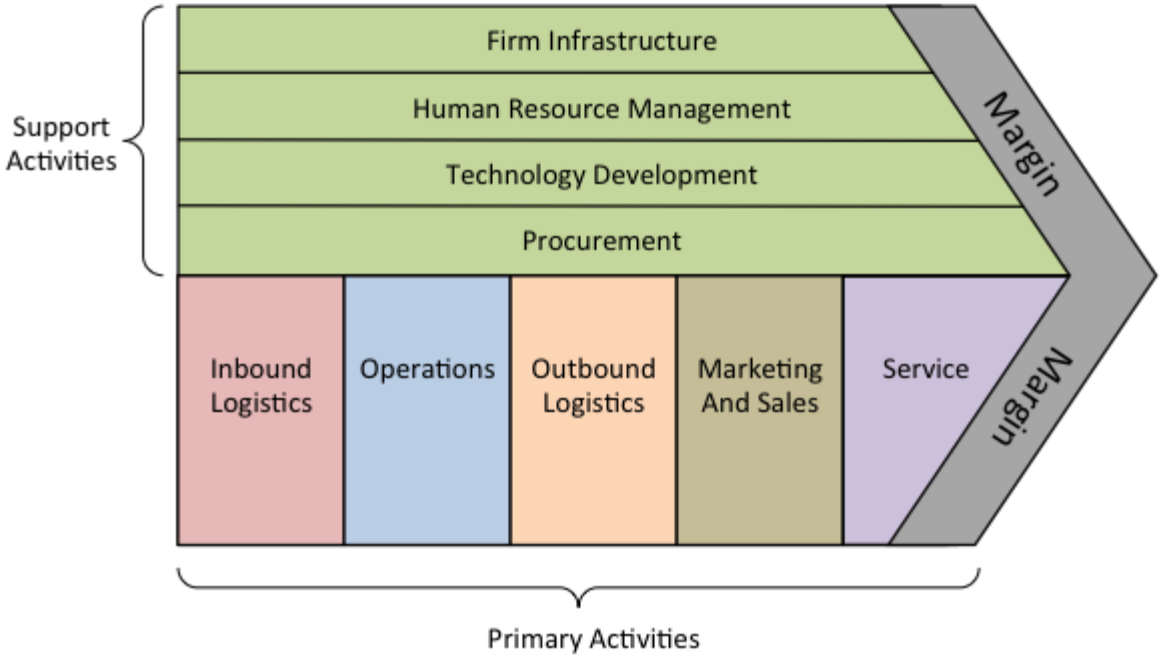


Figure 7 Michael Porter's value chain[23]

2.1 Internet value chain

Value chains in the context of the internet have proven to be more complex than Porter's initial proposition[24]. In fact, many industries' value creation processes are dynamic, flexible, non-linear and multi-dimensional. The value chain as proposed by Porter is, in contrast, linear in structure.

[20] [1] Next Generation Grids Expert Group. Future for European Grids: GRIDs and Service Oriented Knowledge Utilities. Third Report.(January 2006).

[21] European Commission. 2006. From Grids to Service-Oriented Knowledge Utilities A critical infrastructure for business and the citizen in the knowledge society. SOKU brochure. Office for Official Publications of the European Communities. Luxembourg.

[22] European Commission. 2003. Grids Challenges and opportunities for business & industry. European Commission Information Society Directorate-General. Final Report of the European Study Contract No. 30-CE-065970/ 00-56.

[23] https://www.researchgate.net/figure/Michael-Porters-value-chain-6_fig1_316889653

[24] M. E. Porter. 1998. On Competition. A Harvard Business Review Book. Boston.

Consequently, Value Networks[25] emerged as a way to model these non-linear complex sets of social and technical resources, by establishing relationships among different roles.

Within the aforementioned value networks, different stakeholders exchange resources, thus generating value. Even though value networks are a new way to describe processes of tangible and intangible value, it must be noted that value networks tend to grow exponentially in terms of structure, due to their increased complexity.

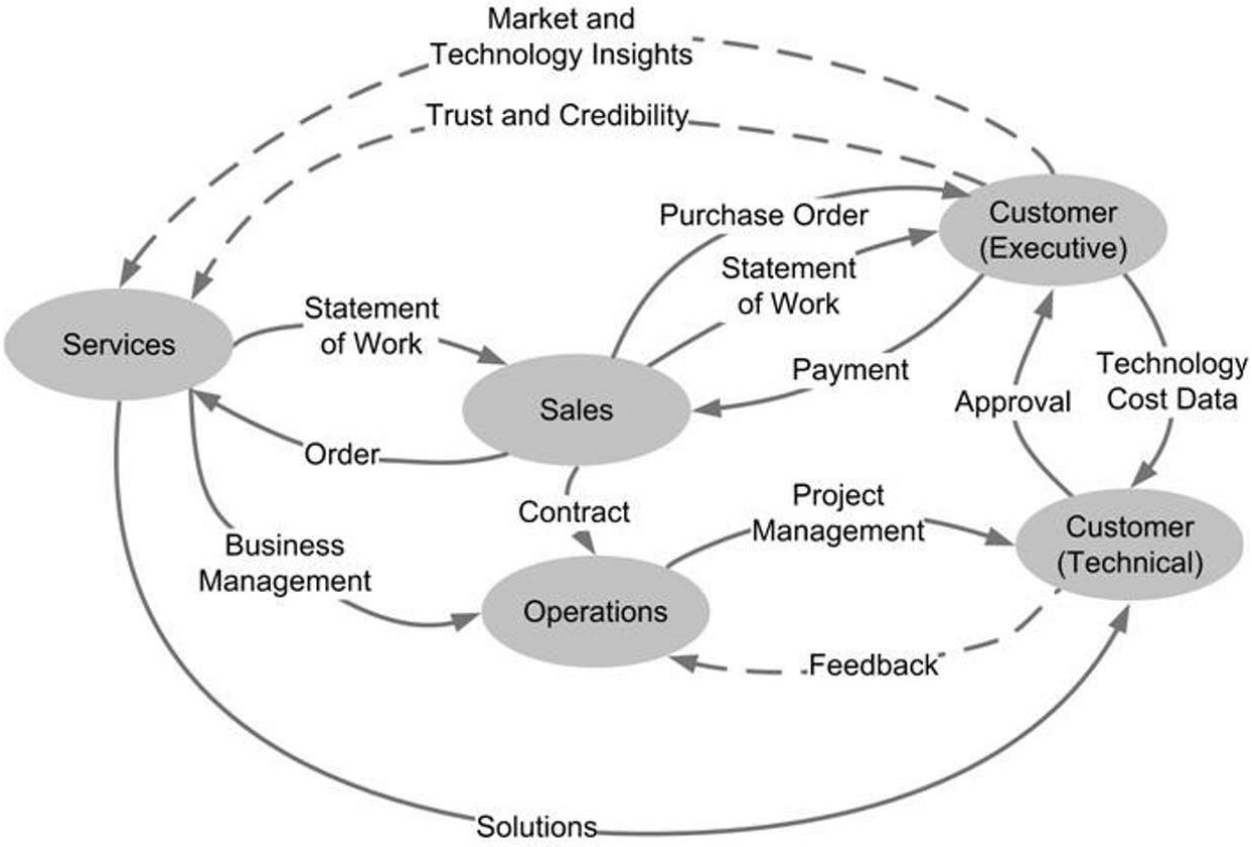


Figure 8 A simplified Value Network illustration[26]

The concept of “value grid” (not to be confused with Grid Computing), has been recently proposed. In this model, the flow of knowledge and intangible benefits can take place between any number of stakeholders anywhere and anytime, thus resembling a grid-like value creation scheme. At the same time, it maintains an organised and systematic structure. Whereas value network model includes actors which take part in a particular business, the value grid also incorporates such aspects as identifying new business opportunities and threats; and monitoring the competition and new trends in terms of the technology, society, etc.[27]

[25] M. E. Porter. 1985. Competitive Advantage. Creating and Sustaining Superior Performance.
[26] https://thinking.visible.is/post/what-is-the-value-network-a-simple-introduction-60c790065a33d254f25ef5d7

[27] Kodó, K., & Hahn, I. (2017). Literature Review of the Value Grid Model.

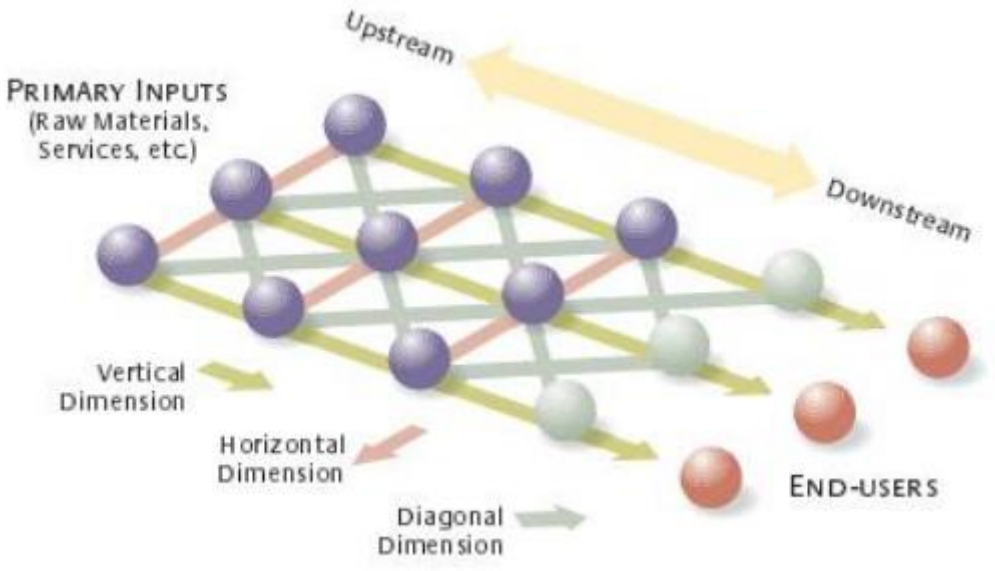


Figure 9 Value Grid Model[28]

In sum, regardless of the methodology we use in order to express value creation, those involved in the business process should be able to easily identify that value creation. Furthermore, the business project's added value should be expressed in terms of its competitiveness, expected ROI, scalability and sustainability.[29]

2.2 Cloud computing value chain

The cloud computing value chain incorporates different types of stakeholders, not just the ones behind the technology; and they are involved in different types of roles. We can distinguish between operational and non-operational stakeholders, and end users.

Operational stakeholders are the ones who are involved in making cloud products and services available to consumers, and include **cloud providers**, who deliver services to **cloud customers**; **cloud enablers**, who facilitate access to the cloud in the form consulting, advisory, etc.; **cloud resellers** and **third-party providers** integrate cloud providers' services and additional resources.

Non-operational stakeholders are the ones who determine the conditions under which cloud computing services are providers, and include **regulators, legislators, courts, NGOs, law enforcement agencies** and **industry-standard bodies**.

Below is a representation of the interactions that may take place among stakeholders in the cloud computing value chain. It must be noted that not all stakeholders need to participate in all interactions.

[28] Pil, F. K., & Holweg, M. (2006). Evolving from value chain to value grid. MIT Sloan management review, 47(4), 72.

