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From CSP to DSP

Is the COVID-19 crisis a partner or another steppingstone?

A Technical Paper prepared for SCTE•ISBE by

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1. Introduction

The COVID-19 health crisis is one of those unique transformative moments in time, resembling the effects of wars, economic, political, or governmental crisis. After a few months, human beings are trying to adjust to the changes triggered by social distancing effects.

Customer service providers (CSPs) are in the center of this cataclysm, providing the connection between people, entertainment, retail, hospitals, and governments, accelerating the need for more significant usage of digital services. The major part of the CSPs is embracing the journey to becoming a digital service provider (DSP). Being a DSP will require providers to attend to dynamic customers' demands. It will need to be part of a broader ecosystem of participants to offer not only connectivity but a full suite of digital products and agile services to end customers and partners with a complex business model—and finally increasing their value share in the market.

However, as COVID-19 lockdowns extend, the impacts in the macro-economies are profoundly affecting the population and the CSP's cash flows, forcing them to limit or even stop their investments for a few months. This change management process is shifting the CSP's focus to a myopic investment mode and adding to it telecom industry supply chain disruption shortage, this scenario is the recipe for stagnation.

Against all the odds, some CSPs are finding the creativity and the innovation to meet their customer's needs, but still far from the disruption model proposed by the digital transformation initiatives.

In this paper, the authors will examine the impacts and trade-offs of COVID-19 into societies, industries, economy, and the information and communications technology (ICT) market, reflecting on some post-COVID initiatives CSPs should embrace to expedite the informal labor economy, meet new digital consumer habits, attend public safety requisites and, definitively, reestablish its course to a sustainable digital service provider path.

2. General Pre-COVID Context

New technologies have enabled brilliant innovations and the new kid on the block is called the Fourth Industrial Revolution. According to the World Economic Forum[1], this revolution is defined by a fundamental change in the way we live, work, and relate to one another by merging the physical, digital and biological worlds. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before, in ways which we never saw before. One of the fundamental differences of the current industrial revolution from the previous ones is that previously the changes occurred outside of the human body; instead, in this case, they will involve it and even happen within it.

Today, industries around the world like factories, mining, logistics, and others have embraced their digital transformation. With the introduction of new technologies, widespread connectivity, and cloud workloads, these industries will transform themselves – increasing their process efficiencies, workforce safety, and growing their productivity – generating greater value to the market and back to the communities.

Beyond the current and known initiatives, the next ten years promise us a future where humans will be augmented by artificial intelligence (AI) and digital, physical and biological systems that will work in a tightly coupled mode, possibly changing us, as homo sapiens.

[1] https://www.weforum.org/focus/fourth-industrial-revolution

To name a few examples of the expected human revolution, we may see:

- Disappearing boundaries for human beings between what is natural and what is artificial. Not only as part of the human body itself but including concepts as "mirror world" or metaverse[2].
- Changes between our relationships with life, the planet, work, and consumption. The industries are aiming to cover every human aspect need and generating a new history of how we live.
- Thus, it covers aspects related to health care, equality, materials, energy, political and economic systems, having a context to produce a sustainable life for the planet and human beings.
- This comprehensive set of aspects proposes working with new and natural materials to decouple the economic growth from the constraints of the existing raw materials.

3. CSP's Pre-COVID Context

3.1. CSP's Challenges

CSPs have been facing a hard competitive scenario due to emerging digital disruptors, who are offering higher-value services demanded by the consumers and leveraged on the CSP's infrastructure. As most CSPs compete for similar business to consumer (B2C) & business to business (B2B) services with the lowest competitive advantage, revenues are commonly disrupted by new players. This disruption is commonly based on a combination of platforms, experience, and costs, reducing dramatically the friction for customers to access the products and services they are looking for.

This scenario is shown in Figure 1 and represents something well-known in the industry. The CSP´s revenues are becoming flattened and at the same time, their total cost of ownership (TCO) has increased drastically by significant infrastructure deployment to manage the traffic growth generated by hyperscalers and new consumers' demands.

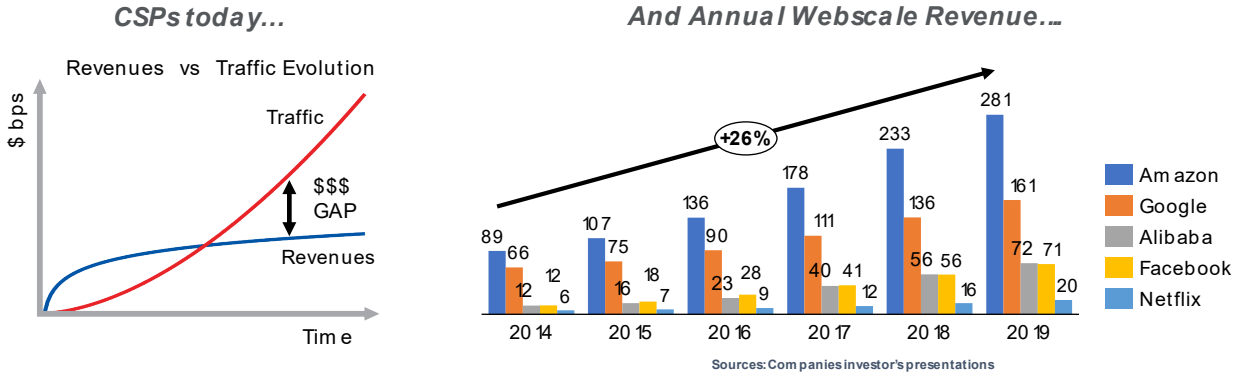


Figure 1 – CSPs vs hyperscale current scenario outlook

[2] https://es.wikipedia.org/wiki/Neuralink
https://www.forbes.com/sites/cathyhackl/2020/07/05/the-metaverse-is-coming--its-a-very-big-deal/#3cc83452440f
https://en.wikipedia.org/wiki/Mirror_world

3.2. CSPs need to do things differently

In the past five years, the telecom industry has been one of the worst-performing sectors for investors as global bets have failed to pay off. That has left companies with huge debts, and now CSPs are under intense pressure to invest in new 5G and full-fiber networks.

On the other hand, regulation has also played a significant role in challenging the telecom business model's execution. Meanwhile, OTTs are scoring higher revenue streams as they have better control of data propelling its business forward. Still, the difference in OTT regulation compared with telecoms has contributed to some disparity of outcomes.

Disruption in technology takes place silently, often too late to be noticed or worst reacted. History has proven that businesses that failed to perceive disruption and re-invent themselves had lost a tremendous amount of value or disappeared- and we all know who they are.

The foundational question is why CSPs fail to perceive the disruption surrounding them?

Kahneman, Lovallo, and Sibony[3] had provided us useful insights on complex corporate decision-making bias; For instance, preconceived notions are difficult to be contradicted even when confronted with strong evidence, leading to an effect named confirmation bias.

Anchoring decisions do leaders weigh one piece of information too slowly in making decisions, and finally, loss aversion makes them too cautious.

Most of today's CSPs' cash flows are defensive and, for the most part, structured by a supplier-buyer mindset and the blame game when things go wrong.

Suppose the traditional telecom operators don't try different strategies. In that case, they will lose value on the market and potentially be acquired, or struggle for the next few years with average growth, similar to the historical examples.

Based on the presented outlook, CSPs need structural transformations on their businesses to be able to compete for higher-value products and services, allowing them to reduce the gap between the revenues and traffic, cover the new and extremely dynamic consumers' demands in this fluctuating world and be able to make their business more sustainable.

GAP + New Demands + Competition = New Products + Improve TTM[4] + Optimize TCO

Transformation

If well inserted and with the right strategy, CSPs have the potential to disrupt markets, inserting themselves into new value chains & capturing new revenues from untapped industries going through Industry 4.0 development, which promises to bring more value in the short-mid term. According to the McKinsey Institute[5], there's near US$9T untapped value to be addressed in this sector by while the largest segment of traditional CSPs market ranges about US$1T - Figure 2.