[29] R. Breite and H. Vanharanta. 2002. Value Chain Management in the Internet Environment. In: Twelfth International Working Seminar on Production Economics

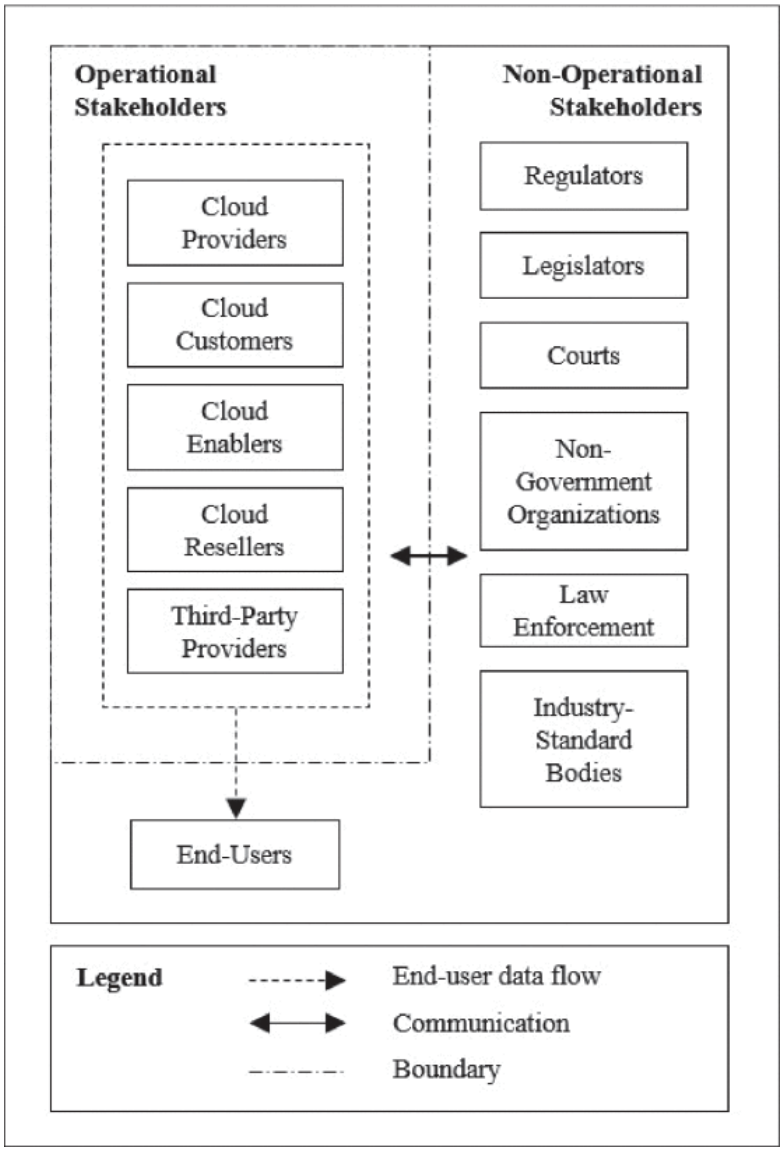


Figure 10 Stakeholders in the cloud computing value chain[30]

2.3 Value chain reference model in cloud computing

The cloud computing value chain reference model presented below was developed building on the foundations of Porter classical model, value networks, and "value grids". This model divides tasks, or services, into three categories: business-oriented support services, primary services and cloud-oriented support services. Within those three areas, services are organised as independent entities. Linkages can take place between any of these areas, and value is gained by accumulating money and knowledge through these linkages. This flexible model allows for customised service packages and should result in cutting costs along the way.

[30] https://www.katinamichael.com/research/2020/11/12/stakeholders-in-the-cloud-computing-value-chain-a-socio-technical-review-of-data-breach-literature

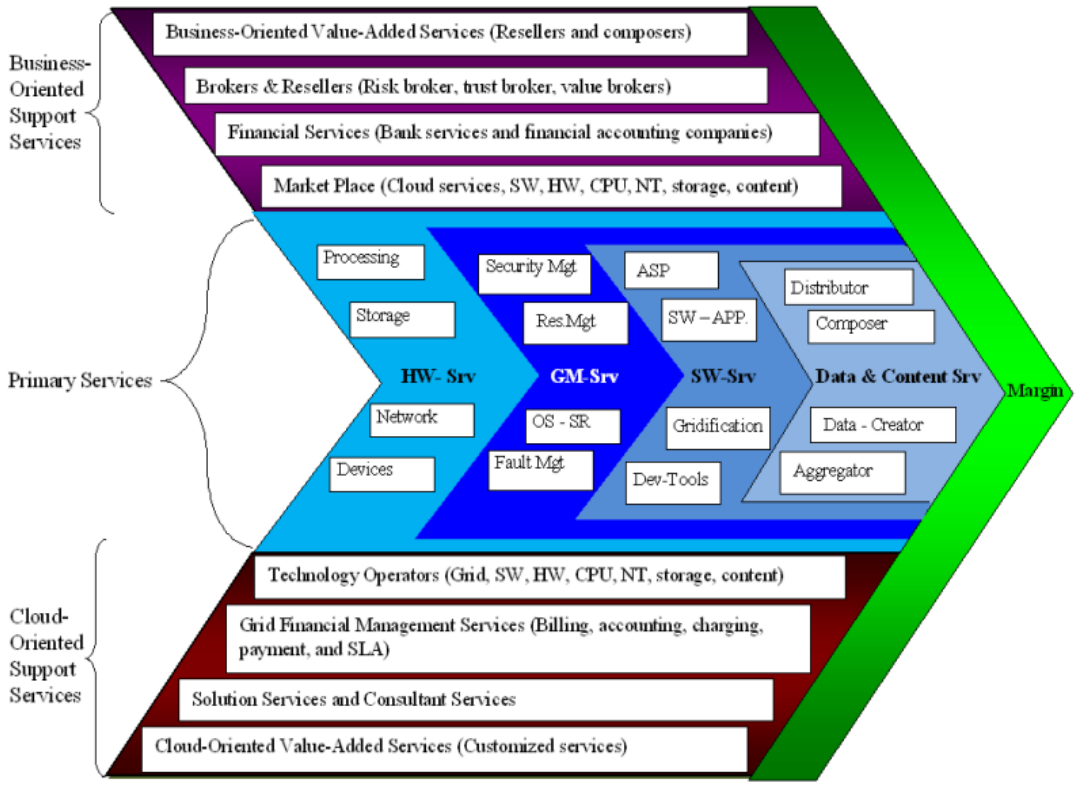


Figure 11 Cloud value chain reference model[31].

The **primary services layer** sits in the centre of the model and is composed of the main infrastructure and features of the cloud computing service model.

The **cloud-oriented support services layer** includes those technology-related activities which are necessary to support the cloud computing service model, such as financial services, tech operators, etc.

Finally, the **business-oriented support services layer** is associated with those activities which are necessary for the functioning of the cloud computing service model, but which are not technical in nature. These include banks, brokers, sellers, distributors, marketplaces, etc.

[31] Bany Mohammed, Ashraf & Altmann, Jörn & Hwang, Junseok. (2010). Cloud Computing Value Chains: Understanding Businesses and Value Creation in the Cloud. 10.1007/978-3-7643-8899-7_11.

3 CLOUD COMPUTING BUSINESS MODELS

3.1 Introduction

3.1.1 The concept of business model

The term "business model" was first introduced in the 1950s to describe how a business organisation creates, delivers and captures value. In the late 1990s, the internet made the term very relevant. Existing companies faced the challenge to offer new products and services, to seek new channels of communication and distribution, to access new customers. This led to the transformation of existing business models.

A business model is not a complete description of what a company does, but a summary of their relationships with customers and money. Existing business models can be studied so we can learn from them and find ideas so we can innovate on our own business projects[32].

3.1.2 The concept of business strategy

Business strategy is the path that entrepreneurs can take in order to reach their business objectives. A business strategy should contemplate how they will organise the company, attract customers, differentiate themselves from competitors and, on the whole, be efficient and successful[33].

3.1.3 The concept of value proposition

The value proposition expresses what customer pains and/or gains the entrepreneur is addressing for each customer segment. This includes information on the market problem that is being solved, the products or services that are being used to solve the problem, and their characteristics. An entrepreneur can offer several independent or related value propositions, targeting one or more target customer groups.

3.1.4 The concept of value creation

Value creation refers to the set of activities that add value for shareholders, increasing the return on invested capital, as well as the value of goods or services for consumers. Economic profitability means obtaining a higher level of profits than losses in a given field; in this case, these are reflected in the benefits or results of an investment or economic activity.

3.1.5 The concept of value delivery

Value delivery deals with the concept that we need to make sure that our customers are satisfied with the service we provide them. This includes delivery of goods and services, processing orders, managing our inventory, solving our customers' problems, etc. The value delivery allows us to know that the model we have created works from a customer satisfaction perspective.

According to the more traditional system, providers first define a product/service, then they develop it and finally they sell it. All these stages take place on the company's side. However, the value delivery system looks at the process from the customer's perspective. The steps followed in this system consist of selecting a value, then providing it and finally communicating it to our

[32] Li, F. (2020). The digital transformation of business models in the creative industries: A holistic framework and emerging trends. Technovation, 2020(92-93), p. 102012. doi: 10.1016/j.technovation.2017.12.004

[33] https://businessjargons.com/business-strategy.html

customers. This system intrinsically implies that all areas of a company must be coordinated and share the same objectives and values[34].

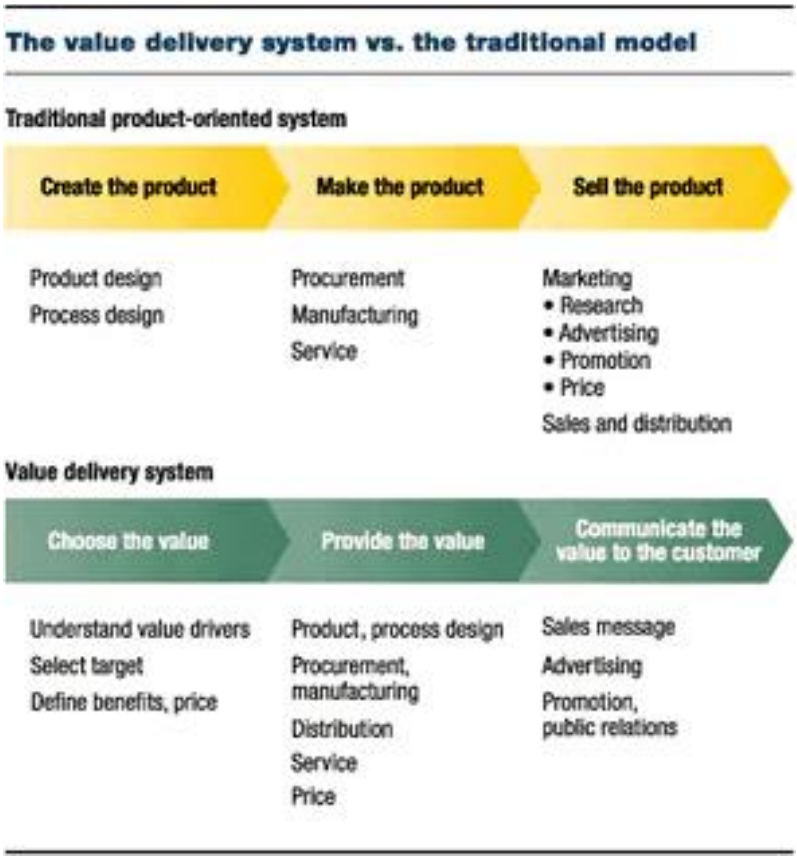


Figure 12 The value delivery system vs. the traditional model[35]

3.2 Business Models in cloud computing

Good business models must keep in mind, apart from the economic logic of the company, other factors such as market sizes and characteristics, relevant competitors, social trends, etc. Technology, by itself, has little value. Therefore, cloud computing is only valuable when applied within a sensible business model.

The figure below illustrates examples of the most common business models in cloud computing: SaaS, PaaS and IaaS.

34 https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/delivering-value-to-customers

35 https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/delivering-value-to-customers