[3] Kahneman, D., Lovallo, D. and Sibony, O., 2011. The Big Idea: Before You Make That Big Decision…. [online] Harvard Business Review
[4] Time to Market
[5] https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/the-trillion-dollar-opportunity-for-the-industrial-sector

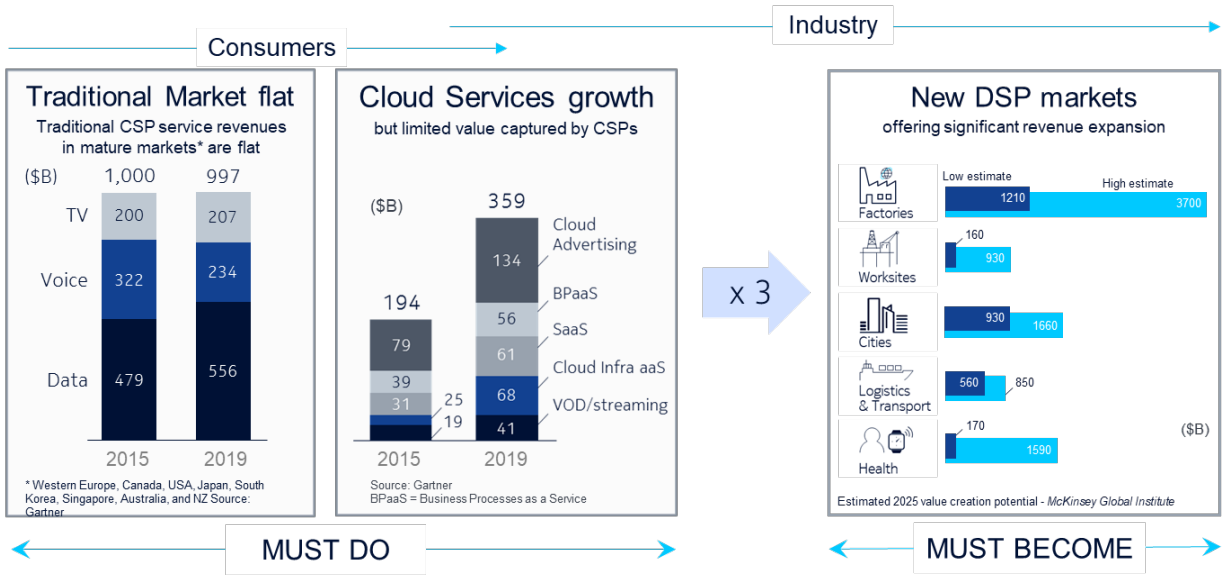


Figure 2 - Nearly US$9B untapped industry 4.0 value to be addressed by CSPs (McKinsey Global Institute)

3.3. What does transformation into DSP mean?

Eyeing the benefits described in the previous sections, many CSPs started journeys to become themselves more agile and digital companies, namely digital service providers or DSPs. According to Martin Creaner[6], DSPs are those capable of responding to the changing demands of their clients, fostering and being part of larger ecosystems based on much more complex business models, offering not only connectivity but a wide spectrum of digital products and agile services and therefore increasing the value for their end customers, partners and shareholders (see Figure 3)

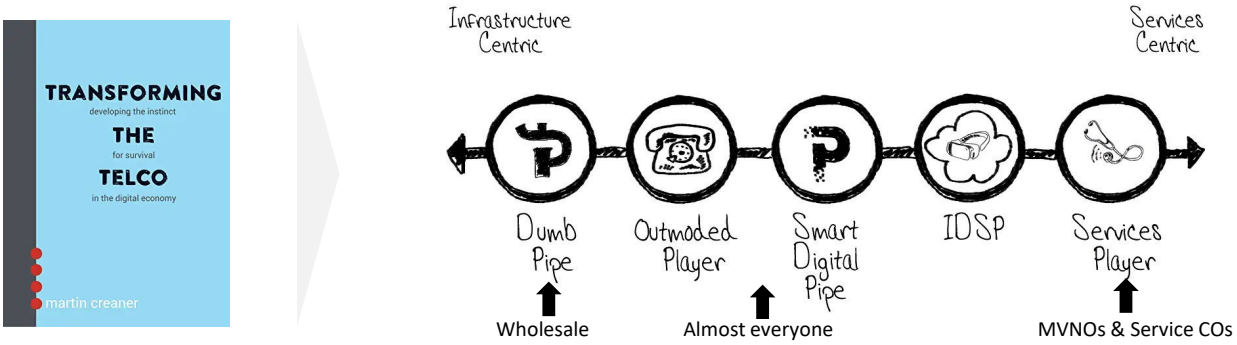


Figure 3 – CSPs transformation options

The authors researched six global CSPs located in six unique countries (see Figure 4). This picture emphasizes the difference in scale between current CSPs and hyperscalers and, for this reason, the need

[6] Creaner, M., 2020.*Transforming The Telco: Developing The Instinct For Survival In The Digital Economy*. CenterNODE.org.
https://www.youtube.com/watch?v=xl6gIEb8OAM (Martin Creaner - Former CEO & President - TM Forum)

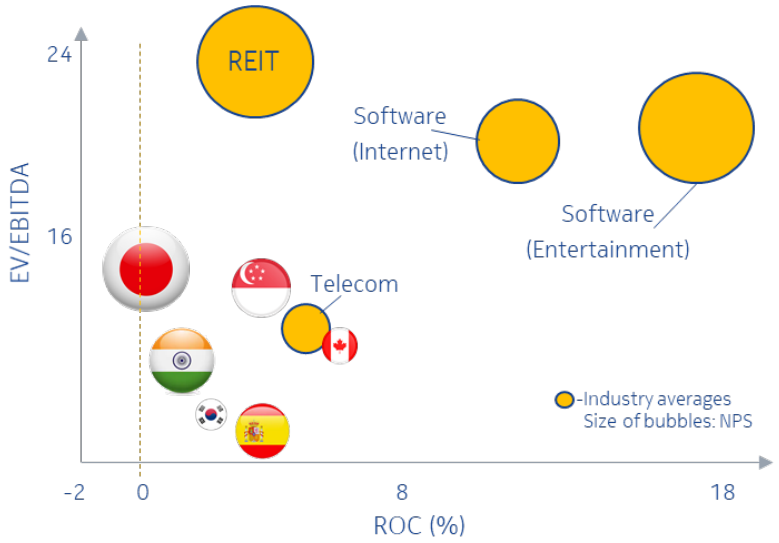
for this CSPs transformation to achieve greater value, allowing them to increase their margins in this new scenario.

In other words, those CSPs deciding to close the gap must offer higher value-added services and products to consumers. This will be only possible by implementing structural transformations, which will require strong leadership to manage the risks and failures.

In Figure 4, the listed CSPs are going or went through serious digitalization efforts, supported by automation, big data analytics, machine learning (ML), AI, network function virtualization (NFV), software-defined networks (SDN), and cloud strategies ranging from two to eight years.

These initiatives aim to improve customer experience, provide operational expenditure (OPEX) savings, and allow a shorter time to market (TTM). However, after careful investigation, these CSPs' digital transformation initiatives are failing to deliver on their value and efficiency results according to public market information.

Their valuation over earnings before interest, taxes, depreciation, and amortization (EBITDA) varies quite considerably, as well as their perceived Net Promoter Score (NPS), providing signs that it takes a good strategy and organization alignment to generate value back to the investors and clients.



Sources: December, 2019 - S&P, prof Damodaran Stern School of Business, Net Promoter Score Guru

Figure 4 - –Six tier 1 CSPs' EV/EBITDA, ROC and NPS as of December 2019

An effective approach to transformation requires establishing the business vision, assessing the present, and guiding the transformation to the target state. Aligned with its business strategy and a clear transformation roadmap, a CSP will need to re-arrange its organization's culture, skills, process, and technology to successfully embrace its digital transformation initiatives.

A common misconception is that if a company deploys an extra set of technologies, then digital transformation is done. However, Becky Frankiewicz and Tomas Chamorro-Premuzic[7] explain that the reality is that digital transformation isn't just about technology, but it's about organizational adaptability. To keep pace with the changes driven by digital transformation, organizations must learn to be an agile, adaptable, and organizational culture; and talent skills are crucial to the success of any digital initiative, including unlearning old behaviors.

For genuine change to happen, company-wide support is critical. The CSP leadership and executive teams must provide a clear vision and strategy for how the change will be realized, prioritize it properly, define concrete goals and accountability for the firm and measure its achievements. Thus, the entire organization must point in the right direction. The employees must understand their role in the transformation and how they are driving change. New technologies and change management will require new skills, culture, and processes, too.

The truth is that CSPs will need to have aligned the four pillars of the business strategy shown in Figure 5, the key structure over which workforce skills and culture, process, and technology will be based, to create a framework to support their employees to deal with the new software-centric technologies.

Figure 5 - The four digital transformation pillars

To promote cultural cohesion, soft-skills training will need to be included, intellectual curiosity must be permanent and fostered for continuous learning. Other important characteristics are teamwork, adaptability, and flexibility to unknown conditions, change management practices, effective communication, negotiation, and conflict resolution.

Re-skilling can cost a reasonable amount of financial investments and will need to be surgically inserted in the operator's context and budget to provide the right outcomes.

A business strategy, described above, is the fundamental pillar of the digital transformation. One typical proposal is to move forward with operational efficiency optimization, improving the current businesses as

[7]"Digital Transformation Is About Talent, Not Technology", Becky Frankiewicz and Tomas Chamorro-Premuzic, Harvard Business Review, May 2020. Available online at: https://hbr.org/2020/05/digital-transformation-is-about-talent-not-technology.

much as possible. In contrast, new services, products, and business models should be investigated to leverage competitive advantage. This approach is defined as the "S Transformation"[8]- Figure 6.

The transformation process is not a project; it does not have an end; conversely, it is something that once it starts is the new mode in which the company will work. It becomes a new Business as Usual.

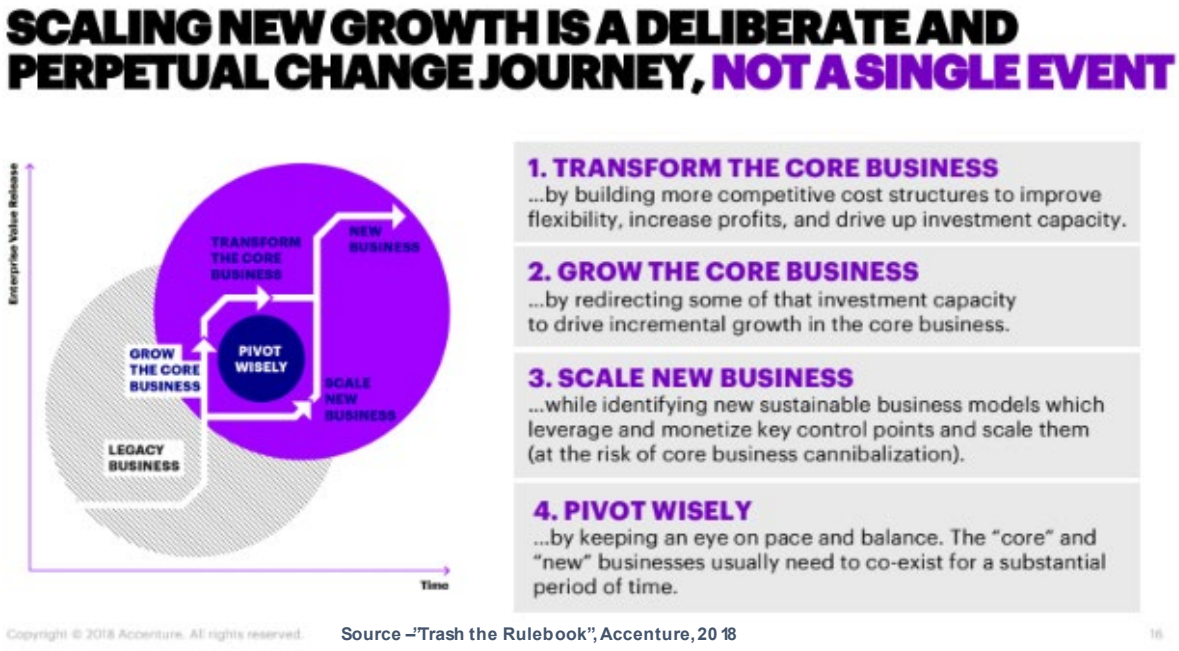


Figure 6 – The "S Transformation" approach

As CSPs are looking for ways to move towards its digital transformation journeys, there are notable pitfalls they should avoid.

Much has been studied and written on this topic and these extensive projects seem to have an interesting commonality on its pitfalls. According to the authors, one of the most comprehensive analysis of this topic is covered by John Kotter[9]. Figure 7 describes a graphical and rather pedagogical version of his framework.

[8] Accenture, 2018. Trash The Rule Book.
[9] "Leading Change - Why Transformation Efforts Fail", John P. Kotter, Harvard Business Review, January 1996

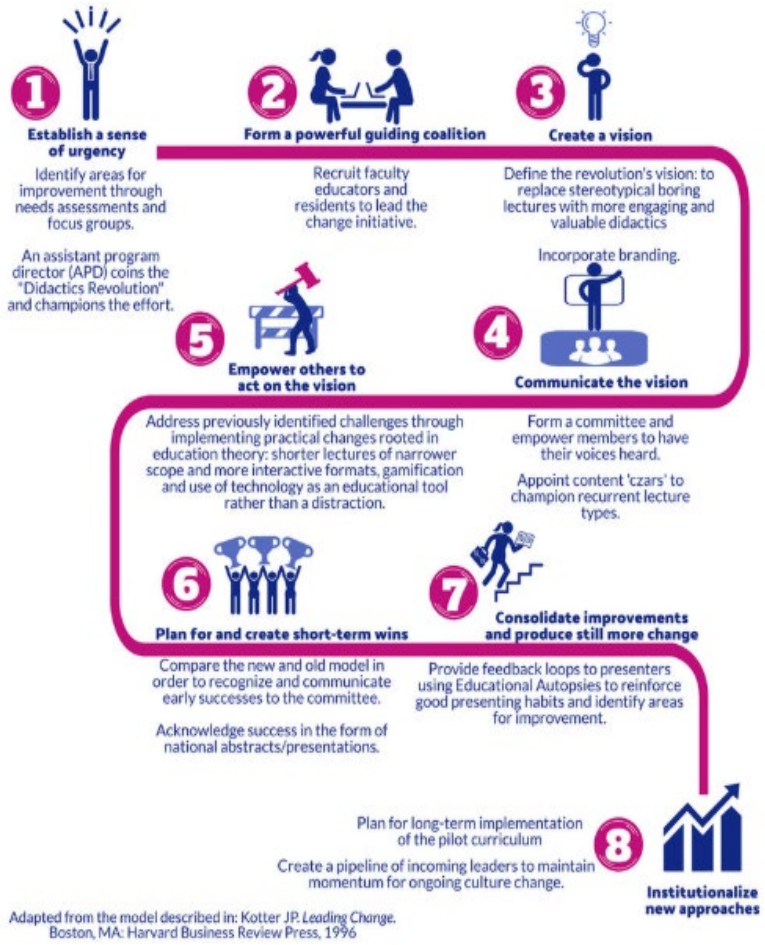


Figure 7 – Kotter's vision about Digital Transformation Pitfalls

According to another study, Mike Sutcliff, Raghav Narsalay, and Aarohi Sen[10], there are two major digital transformation challenges observed:

1) A silent disagreement between top-level managers on the project goals, leaving their direct reports confused on what to prioritize, and how to measure progress.
2) A gap between the digital capabilities that were used to support a pilot, and the capabilities required to support the scaling of it. If this problem isn't addressed, the firms could face lengthy delays to scale-up production or leadership team's hurrying things to meet the promised changes.