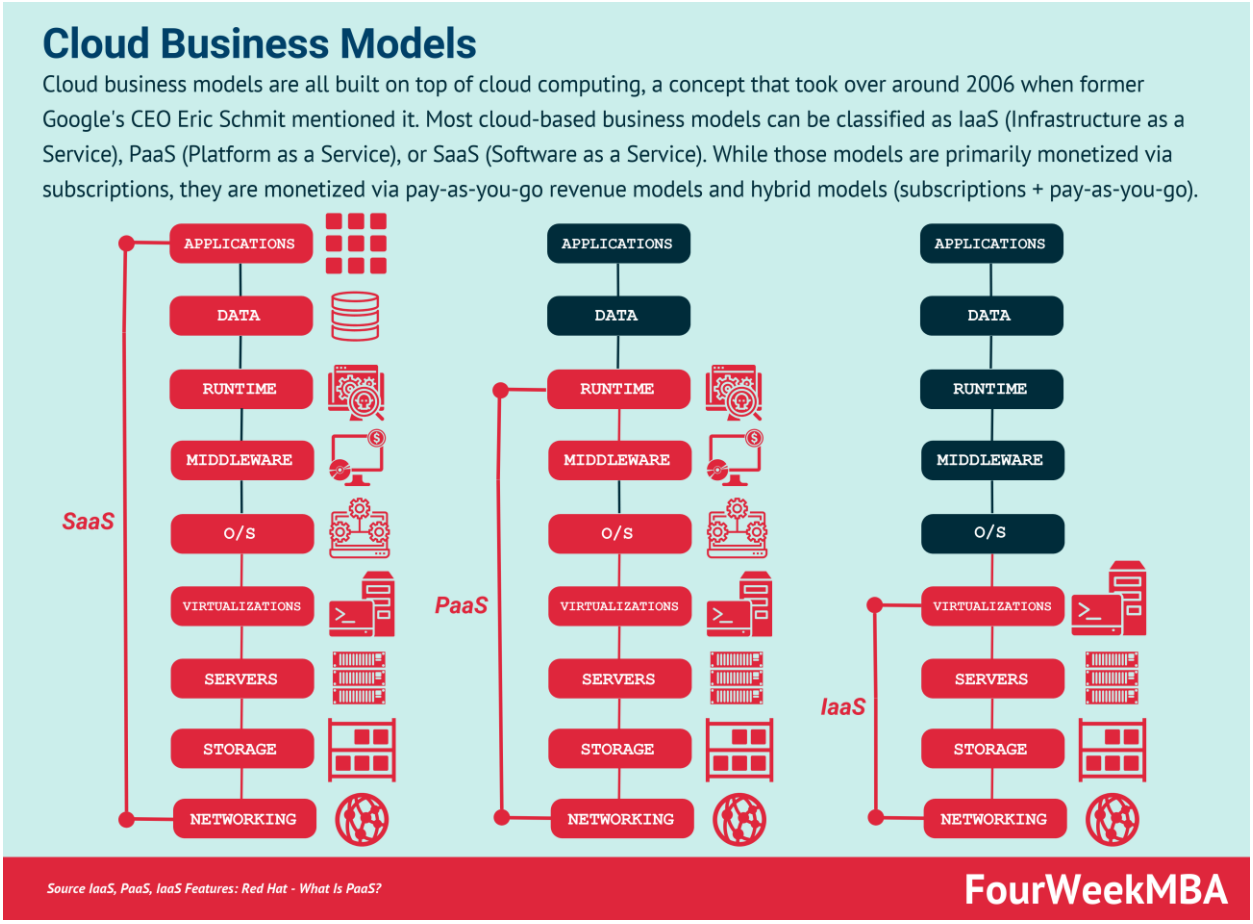
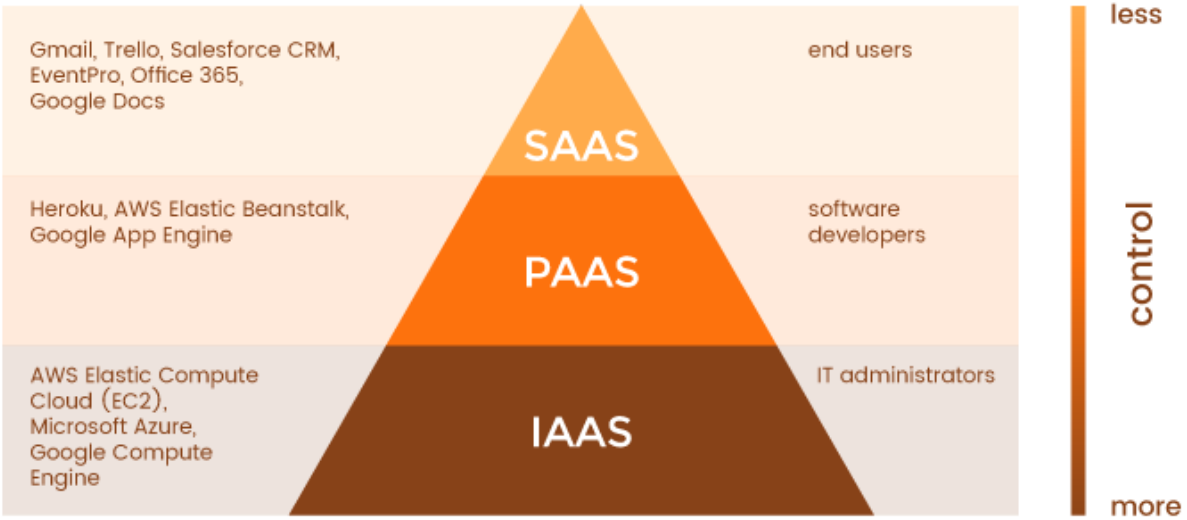


Figure 13 Cloud business models[36]

These three main cloud computing business models can also be categorised in terms of the level of control that they allow. Below is a visual representation of these models with examples and types of typical users:



[36] https://fourweekmba.com/cloud-business-models/

Figure 14 Cloud services models[37]

3.2.1 SaaS

SaaS basically allows users to use software applications online. Most of the leading organisations are using Software as a Service (SaaS).

Examples: Office365, Google apps, Salesforce.com

Figure 15 Some SaaS offer options[38]

The following is an example of a representation of a business model canvas for SaaS:

[37] https://rubygarage.org/blog/iaas-vs-paas-vs-saas

[38] https://jelvix.com/blog/saas-business-model

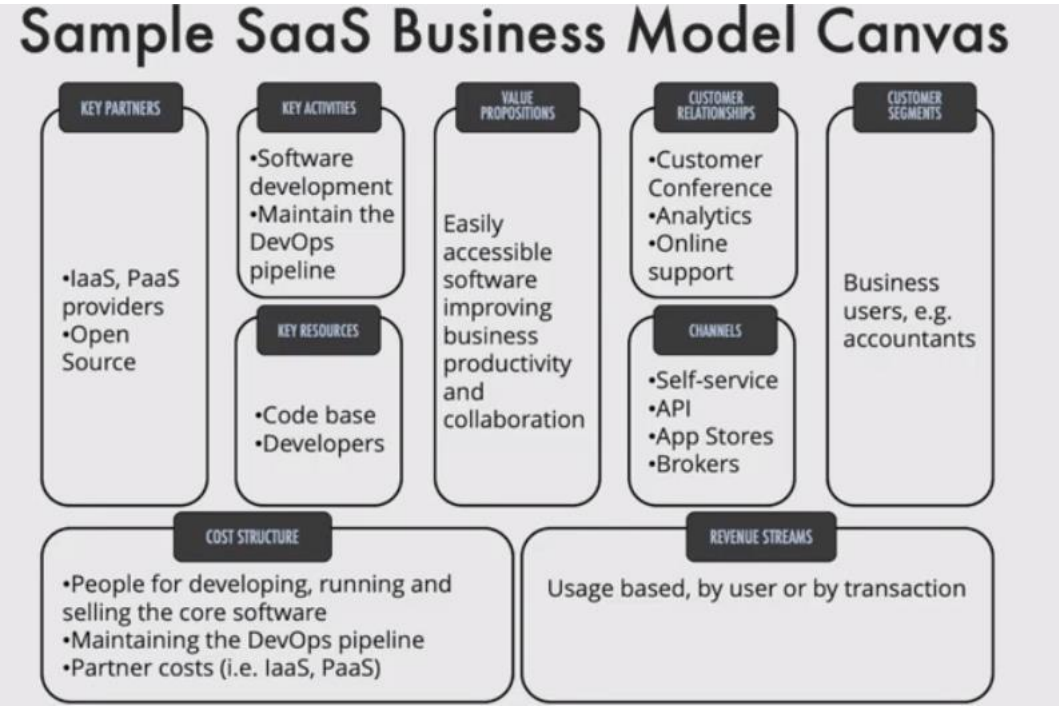


Figure 16 Sample SaaS business model canvas[39]

SaaS makes it easier for customers because it doesn't require installation; they don't have to think about software updates, storage, etc.; it is typically available from different types of devices; they generally adhere to security standards; and, since service providers gather user data, it allows for constant improvements.

3.2.2 PaaS

Platform as a Service allows users, usually companies or other types of organisations, the necessary tools to develop, test, run, and manage their own applications[40]. PaaS basically makes life a lot easier for developers, as they can purchase the resources from the cloud service provider on a pay-as-you-go basis. Platform as a service not only includes server, storage, and networking but also database, tools, business services, and many more.

Examples: Force.com, Heroku, Google app engine, AWS, Windows Azure.

[39] https://www.clubcloudcomputing.com/2014/12/business-model-canvas-saas-providers/

[40] Platform as a Service (PaaS) - Advantages & How it is Used - DataFlair (data-flair.training)

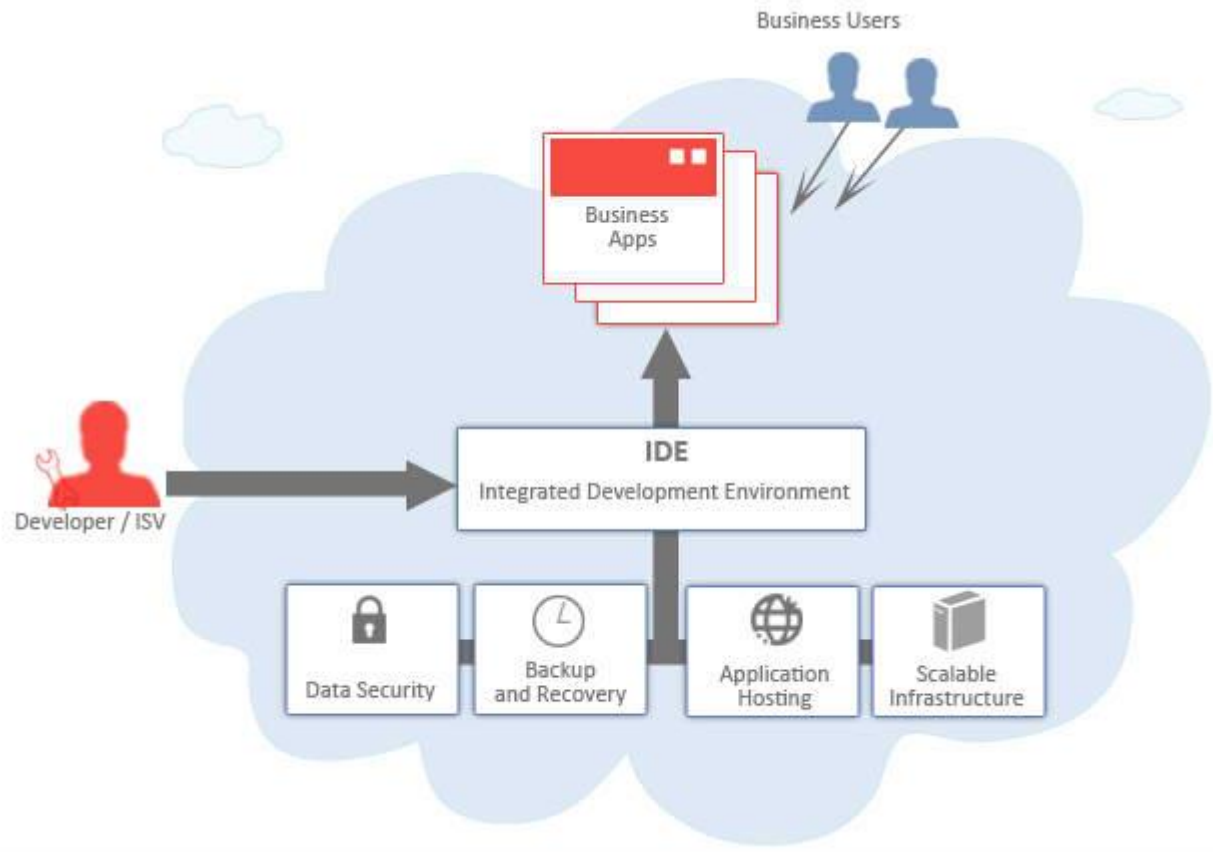


Figure 17 PaaS value chain[41]

3.2.3 IaaS

IaaS involves renting a hardware infrastructure from a third party, in which several users typically share the same physical machine. IaaS providers often provide additional services, such as servers, networks, backups, firewalls.

IaaS is a scalable, pay-per-use model which is based on storage and processing needs. Since customers pay exclusively for the services they use, they can avoid making large investments in IT equipment. It allows companies to increase the efficiency, redundancy, security and control of their infrastructures; but forgetting about its installation and maintenance.

IaaS is the basis of any cloud service provision, since there is no cloud without infrastructure.