Both could be remediated, but they require communication and negotiation skills. The first challenge needs to be discussed between the stakeholder parties. The opportunities and the benefits need to be articulated, but also the problems it solves and how the firm will re-orient the organization before investing in the desired solution.

[10] "The Two Big Reasons That Digital Transformations Fail", Mike Sutcliff, Raghav Narsalay and Aarohi Sen, Harvard Business Review, October 2019. Available online at: https://hbr.org/2019/10/the-two-big-reasons-that-digital-transformations-fail.

The second challenge is more complex and will require the stakeholders to look outside the organization to close the divide or raise the capabilities from inside, starting with the pilot and growing from it.

Finally, Jacques Bughin and Nicholas Van Zeebroeck[11] describe six strategies to face this transformation. Within their studies, they concluded three offensive and three defensive options, being the former more successful to achieve the desired transformation.

- Offensive: Platform play, New marginal supply, Digitally-enabled products, and services
- Defensive: Rebundling and customizing, Digital distribution channels, Cost efficiency

Given that the pandemic crisis forced many operators to fix some operational inefficiencies, a few CSPs claim it helped them to prioritize their digital transformation efforts. We will look more carefully at this topic in the following sections.

"Wisdom consists of knowing how to distinguish the nature of the trouble,
and in choosing the lesser evil"
The Prince, Niccolo Machiavelli

4. COVID-19 pandemic impacts

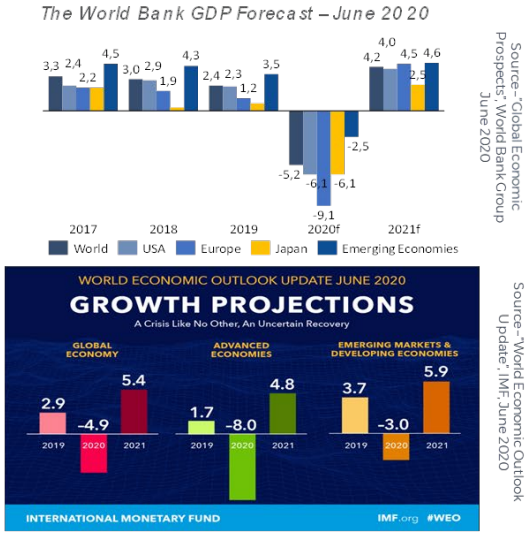
4.1. Global Economy

In March 2020 many governments started taking measures to protect and mitigate the pandemic impact on the health of their populations. These decisions have heavily affected the global macroeconomy, as the International Monetary Fund (IMF) and World Bank have shown in their reports and forecasts - Figure 8Figure 8.

At the writing of this paper, it is impossible to estimate the economic impact of the health crisis, as it depends on its duration. Although some forecasts provide a more optimistic scenario, according to the World Bank, this is the most significant recession since World War II.

The critical question is how the macroeconomy, political tension, and exchange rate variations will affect the CSP's investments and, in particular, how it will affect its digital transformation initiatives to address the 4th industrial revolution requirements?

[11] "6 Digital Strategies, and Why Some Work Better than Others", Jacques Bughin and Nicholas Van Zeebroeck, Harvard Business Review, July 2017



- The World Bank forecast envisions the deepest global recession since World War II.
- Emerging economies analysis shows two battlefronts:
  - Contention of the domestic outbreak
  - Cope with the economic spillovers from the deep recession in advanced economies
- There are similar conclusions reached by IMF studies

How will the GDP impact CSP's investments to address the 4th Industrial Revolution requirements?

Figure 8 – Global Economy Projections[12]

There were severe decisions taken by governments to control the spread of the decease, which are affecting several industries around the globe. A few examples are[13]:

- During the lockdown -stay-at-home, shelter-in-place, and quarantines-, nearly 3 billion population were living in countries whose borders were shutdown to nonresidents, and 93% of countries had imposed immigration limits.
- As of April 10, governments across the globe had announced stimulus packages amounting to $10.6 trillion—this is the equivalent of eight Marshall Plans.
- The global macro-economy will affect enterprises, including CSPs, and finally, the governments will need to fund these stimulus packages to move the economy.

4.2. CSPs Traffic

Government measures described in the previous section have produced some changes in population habits. Work, study, leisure, and consumption from home are the new norm, all made possible by CSPs infrastructure around the world.

Change in traffic profiles has been significant, and behavior varies between regions and countries depending on several factors such as isolation intensity, lockdown periods, e-learning availability, and e-commerce maturity.

One remarkable aspect during the lockdown is that traffic volumes varied, but it all had a severe impact during peak hours affecting the current networks and the capacity planning cycles.

[12] https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020
https://www.worldbank.org/en/publication/global-economic-prospects
[13] "The future is not what it used to be: Thoughts on the shape of the next normal", Kevin Sneader and Shubham Singhal, McKinsey & Company, April 2020. The exact value of some figures from this article can be discussed, but undoubtedly, they are really large

The periods of peak hours had extended considerably, with upstream traffic struggling access network resources.

This can be seen in Figure 9, Figure 11, and Figure 11.

Traffic Growth	1 Feb – 1 Mar Growth	1 Mar – 1 Apr Growth	1 Apr – 19 Apr Growth	Total 1 Feb – 19 Apr
Upstream	+2.07%	+123.18%	-2.95%	+121%
Downstream	-2.39%	+11.72%	+13.67%	+23%
Total	-1.74%	+28.69%	+9.28%	+38%