Examples: GOGRID, AWS(EC2), Rackspace.com

[41] http://www.info-lab.com/platform-as-a-service-paas/

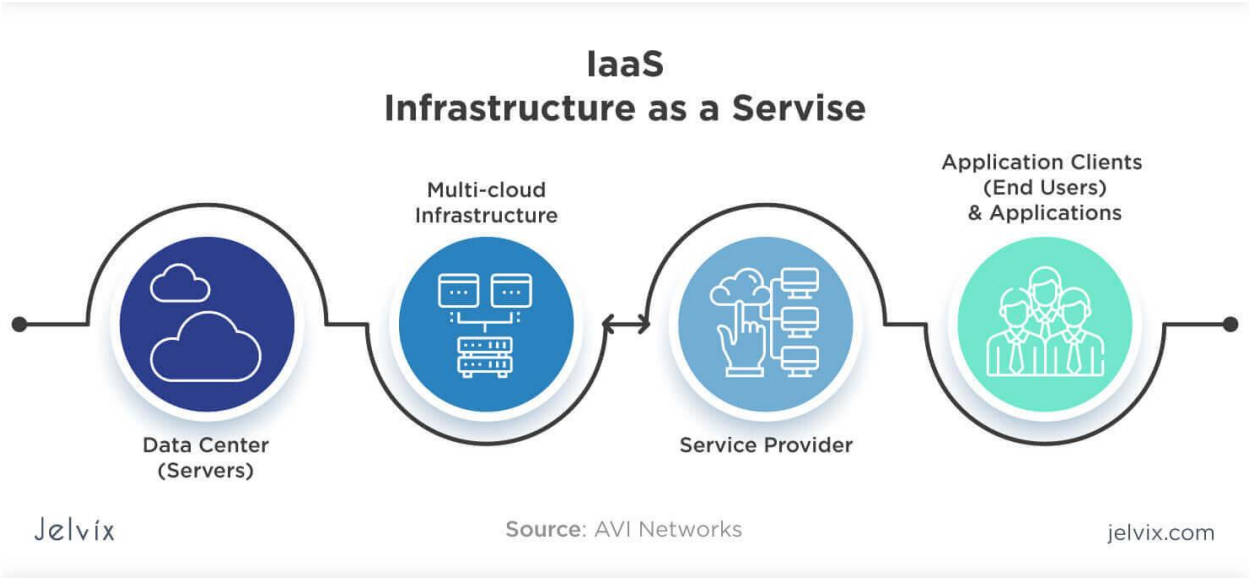


Figure 18 Infrastructure as a Service[42]

It is widely believed that cloud computing is going to continue to grow in the near future. Some believe that IaaS and PaaS have the highest growth potential[43]. According to Gartner, IaaS is expected to double its revenue in just four years, from 2019 to 2022; and SaaS will continue to be the business model with the highest share of the market:

	2018	**2019**	**2020**	**2021**	**2022**
Cloud Business Process Services (BPaaS)	45.8	49.3	53.1	57.0	61.1
Cloud Application Infrastructure Services (PaaS)	15.6	19.0	23.0	27.5	31.8
Cloud Application Services (SaaS)	80.0	94.8	110.5	126.7	143.7
Cloud Management and Security Services	10.5	12.2	14.1	16.0	17.9
Cloud System Infrastructure Services (IaaS)	30.5	38.9	49.1	61.9	76.6
Total Market	**182.4**	**214.3**	**249.8**	**289.1**	**331.2**

BPaaS = business process as a service; IaaS = infrastructure as a service; PaaS = platform as a service; SaaS = software as a service
Note: Totals may not add up due to rounding.

[42] https://jelvix.com/blog/cloud-service-models

43 https://jaychapel.medium.com/saas-vs-paas-vs-iaas-where-the-market-is-going-fcc46771731d

Table 2 Worldwide Public Cloud Service Revenue Forecast (Billions of U.S. Dollars)[44]

3.3 Evolution of cloud computing business models

3.3.1 The Siebel Systems business model

In analysing cloud computing business models, we will begin by looking at Siebel Systems, which was founded in 1993. The company started providing sales force automation software and soon became known for its CRM solutions. In 2002, Siebel achieved a 45% market share and branded itself as the leading CRM provider (Gilbert 2002). In 2005, the company was purchased for USD 5.8 billion by one of its long-time competitors – Oracle (Peters 2011). Siebel was a traditional software company that required customers to invest in:

1. a license fee;
2. support services;
3. upgrades.

The high costs required to purchase in-house computing resources, licenses, training and running the system committed customers to the service (Boulton 2012). However, the advantages of cloud-based solutions and the low switching costs associated with it made it a viable option (Marston et al. 2010). Several blogs and articles in the mid-2000s express the doubts of managers on whether they should renew their expensive legacy software packages from Siebel or try out the trendy cloud solutions. As the cloud model had proven its capability to handle high loads reliably, the real question to ask was whether Seibel was still relevant.

Cloud-based services positioned themselves as a modern alternative to Siebel with features such as social media integration, better user interfaces, and the removal of server maintenance. Siebel's past success and associated business model led the company to a doomed outcome when technology changed the rules of the game. While Siebel is progressively switching its offering to the cloud with Siebel CRM on Demand, it is still chained to an old business model and an outdated framework of resources, processes, and priorities.

3.3.2 The Salesforce.com business model

Salesforce.com is a web-based, on-demand and off-premises solution that allows customers to rent software. It offers a pay-per-month solution operated through the Internet. Back in 2012, Salesforce.com was the fastest growing CRM provider in the United States[45].

At the time, Salesforce.com was facing resistance from some corporate IT departments. The reason was not technological, but rather because Salesforce.com was disrupting the CRM industry and IT departments. Until then, IT departments were used to manage software which was used in the companies. But Salesforce.com required no installation to use the service. This also meant that the customers of Salesforce.com were no longer IT departments, but business directors within the organisations.

The table below shows the fundamental differences between Siebel and Salesforce.com in 2012:

[44] https://www.gartner.com/en/newsroom/press-releases/2019-04-02-gartner-forecasts-worldwide-public-cloud-revenue-to-g

[45] Wardley, M., & Shirer, M. (2012). The fight for CRM applications market leadership gets tighter, according to IDC.

	Siebel	Salesforce.com
Pricing mechanism	Yearly fee – a large upfront payment required	Free trial + monthly subscription– No trial cost / low monthly cost
Funding	Capital expense (CAPEX)	Operational expense (OPEX)
Total cost of ownership	Higher – Dedicated infrastructure, dedicated personnel	Lower – A shared pool of virtual computing resources (networks, servers, storage)
Access	On premises hardware	Any mobile device or hardware
Upgrades	Non-frequent, manual and paid extra per upgrade	Frequent, automatic and free as part of the subscription
End-user adoption	Normal for the industry	High due to mobile access and the user-friendly interface
IT Team	Requires a specialised IT team	Minimal to non-existent
Security	Handled by the local IT team	Handled by the service provider
Data storage	On premises servers	The service provider's servers
User interface	Classic look and feel	A modern Facebook-like interface
Maintenance	High	Low to non-existent
Implementation	Normal for the industry	Very fast and easy
Network	Closed	Open to outside developers
Initial strategic approach	Targets mainly large corporations	Targets mainly SMEs

Table 3 Core differences in the business approaches of Siebel and Salesforce.com[46]

As of October 2020, Salesforce.com is the largest CRM in the world for the seventh year in a row, with a 19.8% market share. Oracle, SAP, Adobe and Microsoft follow at a distance, with shares that go from 5.3 to 3.8%[47]. This incredible rise to the top of the CRM market was made possible thanks to a combination of technological advances and business model innovation.

[46] DaSilva, Carlos M., et al. "Disruptive technologies: a business model perspective on cloud computing." Technology Analysis & Strategic Management 25.10 (2013): 1161-1173.

[47] https://www.salesforce.com/news/stories/salesforce-is-1-in-global-crm-market-share/

3.3.3 Siebel Systems vs. Salesforce.com

3.3.3.1 Customer value creation

Customers are always looking for an easy-to-use service with high benefits and low costs. Salesforce.com responds to this by offering a service that requires little start-up investment, practically no installation burdens, no need for maintenance or a skilled IT team, no requirement to purchase additional hardware and no minimum subscription period. Although certain customers were concerned by the off-premises data storage solution of Salesforce.com's model, the advantages of using Salesforce.com over traditional providers soon outweighed such hesitation. An emblematic example is the company Haagen-Dazs based in Minneapolis and part of the Nestle USA group. The company's brand manager revealed it would have cost $65,000 to set-up a custom-designed database to manage the Haagen-Dazs' retail franchises through a traditional CRM model. Instead, the company only invested $20,000 to launch the same service with Salesforce.com and can instantly monitor all franchises across the United States (Hempel 2009)[48].

Similarly, RehabCare, a North American provider of medical rehabilitation services, built a patient admission application for clinicians within only four days using Salesforce.com's tools and services. The company revealed it would have taken six months to build a similar application using Microsoft development tools[49].

3.3.3.2 Revenue stream

Salesforce.com made two significant innovations in terms of their business model. First, it implemented the "rental" model and charged customers a monthly fee based on the number of users that they had. Salesforce.com realised that they could expand their market share by targeting smaller companies. By doing this, Salesforce.com cashed on a significant blue ocean market[50] at the time deemed unattractive by bigger, already established companies.

Second, Saleforce.com realised that new customers would want to test the product before making a decision to fully go for it. As a result, while other service providers were promising their clients a customised solution in exchange for commitment, the goal of Salesforce.com was to get prospective customers (specifically end-users) to try its product for free. During the trial period prospective clients have full access to the Salesforce.com suite of products and users' support. At the end of the trial period prospective clients have the option to purchase the application or simply walk away.

[48] http://money.cnn.com/2009/02/16/technology/hempel_salesforce.fortune/index.htm

[49] Fowler, S., Gownder, J. P., & Wiramihardja, L. (2010). Case Study: RehabCare Extends Its Healthcare Offering Using iOS Devices.

[50] Kim, W. C., & Mauborgne, R. (2005). Blue Ocean Strategy: How to Create Uncontested Market Space and Make Competition Irrelevant (1st ed.). Boston: Harvard Business Press

3.3.3.3 Value network

In 2007, Salesforce.com extended its services by launching Force.com – a customisation platform for corporations. The company knew it could not provide a complete back-end customised solution. Salesforce.com allowed outside developers to contribute to its infrastructure. Making sure that their infrastructure was compatible with .NET, Java, PHP and Ruby on Rails was key, as it allowed for integration with tools such as Facebook and Twitter. Competitors became partners, allowing Salesforce.com to better serve existing clients and acquire new ones. In 2011, more than 340,000 developers were contributing to the Salesforce.com platform[51].

3.3.3.4 Resources and capabilities

The key resources of Salesforce.com are built upon its scalable technology and products[52]. Salesforce.com spent several millions of dollars in order to build a unique state-of-the-art datacentre compatible with its clients' requirements[53].
Besides technology, over the years Salesforce.com has built up a strong team of highly competent employees[54]. While the technical departments were motivated to build an exceptional product, the sales and marketing departments created together a highly marketable product. The company understood that it needed to convert trial users into paying customers as well as to keep existing customers happy with the service. Salesforce.com attention to customers led it to create the "lead qualifiers" position (non-existing position until then in the industry), person responsible for contacting free trial users and identifying future paying customers.

3.3.3.5 Strategic decisions

Salesforce.com leveraged technological developments (i.e. faster, safer and more reliable internet connection) in order to strategically reach a blue ocean by targeting SMEs that until then had been ignored by large players. This strategic focus allowed it to gain credibility and grow with its client base. Progressively, large corporations started implementing Salesforce.com in some departments – a commitment that soon spread throughout the whole company.

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[51] http://www.salesforce.com/company/news-press/press-releases/2011/02/110224.jsp

[52] http://techcrunch.com/2009/03/23/the-efficient-cloud-all-of-salesforce-runs-on-only-1000-servers/

[53] http://ecorner.stanford.edu/authorMaterialInfo.html?mid=1664

[54] http://www.forbes.com/sites/greatspeculations/2011/03/24/rising-operating-expenses-threaten-salesforce-com-profits/

3.3.4 The Amazon web services business model

Amazon followed a different path. Its online retail store required a sophisticated computing infrastructure in order to not only operate throughout the year, but also to deal with large seasonal variations on their website (especially the large peak in demand right before Christmas). As a result, early on it needed a very sophisticated, efficient and, most importantly, scalable computing system[55]. In 2002, Amazon decided to rent out part of its computing platform to developers. This was the beginning of Amazon Web Services (AWS), a business foreign to its core activities until then. The results motivated Amazon to offer corporate customers the opportunity to use AWS and optimise their computing power by avoiding the waste associated with overcapacity and eliminating investments in computing hardware. As the then CEO of Amazon Jeff Bezos said: "You don't generate your own electricity. Why generate your own computing?"[56]. He went further to say that AWS has the potential to become as large as the company's retail business[57].

3.3.4.1 Customer value creation

At first, developers could use Amazon IT services to develop applications on top of Amazon's web store. Amazon gradually extended its computing and storage to SMEs that were able to leverage a robust large-scale computing infrastructure at a fraction of the cost of owning, upgrading and managing on-premises infrastructure. Besides helping established businesses, cloud computing and AWS removed a considerable entry barrier to start-up companies[58]. Amazon now serves several large corporations including Samsung, Foursquare, and SEGA.

3.3.4.2 Earnings logic

Amazon's earnings logic is based on the freemium model. The service is free to use for new clients up to a year, in an effort to motivate companies integrate AWS (while free to subscribe, integrating AWS within a company takes time and effort, thus creating commitment). By offering a flexible on-demand pricing model, Amazon only charges customers for what they truly use with no minimum fees and no long-term commitments.

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[55] Siegel, M., & Gibbons, F. (2008). Amazon Enters the Cloud Computing Business.

[56] https://www.researchgate.net/profile/Peter_Trkman2/publication/255960061_Disruptive_technologies_A_business_model_perspective_on_cloud_computing/links/02e7e52208af240eec000000

[57] https://www.wsj.com/articles/SB10001424052748704739504576067580949404062

[58] http://www.ft.com/intl/cms/s/0/fc871bca-58e1-11e1-b9c6-00144feabdc0.html#axzz1sF3KKgmi

In an attempt to lock existing customers into its service Amazon introduced “reserved instances” packages where customers pay a onetime fee (one year or three years term) get lower costs per usage[59].

3.3.4.3 Value network

Initially, developers acted as partners on Amazon’s e-commerce platform. Developers were using Amazon’s resources to develop custom applications in order to sell products from third parties’ resellers on the retail store Amazon.com[60].

As Amazon’s focus diversified to storage and computing, developers working for start-up and SMEs also became customers. Thus, developers became resellers of Amazon’s web services to companies seeking cloud-related services.

3.3.4.4 Resources and capabilities

Amazon developed infrastructure-related resources due to its own need for a very scalable infrastructure. Amazon started the IaaS business as a way to resell the hardware capacity that sits idle for most of the year (most of the hardware exists to absorb the increased load of the Christmas shopping period). In a nutshell, Amazon’s own gigantic requirements allowed it to strategically position itself in the cloud industry as the leading IaaS provider due to its economies of scale and brand name. Amazon’s then CEO Jeff Bezos stated that IaaS is what it has “been doing for 11 years, operating a web scale application, a very complex one, that is based on a lot of transactions with high availability, reliability in a high volume, low margin business”[61]. In addition, branding its service under the Amazon umbrella projects an image of credibility and reliability to possible target customers.

3.3.4.5 Strategic decisions

The AWS strategy is based on offering a basic infrastructure at the lowest possible price. The economies of scale that have been achieved have allowed Amazon to cut its prices 19 times since it started offering cloud services[62]. Amazon.com’s competitive strategy has always been to offer the largest possible selection of products at the most competitive prices (Casey and Carroll 2004). Thus, the Amazon AWS strategy is to become the basic infrastructure for other cloud services to build on.

[59] https://aws.amazon.com/fr/ec2/pricing/reserved-instances/

[60] http://online.wsj.com/article/SB10001424052702304441404577482902055882264.html

[61] http://www.oreillynet.com/pub/a/network/2006/12/20/web-20-bezos.html?page=last

[62] http://www.businessweek.com/news/2010-10-28/microsoft-woos-toyota-duels-amazon-com-in-cloud-bet.html

To summarise, Salesforce.com and Amazon.com differ strongly in their approaches not only regarding the use of the technology itself, but also the way they apply it for commercial purposes (see Table 3 for a comparison of the two companies' business models).

	Amazon.com	**Salesforce.com**
Customer Value	Utility type Broad applicability Time and money saving Low entry cost No subscription period	Service type Narrow focus Time and money saving Low entry cost No subscription period
Earnings logic	Low differentiation – Low margins Billed per usage only	High added value – Higher margins Billed per user/per month
Value network	Developers as customers	Developers as partners
Resources and capabilities	Strong brand equity	Strong sales team and call center
	A state-of-the-art IT platform that is reliable, secure, scalable, and flexible	
Strategic decisions	A freemium model where customers can use the product up to a certain threshold for free – building up switching costs Offers the cheapest alternative to owning servers/data storage hardware offering the lowest priced option on the market	A focus on non-consumers (blue ocean) – SMEs that cannot afford complex competing solutions then move up market to replace existing solution providers A focus on selling its service to the end-user instead of the CIO
Main Cloud Focus	**IaaS**	**SaaS**

Table 4 Summary of the cloud computing business models of Amazon and Salesforce.com[63]

3.4 Lessons learned

From the above examples, we can obtain the following conclusions:

[63] DaSilva, CM & Trkman, Peter & Desouza, Kevin & Lindic, Jaka. (2013). Disruptive technologies: A business model perspective on cloud computing. Technology Analysis and Strategic Management. 25. 10.1080/09537325.2013.843661.

- A disruptive technology helps, but the business model determines success.
- Just because one is successful at one point, it does not mean that it will last forever. A company must always be on the lookout for new trends in technology, consumer behaviour and business models.
- In order to adapt, companies need to differentiate between when to grow on existing business models, when to modify them, and when to dismiss them altogether and adopt new ones.
- Sometimes it is a good idea to allow users to try your service for free. It allows you to attract a larger number of potential customers and generates word of mouth.
- Marketing is a powerful tool to attract new customers. One should not underestimate its influence.
- It is important to constantly be vigilant of new developments in the industry. Speed is key in adapting to new scenarios.
- Making your customers depend on you can be an advantage. Companies should try to use it and exploit it.

3.5 St. Gallen Business Models as applied to Cloud Computing Services

3.5.1 The St. Gallen Business Model Navigator

Not everyone agrees on what ingredients constitute a business model. There are different approaches depending on who is speaking.

To describe the business models throughout the St. Gallen study, they employ a conceptualisation that consists of four key dimensions: The Who, the What, the How, and the Value. Because it is concentrated in these four areas, it makes understanding business models quite simple. However, it is not so simple that it does not cover the necessary principles of business models:

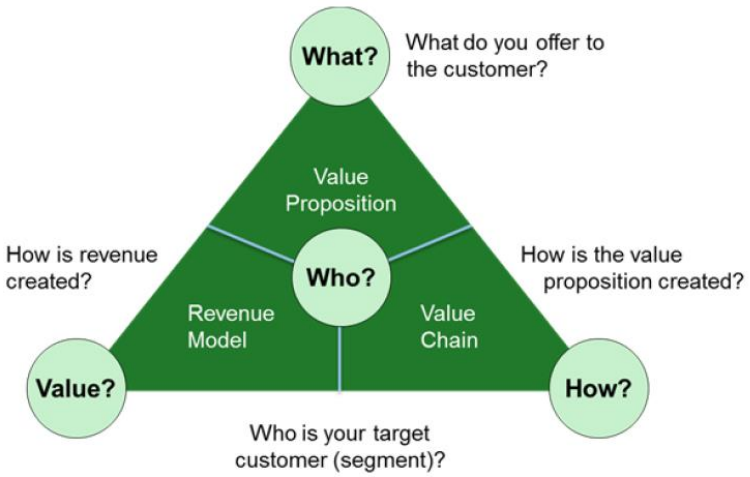


Figure 19 Business model definition – the magic triangle[64]

[64] Gassmann, O., Frankenberger, K., & Csik, M. (2013). The St. Gallen business model navigator.

The St. Gallen business model navigator asks the following questions out of business models:

1. Who is the target customer?
2. What is the value proposition?
3. What is the value chain behind the creation of this value?
4. What is the revenue model that captures the value?

Business model innovations can consist of small divergences from existing ones, whether they may be based on other technologies, industries or geographical locations. The St. Gallen business model navigator project analysed several hundred business model innovators. What they discovered was that around 90 % were re-formulations of previously existing concepts.

Over time, the proponents of the St. Gallen Business Navigator have developed the 55 business model patterns as part of their methodology:

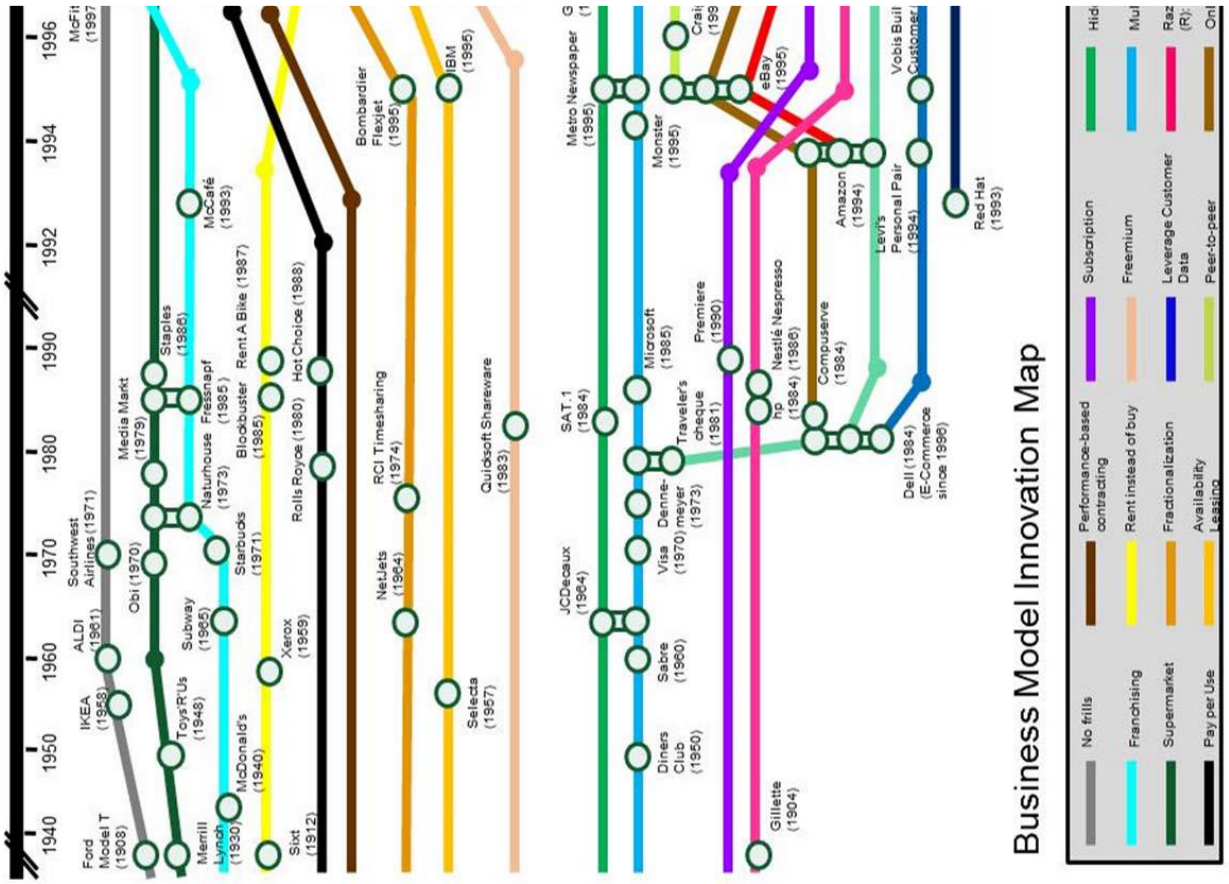


Figure 20 The business model innovation map[65]

[65] Gassmann, O., Frankenberger, K., & Csik, M. (2013). The St. Gallen business model navigator.

3.5.2 The St. Gallen Business Model Navigator in cloud computing

Out of the 55 business models proposed by St. Gallen, these are the ones which are most suitable for cloud computing entrepreneurs:

Model 1. ADD-ON (what): A low-price, basic service is provided. But then there are multiple added-value services. The idea is that customers will purchase these additional services, thus generating more revenue.

- Service model: SaaS
- Examples: SAP

Model 2. Affiliation (how): Become a platform for others to sell their products and charge them a fee for either sales or display opportunities. If you are a big platform, you allow your customer to reach a much larger audience.

- Service model: SaaS
- Examples: Amazon store, Pinterest ….

Model 11. Digitisation (what how): Convert existing products or services into digital equivalents. The quality of the service provided should not vary from that of the physical alternative.

- Service model: SaaS
- Examples: Hotmail, Facebook, Dropbox, Netflix,

Model 12. Direct selling (what how): Direct sale of products or services without the participation of intermediaries. This allows for lower prices, higher margins, or both.

- Service model: IaaS, PaaS
- Examples: Dell, AWS, Azure

Model 18. Freemium (what value): A basic, free version of the product or service is provided. If the customer wants to use more advanced features, they will have to pay for them.

- Service model: IaaS, PaaS, SaaS
- Examples: Gmail, Skype, Spotify, Dropbox

Model 20. Guaranteed availability (what how): The product or service is available at all times. This business model is intrinsic to cloud computing.

- Service model: XaaS
- Examples: IBM, AWS, Azure, Google

Model 27. Lock-in (what how value): Make it difficult for customers to switch to a competing company.

- Service model: IaaS, SaaS
- Examples: Microsoft, HP, Apple

Model 29. Make more of it (who what how): Sell the know-how and other assets generated by your own company to increase revenue.

- Service model: IaaS
- Examples: AWS

Model 35. Pay per use (what how): Customers are charged according to how much of the product or service they have consumed in a particular period of time (usually a month).

- Service model: SaaS, PaaS, IaaS
- Examples: Google

Model 39. Razor to blade (what how who): The main product itself is cheap, but one must purchase related products (usually at a high price) in order to make the main product work.

- Service model: XaaS

- Examples: HP, Amazon kindle,

Model 40. Rent instead of buy (what how): The product is not sold, but rented, allowing the customer to have access to the product in situations where they may not be able to afford to buy it.

- Service model: XaaS
- Examples: Netflix, AWS, Azure, Google, iCloud

Model 47. Solution provider (what how): Select a domain and offer every possible product and service within it. This allows to lock in customers and gain knowledge from them to develop the service further.

- Service model: IaaS
- Examples: AWS, Azure

Model 48. Subscription (how what): A regular fee is paid for a product or service, thus providing steady income.