Figure 9 – Global Pandemic Traffic Scenario

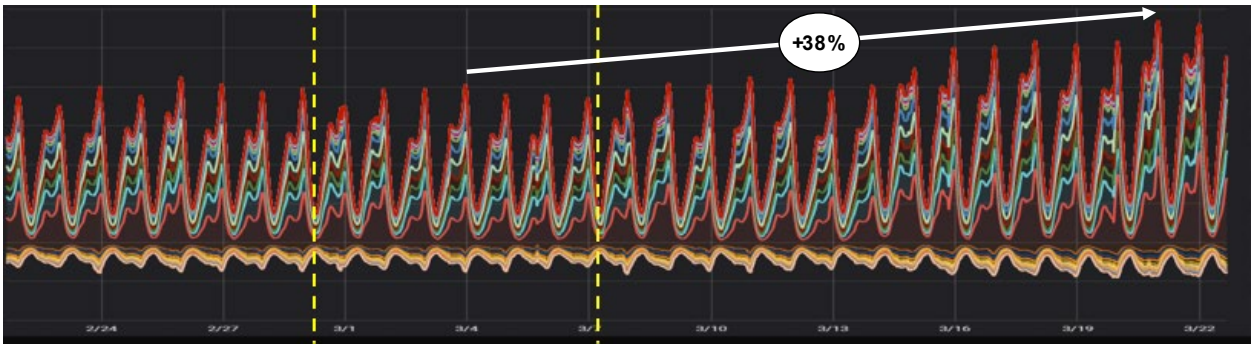


Figure 10- Higher traffic volumes and peak hour period extension

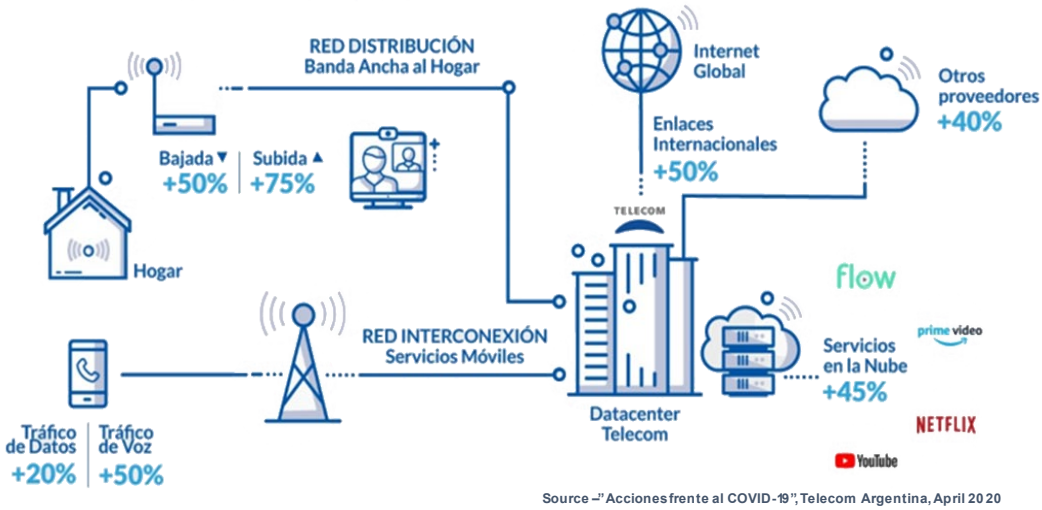


Figure 11 – Public traffic impact from Telecom Argentina, April 2020

4.3. Other CSPs Aspects

The situation was uncommon, but COVID-19 forced the CSPs to speed-up their operational initiatives to address the unexpected conditions.

During the past 5 months of social distancing and lockdown we observed:

1. CSP's networks have responded reasonably well to the change in traffic demands, including 40% to 50% traffic spikes.
2. Remote working and e-learning have amplified the gaps in the upstream capacity and also in the rural broadband connectivity.
3. The higher adoption of remote work accelerated the demand for the enterprise digitalization, including medium and large enterprises embracing more cloud services, and some CSPs providing higher capacity and resilient residential broadband access.
4. CSPs across the globe are going beyond the call of duty to help communities and consumers to manage COVID-19, including free access to e-learning resources, movies, games, and ultra-reliable services to first responder's authorities.
5. As consumers and SMEs' incomes were severely affected by economic stagnation and increasing unemployment rates, CSPs are facing a severe impact on their revenues and investment plans. Some consumers can't afford their billings, and some governments have temporarily suspended the option to disconnect the service.
6. IT Systems -e.g., business support systems (BSS) & operations support systems (OSS) - have to be re-oriented to these new conditions. In some countries, operators had to revise their prepaid recharge systems and policies quickly to provide a more seamless customer experience.
7. To keep up with the higher demands for traffic growth, e-learning, remote working, virtual private network (VPN) and security, CSPs had to revise their budget plans and invest capital expenditure (CAPEX) and OPEX to minimize operational issues.
8. Global supply chain disruptions have impacted the CSPs' ability to scale-up deployments.
9. On the fixed access networks, CSPs re-arranged their field operations to service their consumer's homes when outages related to their customer premises equipment (CPE) or residential gateways (RGWs) happened.

When CSPs look at the bright side of the COVID-19 pandemic, they list several opportunities to speed up a few digital transformation initiatives, such as those listed above.

As was previously described in this paper, also with the social distancing, the global macroeconomy is heavily affected and thus CSPs revenues and investments are at risk. When we look at the global CSP's revenue breakdown, approximately 50% of it comes from mobility products and services. As the population is in lockdown, they rely more on fixed internet access, affecting largely the CSP's mobile services and handset revenues.

During the 2nd and 3rd quarter of 2020, operators revised their CAPEX plans, and given the general economic and network effect from the pandemic, including revenue impact, disruption of the supply chain and the need to expand network infrastructure, their investments not related to short-term aspects are likely to fall compared to previous years.

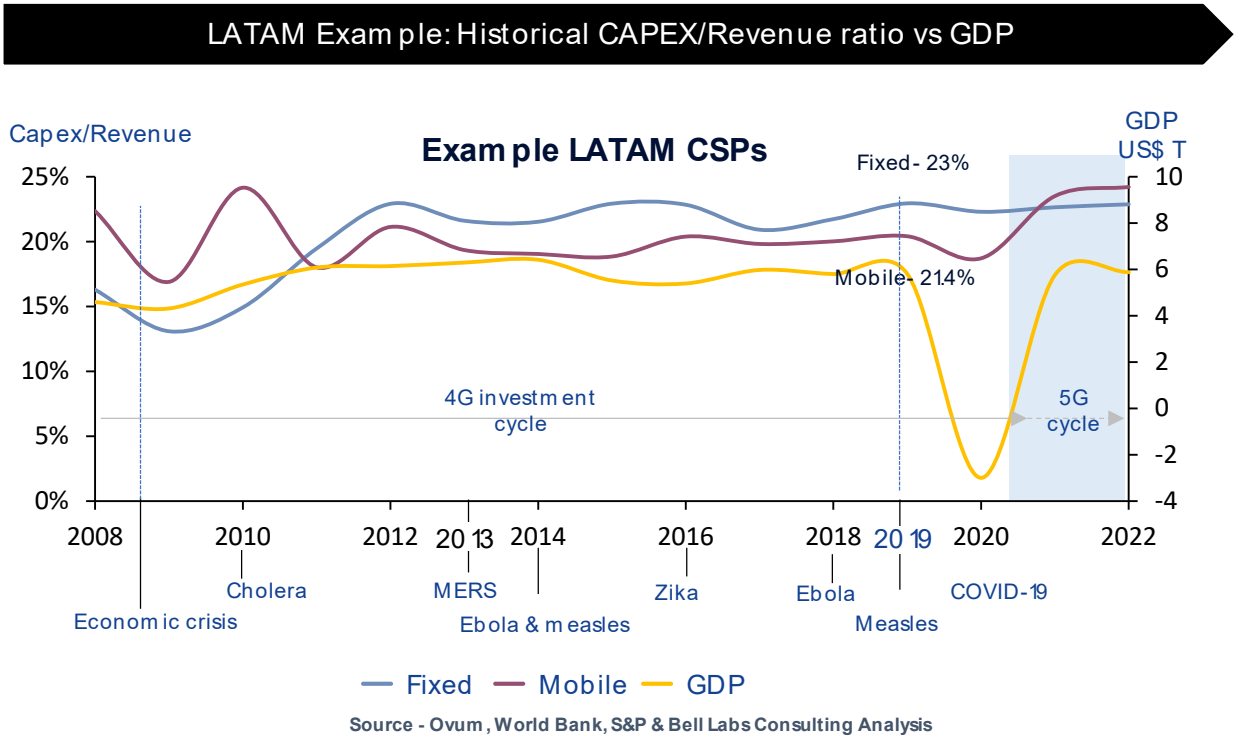


Figure 12 - Historical CAPEX/Revenue ratio vs GDP

Although traffic has surged and profile has changed due to COVID, operators will focus on improving and maximizing existing network and technology, so other investments will be pushed to late 2021-2022 whenever possible

In many emerging countries we observe a delayed investment in 5G networks, while developed countries slowed down their 5G network deployment plans in the first half of 2020. However, similar to the 4G deployments, 5G is expected to ramp up from 2021 onwards. Additionally, given that most of the wireless CAPEX comes from radio access network (RAN) investments, and the population will tend to be in-doors, investment in RAN will drop.

In the particular case of Latin America (LATAM) -see Figure 12- major CSPs will see a revenue decline in 2020 between -3% to -14%[14], directly impacting CAPEX growth, but although gross domestic product (GDP) impacts revenue, capital intensity has been reasonably constant, with peaks mainly in wireless due to technology refresh.

4.4. Some key questions remain

CSPs around the world have been relatively successful in dealing with the challenges that the current pandemic is presenting. Many of them have been displayed in the previous section.

But some key questions remain.

- Was the CSPs' success in managing the COVID-19 crisis achieved with the same principles required to transform them into a DSP or did accelerated efficiency only follow the existing CSPs' operating model?
- Can these results be claimed as part of a digital transformation?
- Will the macro-economic outlook delay non-critical investments like 5G and transformations to DSPs?

4.5. Pandemic Opportunities

The previous questions are even more crucial considering the opportunities that can emerge from this crisis. Some of them can imply permanent changes and, therefore, opportunities to be taken in the short-term.

In areas like e-commerce, fintech, telemedicine, automation, remote working, and e-learning, the COVID-19 pandemic could be a decisive turning point in the short and mid-term, laying a foundation for digital services adoption for the future[15]. For example:

- In China, individuals aged 36 and over and residents of smaller, less prosperous cities have begun to shop online.
- In Europe, 13% of consumers said they were planning to move to online purchasing options.
- In Italy, e-commerce transactions have risen 81% since the end of February.
- The business opportunities for banks and fintech companies are exponential with shifts to digital payments and remote cashless transactions.
- In the US, one of the largest stand-alone telemedicine service providers reported a 50 percent increase in remote consultation during the pandemic.
- France, Korea, and Brazil changed its regulations to ease access to telemedicine.
- Automation efforts are increasing in every industry. According to the McKinsey Global Institute, 60% of jobs could see more than 30% of their critical tasks automated, affecting 400 million to 800 million jobs by 2030.
- Remote working and e-learning will bring many opportunities to be explored by CSPs. In the short term, there are enhancements to the upstream capacity congested by the use of collaborative tools like Zoom, WebEx, and Microsoft Teams. In the long term, work, schools, and colleges will host a mixture of local and remote presence and the use of extended reality for an enhanced experience.

[14] Jordan, G., Sarmiento, T. and Campos Rodriguez, K., 2020. COVID-19 Could Cause Latam Telecommunications Revenues To Drop 3% To 14% In 2020. S&P Global - Market Intelligence.
[15] "The future is not what it used to be: Thoughts on the shape of the next normal", Kevin Sneader and Shubham Singhal, McKinsey & Company, April 2020

5. Post COVID-19 world

5.1. CSPs Additional Opportunities

Aside from the COVID-19 crisis, a few CSPs are targeting new B2B and business to business to consumer (B2B2C) services to the industries which will require low jitter, latency, and strict service level agreements (SLAs) only made possible by private wireless networks coupled with edge cloud. Currently, webscale and hyperscale companies need a more granular footprint to be able to fulfill these SLAs because it is not possible with their existing centralized architectures, and here is where the battle for edge space starts - Figure 13 and Figure.

Additionally, CSPs do not own the foundational capabilities that hyperscalers have, such as agility, flexibility, and shorter innovation cycles that allow them to offer these products and services at the pace and dynamism that the clients and the market are demanding.

Current hyperscalers are approaching CSPs worldwide, given its proximity to their end clients, proposing strategy agreements to provide their customers with new services soon. Just as a final remark, given the differences described in sections 3.1 and 3.3 of the present paper, authors suggest these agreements have to be carefully analyzed and be a critical part of CSPs' business strategy.

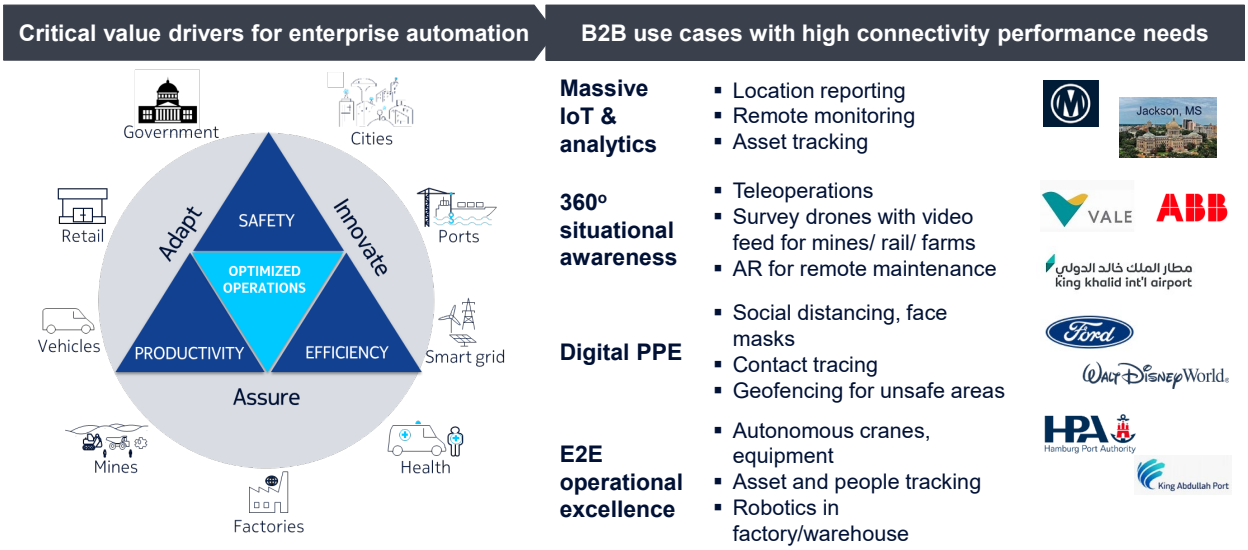
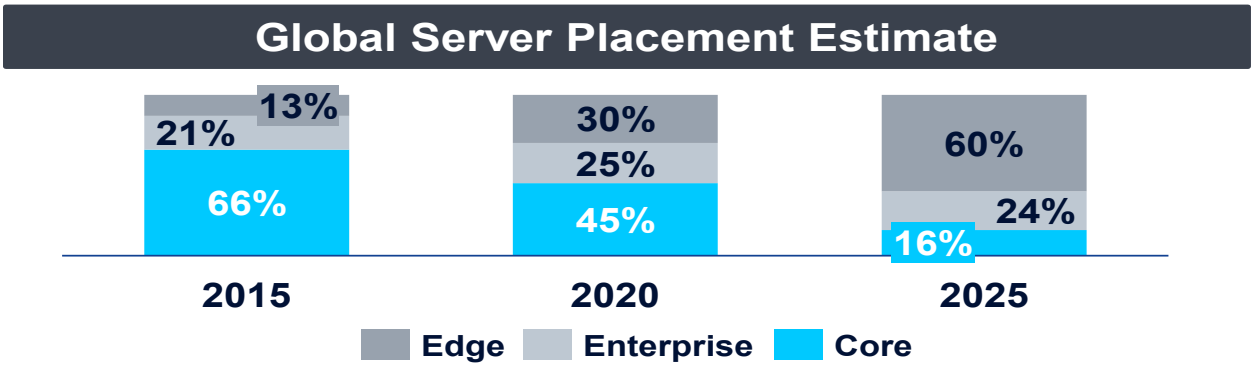
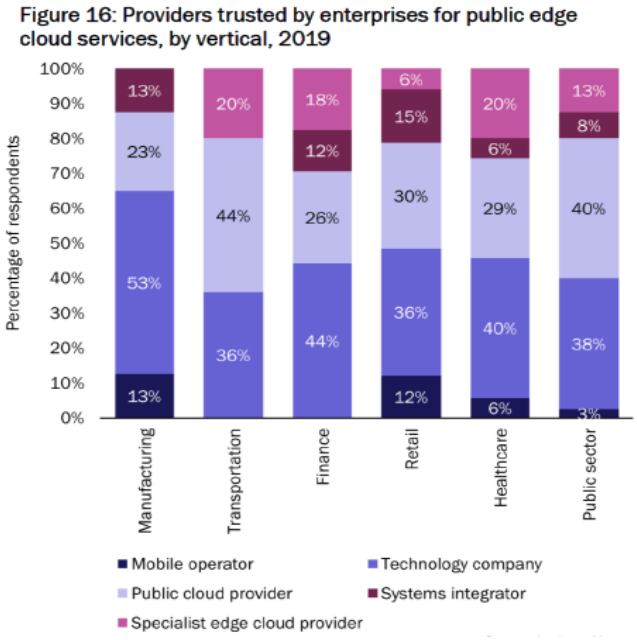
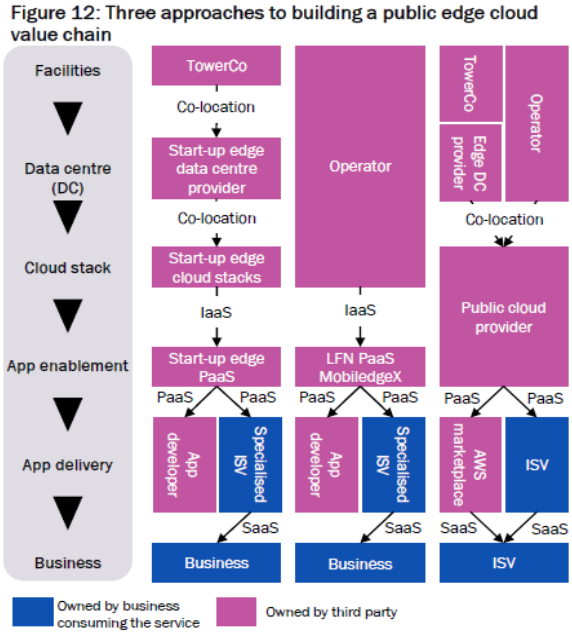