- Service model: SaaS
- Examples: Netflix, Salesforce, Spotify

Model 54. User designed (what how): This consists of creating a platform for customers to design their own products or services, such as product design software. This allows customers to save money on infrastructure. Revenue is typically generated from the use of the platform. However, there is the possibility of receiving a percentage of the customers' revenue from the sale of the products which have been generated by using our platform.

- Service model: PaaS
- Example: Amazon kindle

4 GAME CHANGERS

4.1 Impact of cloud computing business models: Osterwalder Business Model Canvas

In 2008 Alexander Osterwalder proposed the Business Model Canvas to facilitate the analysis of different business models and it has become the standard model for this generation.

Osterwalder's Business Model Canvas is divided into 9 blocks grouped into 4 areas:

1. In the centre the Value Proposition (What) is described.
2. To the right of the Value proposition, the market area (who) that includes relationships with customers, market segments and channels.
3. To the left of the value proposition the company (How) itself is described, its key activities, key resources and key partners.
4. Finally at the bottom we have the financial part of the business (How much), both the costs involved and the income from carrying out the activity.

Osterwalder defines the theme within each block as follows:

4.1.1 Offer

The offer describes the service or product that is offered to customers. It includes the specific features and benefits for each market segment we are targeting. Features can be novelty, performance, customisation, design, or price.

4.1.2 Customers

Market segments: those groups of people or entities to which a company is directed. They are the key to the business model. They can be mass market, niche market, segmented market, or a diversified market.

Customer relationships: a type of relationship must be established with each market segment. Specific strategies can be established in the relationship with customers depending on the segment and the interests of the company (recruitment, loyalty, sales stimulation).

Channels: it is the way in which a company communicates with its customers and offers them the value proposition.

4.1.3 Infrastructure

Key Activities: These are the actions that the company must execute for its business model to work.

Key Resources: the most important assets to make the business model work.

Key Partners: Network of suppliers and partners that contribute to the development and execution of the business model.

4.1.4 Financial viability

Revenue streams: represent how the company generates revenue for each customer.

Cost structure: it is made up of all the costs involved in starting a business, so they are the consequence of the canvas blocks.

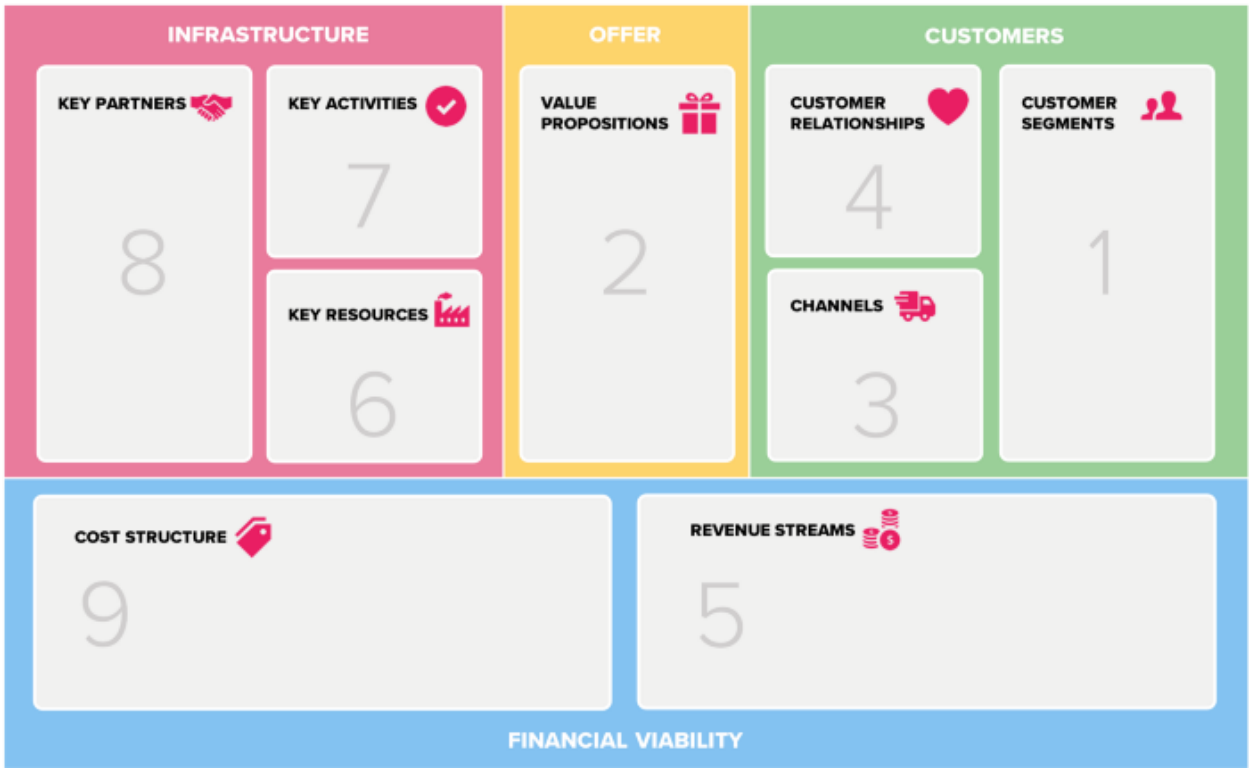


Figure 21 Business model canvas[66]

4.2 Cloud Computing Business Model Canvas

Following Osterwalder Business Model Canvas, we can see how Cloud Computing Business Model has disrupted each area of this model.

4.2.1 Key partners

All business models are interrelated, SaaS providers need PaaS and IaaS providers as a key partner in terms of cost savings, for example, to avoid the costs of building the necessary infrastructures. The key partners in cloud computing are also internet or network providers, who facilitate access to their services[67].

On the other hand, consulting services and technical experts in cloud computing must also be included as partners, who help in the migration of company data, specific technical problems and coaching on the use of accumulated data.

4.2.2 Key Activities

The key activity of a cloud computing company is to improve its service offered, for example, by improving the software developed in SaaS, or the utilities for the development of applications in PaaS.

The most advanced organisations eliminate operational activities. Developers and product

[66] https://medium.com/upwave/visualize-your-business-model-with-upwave-16ed2e67c32c

67 https://azure.microsoft.com/en-in/partners/

managers have the ability to push features into production. All testing is automated, and the focus of the operational staff is not so much to bring features into production, but rather to maintain the assets and operational structure that allow developers to do it themselves.

4.2.3 Key Resources

Provision of real technical services and understanding of consumer behaviour. The speed of functions, the time between startup and commissioning is a great competitive differentiator. To realise this, the vendor needs an integrated "DevOps" organisation, requiring many people, processes, and technology. Network of partners and IT architecture

4.2.4 Value Proposition

The value proposition of cloud computing is broad, it reflects the main problems of customers and their needs, but it translates into the main advantages of adopting CC: faster implementation time of updates and useful new applications, greater scalability in the use, less investment in IT services translating into cost reduction, ease of handling data at large scales, connectivity in any space that allows a connection to the network, an increase in productivity is demonstrated.

4.2.5 Customer Relationships

The appeal of cloud computing is that the provider can have a much more direct relationship with the customer than is possible with an on-premises solution. Technically, the provider can potentially see each and every user movement and fix or implement service updates almost instantly and on a regular basis.

Likewise, the cloud service provider, by helping new customers move their data to the cloud, makes it difficult for them to move to another competitor, since moving large amounts of data from one server to another is not an easy task. Sometimes the tools offered are unique to the provider, accustoming the client to only work with them.

4.2.6 Channels

Cloud computing providers often generate a wide network of partners that allows them to offer better services, but also to reach more markets.

For example, the main SaaS channels are self-service direct sales, value-added resellers, system integrators, and enterprise app stores.

The channels through which cloud solution providers move are mainly direct sales to the customer through web pages. What the cloud itself allows is that updates or technical procedures can be carried out from anywhere the service provider is located, through the network, obtaining a solution as soon as inconveniences are generated.

4.2.7 Customer Segments

One of the main characteristics of the cloud computing model is that its customers can be from any sector or segment and not just from IT as it was previously. Customers use the cloud to take advantage of the connection and data usage benefits that cloud computing offers. Cloud computing has allowed its use to be extended to all market segments due to its great utility.

4.2.8 Cost structure

This includes all the costs that the company will incur in the process of running the business. These may include direct costs, indirect costs, fixed costs, variable costs, operating costs and opportunity costs, among others.

4.2.9 Revenue streams

The structure of revenue streams is where cloud computing differs from previous IT service models. Cloud computing service models, by definition, are usage-based and have the potential to be much more closely related to the value that customers experience.

4.3 Business Model Canvas innovations in Cloud Computing

Alexander Osterwalder proposes that, in order to be successful, entrepreneurs and companies need to know how they will differentiate themselves from their competitors. He then proposes that entrepreneurs and companies should self-assess each block of the business model canvas to have a clear picture of how innovative they are[68]. We will now look at each of these blocks, so we can:

- Know which targets we have for each block
- See how innovative we are in each individual block
- Look at examples of successful innovators in each block, and how they set themselves apart from the competition

4.3.1 Value Proposition

Innovating the value proposition in cloud computing requires, on the one hand, to visualise new business opportunities that have not been developed or, alternatively, changing and reconfiguring the existing value proposition.

- Offer a service that replaces products
- Increasing level of technology increasing the price
- Take the business to the cloud or sales platform.

Example - NETFLIX:

Netflix began as a disc rental store for movies, documentaries, series and video games, competing with a large company such as Blockbuster (a leading company in the sector), however, its incremental growth came when it began to offer its products in streaming. That is, instead of renting physical products such as DVDs, the rental of movies and series was made by paying on the NETFLIX platform without the need to go to an establishment, since these were in the cloud at the customer's full disposal.

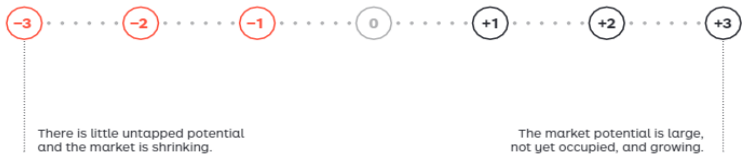
4.3.2 Frontstage Disruption: MARKET Disruption

Customer segment

Thanks to cloud computing we can tap into new, untapped, or underserved markets with large potential. We can achieve this if:

[68] Osterwalder, A., Pigneur, Y., Smith, A., & Etiemble, F. (2020). The Invincible Company: How to Constantly Reinvent Your Organization with Inspiration From the World's Best Business Models (Vol. 4). John Wiley & Sons.

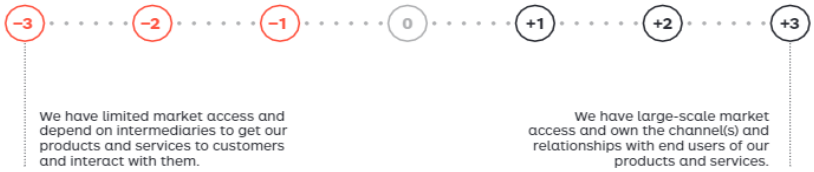
- New markets are visualised where others do not see it by creating new needs that satisfy a new value proposition
- Use own infrastructure and technology with other fines, in new markets, through a different value proposition
- And in the same way, allow access to services and products that were previously of limited access, to a greater number of clients.

How large and attractive is the untapped market potential we are going after?	

Channels

To increase market access to cloud computing and build strong and direct channels to the end customer through:

- Creating paths that reduce or eliminate intermediaries through their own marketing campaigns, activities to generate direct contact with customers, and the creation of a strong brand. Also, seek a better understanding of the market and build strong relationships with customers.

Do we have large-scale and, ideally, direct access to our end customer?	

Customer Relationships

To create strong relationships with customer, cloud computing companies should make difficult for customers to leave and increase switching costs in a positive way. It can be achieved by:

- The difficulty of transferring data, steep learning curves, onerous departure procedures or other customer pains if they decide to leave.
- Other ways can be through, for example: multi-year contracts, upfront sunk costs, cancellation fees, elimination of alternatives or other techniques.

How easy or difficult is it for our customer to leave or switch to another company?	

Example - Amazon Web Services (AWS):

Customer segment: Traditionally, companies looking for large data warehouses had to physically build a storage space and maintain it with their own servers. Amazon for its part, to maintain its business as an intermediary for the sale of online products, had these infrastructures and computers that could store an immense amount of data, but over a year, the full potential of these assets were only used in high season, so the rest of the year Amazon began to offer its data infrastructures to other companies, opening the Cloud Computing market like never before and occupying large market segments.

Channel: AWS has a very strong brand image, created after its cloud services, this helps it eliminate many intermediaries, customer base grows by itself, because the brand name itself is recognised enough so that whoever wants to use AWS comes directly to them through the website.