Figure 13 – Some B2B/B2B2C use cases with strict SLA – Bell Labs Consulting







Source –"Operator opportunities and threats in the public edge cloud computing market", Analysys Mason, April 2020

Figure 14 – Edge Battle – Footprint granularity can be a CSPs valuable asset coupled with the right strategy

To make the context more complex, a few hyperscale companies are acquiring networking vendors[16] and also investing in CSPs, suggesting a strong ambition to move further into the CSP territory to address high-performance services.

Since 2018, many CSPs and technology companies are experimenting with 5G use cases for the enterprise, exploring the early days of Industry 4.0 stringent SLAs and services. Today, most industries use cases are in the fields of manufacturing, transportation & logistics, energy & mining, and utilities.

[16] https://blogs.microsoft.com/blog/2020/03/26/microsoft-announces-agreement-to-acquire-affirmed-networks-to-deliver-new-opportunities-for-a-global-5g-ecosystem/

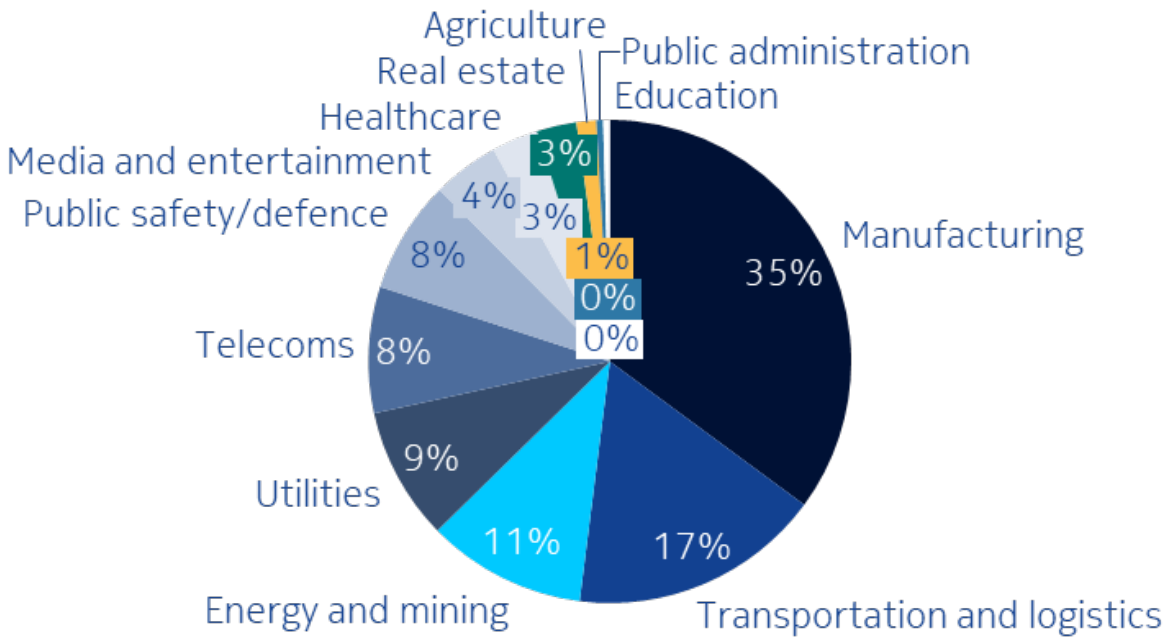


Figure 15 - 5G announced activities by industry OMDIA July 2020

In Table 1, there are a few public examples of CSPs and other companies using 5G access and edge cloud in gaming, public safety, and manufacturing space.

Table 1 - 5G public announcements for enterprise - OMDIA, July 2020

Organization	Type	Country	Activity	Description	Telecoms operator	5G	Edge computing	Date
Tencent 腾讯	Technology vendor	China	Trial/test	Test project on Tencent's campus using a network from Huawei and China Mobile Chengdu to support MEC-hosted online gaming with low latency. (October 2019)	China Mobile	Yes	Yes	October-19
OMRON INDUSTRIAL AUTOMATION	Enterprise	Japan	Trial/test	Tripartite test program with manufacturer Omron, Nokia, and NTT DoCoMo, evaluating layout-free factory designs at multiple Omron sites. Tests include support for autonomous robots, video analytics (used to assess the differences between the most-skilled workers and everyone else), edge computing, and radio propagation in the industrial setting. (September 2019)	NTT DoCoMo	Yes	Yes	September-19
at&t	Telecom operator	United States	Trial/test	AT&T cooperating with Israeli drone detection startup Vorpal. Vorpal needed low latency networking and edge computing, and joined the 5G aspect of AT&T's Foundry innovation lab. (July 2019)	AT&T	Yes	Yes	July-19
at&t	Telecom operator	United States	Alliance/sales partnership	Extensive partnership between AT&T and Microsoft on 5G and edge computing, including providing AI-based translation to emergency responders. (July 2019)	AT&T	Yes	Yes	July-19
at&t	Telecom operator	United States	Network rollout	AT&T is collaborating with MxD (Manufacturing times Digital, a manufacturing industry group) to install 5G technology and Multiaccess Edge Compute (MEC) within MxD's Chicago-based innovation center. (July 2019)	AT&T	Yes	Yes	July-19
BOSCH	Specialist/industrial vendor	Germany	R&D project	Bosch announces its vision for 5G-enabled future factories. Bosch aims to eliminate cabling in order to reconfigure production processes rapidly, perhaps even using wireless power. (April 2019)	n/a	Yes	Yes	April-19
Telefónica	Telecom operator	Spain	Alliance/sales partnership	Telefónica provides private network connectivity using a range of access technologies, cloud computing, and security solutions for industrial specialist Geprom's smart factory projects in Spain. Geprom provides its LEGATO SAPIENT Manufacturing Execution System management software. (April 2019)	Telefónica	Yes	Yes	April-19

5.2. Three probable hypothesis

From the many outcomes of the COVID-19 impact for operators, the authors observe three probable hypotheses for CSPs' digital transformation efforts in the next few years, in Figure 16.