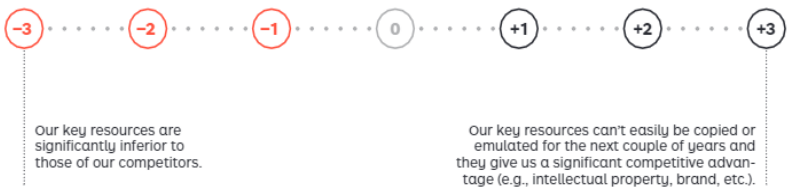
Customer Relationship: Customers who transfer their databases to AWS, in a way, are destined to keep their data in AWS and continue working with them for a long time, since, on the one hand, it is difficult to move such a lot of data from one server to another, as well as the companies sign commercial agreements with Amazon that obliges them to continue with AWS.

4.3.3 Backstage disruption: COMPANY inside disruption

Key Resources

Build a competitive advantage which is a key pillar and difficult to copy.

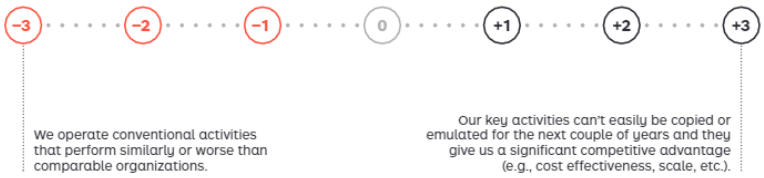
- The creation of a business model in which the number of users is important for the improvement of the system, generating a strong network that is difficult to duplicate.
- Protection of intellectual property (IP), preventing its copy by competitors
- Reinforce and achieve a strong brand through a strong focus on the value proposition.

Do we own key resources that are difficult or impossible to copy which give us a significant competitive advantage?	

Key Activities

Create significantly more value for customers by performing new activities or configuring activities in innovative ways

- Change the activities of a company radically in order to be more efficient (generating lower costs) or faster in the completion of tasks and accelerate time to market.
- Today, by carrying out activities with an environmentally friendly approach and with a social impact, a plus is generated in the brand and the value proposition.
- Adjust the activities of the company listening to the exact specifications of the clients.

Do we create significant value for customer because we perform and configure activities in disruptively innovative ways?	

Key partners

To find radically new ways to make cloud computing business model more scalable, companies could:

- Get others to carry out key activities (for free) as a business model
- Obtaining licenses to carry out activities with greater added value
- Use franchising to make business model more scalable and increase market reach.

How rapidly and how easily can we grow our business model without substantial additional resources and activities?	

Example – WAZE:

Key Resources: The main resources of Waze are its users, who use the App to send updated data of the situation of the roads, allowing those who require it to take advantage of this, therefore it is difficult to replicate it, since the number of users who use this platform positions the app at an important advantage in terms of speed of information over the rest of the competitors.

Key Activities: Waze is not only based on pointing the way to a location like GPS does, but it offers extra traffic information in real time, avoiding crowds and excessive pollution. It also shares information to share vehicles with others, raising awareness about the environment.

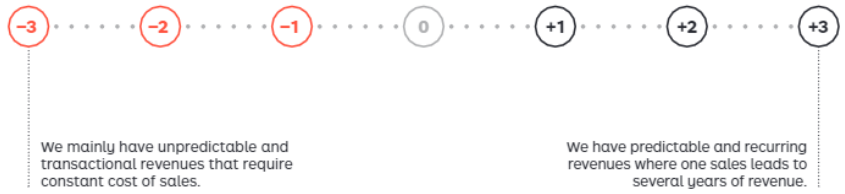
Key Partners: Waze's most important partners are its users themselves, who do the work of keeping route information up to date.

Profit formula disruption: FINANCIAL disruption

Revenue streams

Revenue streams or pricing mechanisms that could be introduced to capture more value from customers or unlock unprofitable markets. Some options are:

- Generate recurring revenues from one-time sales, getting lower costs of sales, increasing revenues, and allowing prediction of incomes.
- Freemium, offering basic products and services for free, and charge extra for premium options of those.

Do we use strong revenue streams and pricing mechanisms to monetise value creation for customers?	

Cost structure

Change the cost structure of the company significantly by creating and delivering value with different and differently configured resources and activities.

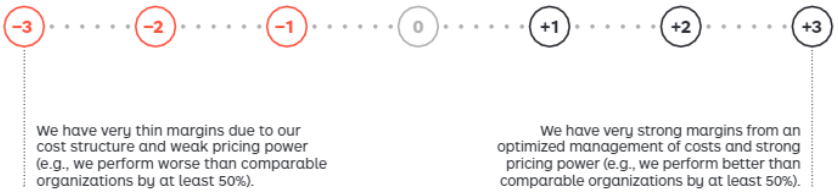
- Eliminate those costs that require a high capital investment
- Technological advances that allow a reduction in costs
- Search other various options where you can generate a cost reduction, for example new activities, new partners, change resources.

Is our cost structure conventional or disruptive?	

Margins

Innovative ways to eliminate the costliest aspects the business model, while focusing on value that matters to customers most and which they are willing to pay for a high price. This can be achieved:

- Reducing cost and increasing value at the same time, focusing on what customer love and is willing to pay which are relative cheap to pay.

Do we have strong margins from low costs and high prices?	

Example - Spotify:

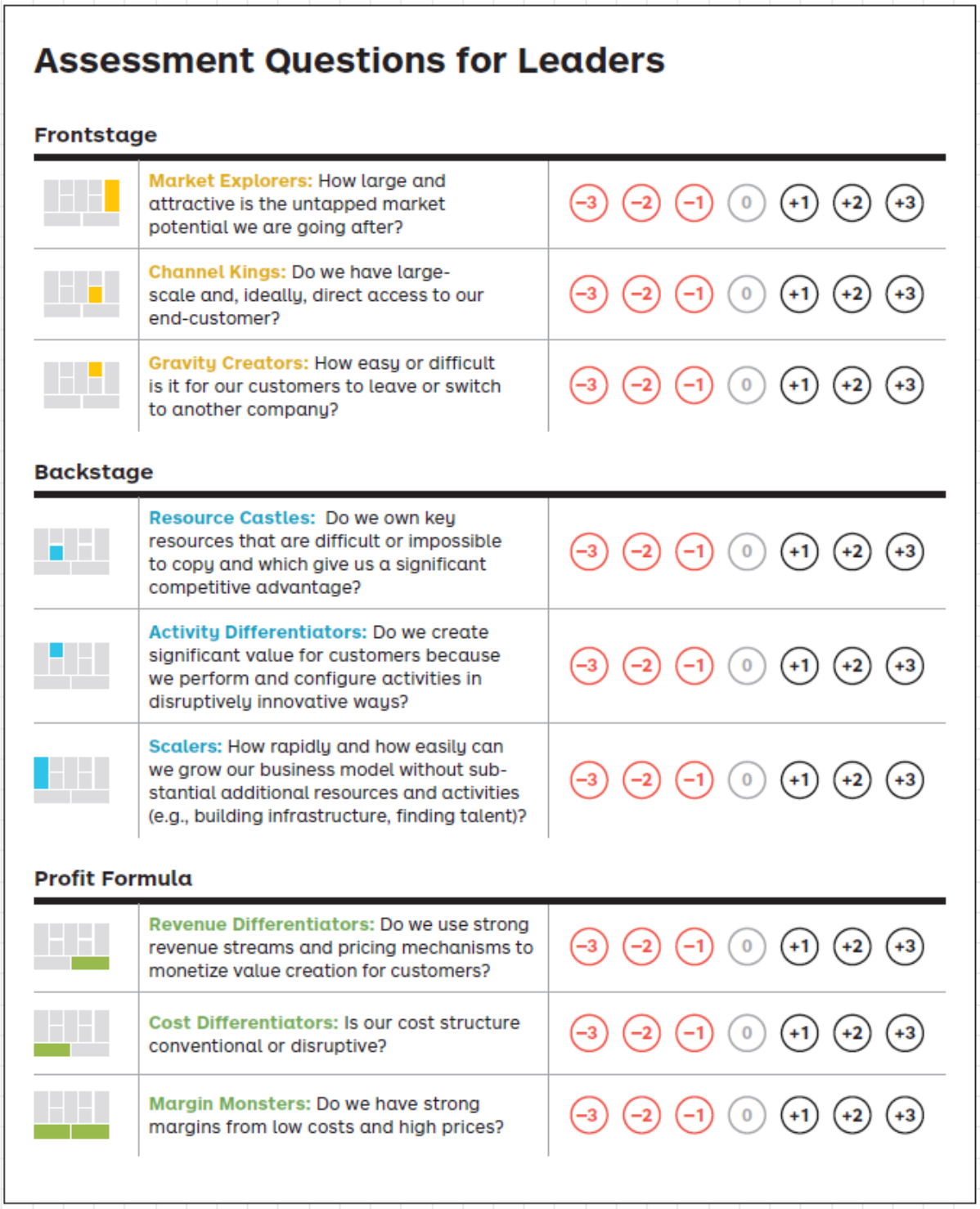
Revenue streams: The main feature of Spotify is its Freemium model, which allows its users to listen to songs and download them in their profiles for free at the expense of advertising and use limitations of music selection, being the payment mode that allows them to choose songs at their preference and avoid advertising.

Cost structure: One of the main costs of Spotify is the license for the distribution of music and podcasts of various artists, so that, by partnering with various record companies and mainly with Sony it has managed to reduce the costs for the distribution of these products.

Margins: Spotify focuses on what its customers are looking for, diversity of musical themes and podcasts. Through commercial agreements with artists and record companies and improving its platform at the service of users, Spotify has increased its margins and profits.

4.4 Business Model Canvas innovations – Self-assessment

The following is a self-assessment questionnaire for entrepreneurs who wish to know where they stand regarding the level of innovation of their projects within the business model canvas. The result of this self-assessment should be a number between -27 and +27.



Assessment Questions for Leaders

Frontstage

	Market Explorers: How large and attractive is the untapped market potential we are going after?	−3 −2 −1 0 +1 +2 +3
	Channel Kings: Do we have large-scale and, ideally, direct access to our end-customer?	−3 −2 −1 0 +1 +2 +3
	Gravity Creators: How easy or difficult is it for our customers to leave or switch to another company?	−3 −2 −1 0 +1 +2 +3

Backstage

	Resource Castles: Do we own key resources that are difficult or impossible to copy and which give us a significant competitive advantage?	−3 −2 −1 0 +1 +2 +3
	Activity Differentiators: Do we create significant value for customers because we perform and configure activities in disruptively innovative ways?	−3 −2 −1 0 +1 +2 +3
	Scalers: How rapidly and how easily can we grow our business model without substantial additional resources and activities (e.g., building infrastructure, finding talent)?	−3 −2 −1 0 +1 +2 +3

Profit Formula

	Revenue Differentiators: Do we use strong revenue streams and pricing mechanisms to monetize value creation for customers?	−3 −2 −1 0 +1 +2 +3
	Cost Differentiators: Is our cost structure conventional or disruptive?	−3 −2 −1 0 +1 +2 +3
	Margin Monsters: Do we have strong margins from low costs and high prices?	−3 −2 −1 0 +1 +2 +3

Figure 22 Assessment questions for entrepreneurs[69]

[69] Osterwalder, A., Pigneur, Y., Smith, A., & Etiemble, F. (2020). The Invincible Company: How to Constantly Reinvent Your Organization with Inspiration From the World's Best Business Models (Vol. 4). John Wiley & Sons.

5 PRICING SCHEMAS IN CLOUD COMPUTING

The change in the business model regarding the management of software and infrastructure data to be offered as services has led to a change in the pricing model.

Therefore, pricing is a key dilemma in cloud computing business models, as it is a core element to ensure the sustainability of the company due to the existence of various costs.

Initial Cost / Investment	Represent the amount of money that Cloud service provider will spend per year, to buy a resource.
Lease Period / Contract Time	It is the time in which the client will lease resources from the cloud service provider. Cloud service providers usually offer lower unit prices for longer subscription periods.
Quality of Service	This factor represent the quality assurance from cloud service provider for the customer. The key aspects of quality of Service (QoS) are: integrity of service provider, availability, security, privacy, scalability. For the better quality of service the price will be higher.
Rate of depreciation [3]	It is the rate at which the hardware of service provider is expected to lose its financial value.
Age of Resources	It represents the age of a particular resource the service provider is leasing to the client [3].
Cost of Maintenance	Represent the amount of money per year that the cloud service provider spends to maintain and secure the cloud.

Table 5 Most common factors that affect in pricing[70]

There are several pricing models that have proven successful in certain companies such as Amazon or Salesforce. However, finding the most suitable one is often difficult, given that there are so many factors that must be kept in mind when doing so. The determination of the pricing strategy is a major challenge but not the only one, since the revenue and business model need to be accordingly defined, taking into consideration the specific market segment one is aiming to gain. The user must also perceive an added value of the service, independently of the composition and topology of the application[71].

Once the most appropriate business model has been decided, it must be analysed to determine the most adequate pricing strategy for the cloud computing application. In this step, companies shall have the means to decide which the most adequate pricing strategy is for their own cloud computing application, based on existing and newly created metrics for online applications.

The following is a list of the most common pricing models observed in the industry:

Free Usage	Per Unit	Payment Type
Freemium	Per unit of measure	Monthly subscription
Ad-based Revenue	Per transaction	License fee

[70] Mazrekaj, A., Shabani, I., & Sejdiu, B. (2016). Pricing schemes in cloud computing: an overview. International Journal of Advanced Computer Science and Applications, 7(2), 80-86.

[71] Arrieta, L. O. E. (2016). From software as a good to software as a service (SAAS): a methodology to define the transformation towards the SAAS business model (Doctoral dissertation, Universitat Abat Oliba CEU).

Related services charged	Per user/device	Flat rate
	Tiered Model	
	Per Feature	

Table 6 Common pricing models in Cloud Computing

5.1 Free Usage

Freemium: Business model that offers core services or features for free and charges a premium for more sophisticated components. The main idea behind it is that instead of expensive sales and marketing efforts, a company wants to create a low barrier for interested customers to sample their offering. The key is to generate sufficient interest and combine this with a minimal barrier and a low cost for users to try the product.

- Capacity-based: Customers are given a free version up to a capacity, usage, or number of user threshold.
- Feature-based: Customers are allowed to use a free version of the product which has certain key features locked until the customer converts to a paid customer.
- Time-based: This is a typical free trial that expires after a fixed period.
- Use-case: This is a less common model in which customers can use the offering for free provided they fall under certain specified categories (i.e., non-commercial use, educational, non-profit, etc.).

The freemium model is recommended when:

- The value of the offering is derived from a collaboration
- When the technology and the functionality is not comprehended by the market
- When there is a substantial increase in value to the user if they upgrade from the free version to the paid version

One of the most critical issues in this model is related to the decision of what functionality is offered as free and what functionality must be paid for. The value offerings of both must be clearly distinguished and the user must appreciate that the value of the paid version increases with respect to the free one. If this is not properly done, the risk of not acquiring a large customer base is very high.

Ad-Based Revenue: Revenue comes from advertising in the application and not from customer, this model allows companies to provide users a "free" service while generating important number of incomes (depending on how visited is the platform where the ads are on). Some of the flaws for the broader community and users are that these have little privacy and control over their actions in the platform as well as some securities breaches from malicious websites[72].

Related Service Charged: Free app use with charge on related services or virtual goods. A service charge, also called a service fee, refers to a fee collected to pay for services that relate to a product or service that is being purchased. In other words, a service charge is an additional charge for the service provided with the purchase of a product or service.

72 https://www.joinprivee.com/post/pros-and-cons-of-the-ad-based-business-model

5.2 Per Unit

Pay as You Go Model: The Pay-per-resource-use is the case in which the customer pays in relation to its use of the infrastructure.

In this pricing strategy, the cashflow is as follows: the IaaS provider charges the SaaS provider for the usage of their infrastructure. The SaaS provider charges, in return, the SaaS user for the application but also for the usage of the infrastructure where the application is deployed.

- Simultaneous users
- Time
- Transaction (DB queries, storage, ...)
- Feature (modules, functionality)

This model is dynamic and allows the most flexible pricing for customers. With this model, customers take on very little up-front risk. Pricing is on a metered or per-unit basis and is generally higher than fixed or tiered plans.

This model is recommended when seeking growth in the customer base.

Tiered Pricing: The pricing is tied to some driver of value and usage that can be for instance modules, data volumes, servers, and so on with the main purpose of encouraging customers to move onto the next level. The telecom industry has been applying this model for many years with their minute bundles. The philosophy behind this pricing is the search for a long-term relationship with the customer. This implies that, in this model, the sales cycles are longer.

In the tiered model the market segmentation becomes a key issue and thus KPIs are more important than ever. For the company, there are advantages to a tiered model: predictable recurring revenues, lower average cost of acquisition relative to lifetime value, and more stable average selling price.

This model is recommended when the customer relationships management is thoroughly involved from the definition of the service offering to the handling of billing and customer concerns.

Per user pricing: Organisations pay based on team size to access advanced collaboration and management tools for teams, and optionally, security, compliance, and deployment controls.

Per meter: Pricing per unit of measure- such as storage (e.g. per MB).

Per transaction: Discrete transaction units that can be easily measured and tracked.

Feature-based pricing: The best for software with a lot of impressive features. Users will pay based on the number of features they want to access, and the highest tier usually offers considerably more features than the lower ones.

5.3 Payment Type

Monthly/annual subscription: Customers pay an amount per month or per year, Cloud computing providers offers different prices for those who subscribe with them for a monthly basis or less for an annual subscription.

License Fee: A large upfront payment for the license of the product, IP.

Flat-rate pricing: One size-fits-all strategy that cuts down the possibility of confusion for the customers. Companies charge all customers the same amount regardless of usage, users or features needed.

5.4 Prices schemas and where they are used: IaaS, SaaS and PaaS

The price schemes presented are better adjusted according to the business model that is followed, below, the price schemes that best suit the business models present in Cloud Computing are classified:

Pricing model	CC´s Business Model	Examples
Freemium	SaaS, PaaS, XaaS	Spotify, Dropbox, YouTube
Ad-based revenue	SaaS, XaaS	Spotify, Facebook
Related service charged	SaaS	Zoom
Per unit of measure	IaaS	AWS, Azure
Per Transaction	SaaS	Financial Apps: Bizum
Per user/device	SaaS, PaaS, XaaS	Adobe Photoshop, Animaker
Tiered Model	SaaS, PaaS, XaaS	Formstack, Zendesk
Per featured	SaaS, PaaS	Adalo, Zerogode
Pay as you go	PaaS, IaaS, XaaS	Google AppEngine, AWS
Monthly/anual subscription	SaaS, PaaS, IaaS	RackSpace, HPE
License fee	SaaS, XaaS	Office 365
Flat rate	SaaS	Botco.ai

Table 7 Pricing models for Cloud Computing Business Models

5.5 Price Comparison

IaaS most relevant providers: Storage Characterisation

Azure and AWS are two of the preferred options for deploying cloud services, and many organisations use both to enjoy each cloud's set of features. However, it is essential to compare pricing between clouds, in this case the price comparison is between the storage service offered by both cloud providers.

Price Parameter	Azure	AWS	Are They Comparable?
Instance Types	General Purpose, Computer Optimized, Memory Optimized	General Purpose, Computer Optimized, Memory Optimized	**Yes**, instance types are comparable on price between AWS and Azure
On-Demand Instances	Priced per # of CPUs and GBs of memory	Priced per # of CPUs and GBs of memory	**Yes**, for the same CPU/memory combination
Reserved Instances	Azure lets you commit to one or three years and pay the balance upfront	AWS lets you commit to one year or three years, with three payment options: - Pay upfront - Pay partially and the balance monthly - Pay monthly	**No**, you can only compare pricing if you pay upfront. AWS provides reduced discounts for partial upfront and monthly payment methods.
Object Storage - Frequent Access	Basic rate for first 50 TB, discounts for 51-500 TB and over 500 TB	Basic rate for first 50 TB, discounts for 51-500 TB and over 500 TB	**Yes**, same pricing structure
Object Storage - Infrequent Access	Offers two tiers: - Infrequent access - Archive storage	Offers three infrequent storage tiers: - Infrequent access - One Zone Infrequent Access - Archive Storage	**Yes**, except for the One Zone tier available only on AWS
Block Storage	Offers two tiers: HDD, SSD	Offers two tiers: HDD, SSD, and free tier with up to 30GB	**Yes**, except for storage volumes under 30GB
Rating Frequency	Per-Hour for most services, Per-Second offered for Windows VMs and Container instances	Per-Hour pricing for most services, Per-Second offered for Linux On-Demand and Reserved instances	**No**, prefer per-second pricing if available because it can save on costs
Price Matching	Azure commits to matching AWS prices for comparable services	AWS does not match prices	N/A

Table 8 AWS vs Azure pricing comparison[73]

1. **Amazon Web Services (AWS)**

Storage Capacity	Standard Storage	Reduced redundancy Storage
First 1TB/month	$0.0390 per GB	$0.0312 per GB
Next 48 TB/month	$0.0383 per GB	$0.0306 per GB
Next 450 TB/month	$0.0377 per GB	$0.0301 per GB
Next 500 TB/month	$0.0370 per GB	$0.0296 per GB
Next 4000 TB/month	$0.0364 per GB	$0.0291 per GB
Over 5000 TB/month	$0.0357 per GB	$0.0285 per GB

Table 9 AWS S3 Pricing[74]

2. **Windows Azure**

Storage Capacity	Locally Redundant Storage	Zone Redudant Storage	Geographically Redundant Storage
First 1 TB/month	$0.024 per GB	$0.03 per GB	$0.048 per GB
Next 49 TB (1 to 50 TB)/month	$0.0236 per GB	$0.0295 per GB	$0.0472 per GB
Next 500 TB (50 to 500 TB)/month	$0.0232 per GB	$0.029 per GB	$0.0464 per GB
Next 500 TB (500 to 1000 TB)/month	$0.0228 per GB	$0.0285 per GB	$0.0456 per GB
Next 4000 TB (1000 to 5000 TB)/month	$0.0224 per GB	$0.028 per GB	$0.0448 per GB

Table 10 Windows Azure Pricing[75]

Example of SaaS providers: Customer Relationship Management

Salesforce and Microsoft Dynamics 365 are two of the more popular Customer Relationship

73 https://cloud.netapp.com/blog/azure-vs-aws-pricing-comparing-apples-to-apples-azure-aws-cvo-blg

74 Mazrekaj, A., Shabani, I., & Sejdiu, B. (2016). Pricing schemes in cloud computing: an overview. *International Journal of Advanced Computer Science and Applications*, *7*(2), 80-86.

75 Mazrekaj, A., Shabani, I., & Sejdiu, B. (2016). Pricing schemes in cloud computing: an overview. *International Journal of Advanced Computer Science and Applications*, *7*(2), 80-86.

Management (CRM) solutions on the market. Salesforce was once way ahead of their competitors. However, Microsoft is slowly catching up.

In terms of pricing, here is how Salesforce's Sales Cloud and Microsoft's Dynamic 365 compare:

Salesforce

Salesforce Sales cloud	
Essentials	€25 per user/month
Professional	€75 per user/month
Enterprise	€150 per user/month
Unlimited	€300 per user/month

Table 11 Salesforce Pricing[76]

Microsoft Dynamics 365

Dynamic 365	
Sales Professional	€54,80 per user/month
Sales Enterprise	€80,10 per user/month
Sales Premium	€113,80 per user/month
Microsoft Relationship Sales	€121,76 per user/month

Table 12 Dynamic 365 (Microsoft) pricing[77]

76 https://www.salesforce.com/es/editions-pricing/sales-cloud/

77 https://dynamics.microsoft.com/es-es/pricing/#Sales

6 CONCLUSIONS

In this first part of the *"Recommendations for Cloud Computing business modelling, analysis and acceleration"* report, we have gone through the main business-related concepts that entrepreneurs in general must keep in mind when developing their business strategies. We then identified those characteristics which are most relevant in the field of cloud computing. We identified the main challenges and advantages that cloud computing entrepreneurs may face when developing their business propositions.

We saw that, by understanding the cloud computing value chain, entrepreneurs can best identify the roles they can play in the market in relation to their environment in order to obtain maximum gains. Moreover, we identified current and future opportunities that cloud computing entrepreneurs may take advantage of to develop potentially successful business ventures.

We then went through the evolution of business models in cloud computing, as we identified the ones which are currently the most relevant ones. After analysing the 55 business models proposed by the St. Gallen Business Model Navigator, we saw which ones could be used by cloud computing entrepreneurs, thus providing an idea of which path entrepreneurs in the field of cloud computing could take.

Cloud computing entrepreneurs not only need to know which business model to apply to their entrepreneurial projects, but also where they need to differentiate themselves from the rest in order to be have a competitive advantage over their competitors. This is why we focused on Alexander Osterwalder's classification of business model innovations. By doing this, we provided a guide for entrepreneurs to know in which areas of their business models they could be most innovative.

It is essential for cloud computing entrepreneurs to think about the business model associated to the technology that they are trying to bring to the market. Moreover, if we take Alexander Osterwalder's business model canvas, for instance, entrepreneurs can assess their proposed business models in comparison with other organisations' business models. Furthermore, entrepreneurs can analyse each of the nine components of the business model canvas to determine their level of innovation. This exercise of self-assessment can save a lot of time in the long journey of entrepreneurship.

Finally, we took a look at the current state of pricing schemas, thus providing cloud computing entrepreneurs with an idea of different ways is which they could charge for their services, as well as how much they could charge, using the main players' prices as reference.

In sum, we have thus far identified, analysed and categorised business models in cloud computing. In the second part of the report (upcoming deliverable D3.4) our investigation will focus on making recommendations on business modelling for cloud computing entrepreneurs.