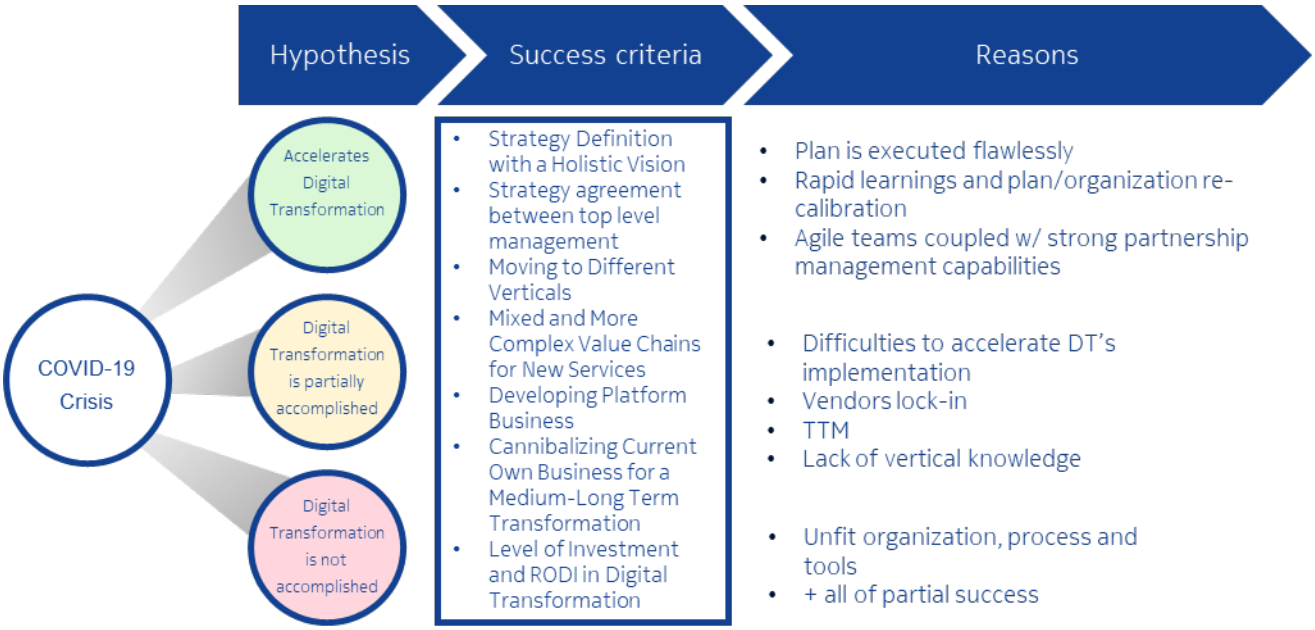


Figure 16 - Digital Transformation's hypothesis after COVID-19

In a best-case scenario, the CSP will accelerate its digital transformation efforts and will agree upon its objectives in terms of strategy definition with a holistic vision, common objective setting between top-level management, the possibility to move to different verticals, mixed and more complex value chains for new services, develop platform businesses, cannibalize current own business for a medium-long term transformation and setting levels of investment and shorter return of digital investments in its transformation plans, aiming for cost efficiencies, and additional revenues.

Besides the several moving parts, the plan would need to be executed flawlessly, with an agile organization that would follow closed-feedback loops and would be able to re-calibrate its actions to meet their main strategy. A wide range of partnership management capabilities would be instituted, and the teams would need to be able to embrace most of the challenges and successfully navigate through them.

In the second scenario, the digital transformation will be partially accomplished as some breakthroughs will be met, but the CSP may face vendor lock-in, a wide range of legacy and costly-to-replace or integrate networks and systems, which will delay their time to market and the digital transformation goals.

Last, some CSPs will start their initiatives with some guiding principles but will fall into difficult internal disputes for resources and budgets which will affect its execution. Quick wins will be achieved, for example, SD-WAN projects, but no meaningful impact on the expected cost efficiencies or in the top-line revenues.

Unfortunately, given the nature of the telecom business and its risk-averse propensity, the authors believe most CSPs will fall into the second or third categories.

5.3. CSPs Decisions

At this point, it is necessary to make a caveat and clarification. CSPs are not uniform entities, conversely, they constitute an innumerable amount of individual cases and particular situations. This myriad is determined by differences in some of the following aspects: strategic definitions and business volumes, contexts of regions, countries, markets, competition, technological and partnership strategies, skills, processes, and internal cultures to name a few. A few examples are the different consumption models of open-source tools[17], level of disaggregation for different DSPs[18] or their technological partnerships, and the activities they involve.

Digital transformation outcomes will depend on each CSP and how conservative or aggressive they move in the process. The COVID-19 crisis outcome is challenging, but the fewer CSPs invest in the long-term scenario more are the chances to be disrupted by hyperscale companies.

Additionally, CSP's leadership teams should define a clear business strategy with a structured roadmap, instill a sense of urgency in the management team, and re-orient their workforce, networks, process, and tools to embrace its DSP transformation.

Probably, today more than ever, decisions will be taken with courage and an optimistic conviction that the transformation from CSP to DSP is required.

"Everywhere we see a motley confusion which draws us into its interests, and when one thing disappears, another at once takes its place"
Lectures on the Philosophy of World History - Georg Wilhelm Friedrich Hegel

6. Conclusion

As mentioned exhaustively, CSPs before COVID-19, had to face their DSP transformation to increase their revenues, decrease their operational expenses, provide a differentiated competitive advantage, and raise their value to its shareholders.

The pandemic was a type of black swan that can and will surely have a significant impact on the defined strategy and goals, since it affects considerably the global economy and, therefore, CSPs' investments. On the other hand, it generates opportunities to accelerate the digitalization process avoiding losing these opportunities.

So far, CSPs were successfully coping with the demands related to increasing traffic consumption, shifts in traffic patterns, upstream bottlenecks, and rural coverage shortage.

Some CSPs have been even more creative and launched interesting new services to enhance home connectivity with redundant connections, coupling broadband and wireless connectivity in the same CPE[19], others were quick to attend the hospital's demand for connectivity, and some utilized IoT

[17] https://www.lfnetworking.org/publications/2020/06/17/onap-consumption-models-whitepaper/
https://www.lfnetworking.org/wp-content/uploads/sites/55/2020/06/ONAP_EUAG_Whitepaper_061720.pdf
[18] https://www.linkedin.com/pulse/what-your-disaggregation-tolerance-level-dtl-csp-dsp-rajiv-papneja/?articleId=6678402852722876416
https://www.linkedin.com/pulse/what-your-dtl-csp-rajiv-papneja/?trackingId=2xZDlTd%2FcYH3A4WzfBVR9w%3D%3D

[19] https://techround.co.uk/news/bt-launches-new-dedicated-connection-home-broadband-service/

solutions for tracking and even experimented with drone deliveries[20]. Many established banking institutes sped up digital banking best practices, and notably over the top (OTT) companies have launched mobile payment solutions to support their communities[21]. Other companies and cities deployed temperature screening cameras to help communities to monitor fever outbreaks[22]. An important CSPs with a wide presence in LATAM had created a crowdsourcing app to match unemployed workers to job demands[23]. These initiatives are spot-on with the near-term focus on current CSPs' B2B2C competence areas.

CSPs now need to look at what they will do in the post-COVID-19 world. Possible products and services' scenario can see the acceleration of such offers, especially the ones with faster return of digital investment (RODI) and slow others given the constrained investment priorities and supply-chain shortages.

Networks will demand more upstream capacity to manage collaboration tools based on unicast implementation. The access networks are expensive to deploy and redesign and doing it to attend greater speeds or resiliency will drive a considerable part of CSP's investments. Fixed or converged operators must have a strategy that will look not only for the near term demands but beyond as the fiber return on investment (ROI) ranges for the next 7 to 10 years. Considering what-if scenarios, for example, if a new catastrophe takes place in 3 years from now, how would one network behave in terms of capacity, upstream and resiliency?

Also, given its cost-saving nature, the cloud has been deeply embraced by the IT world and slowly, we see cloud-native network applications becoming mature. CSPs are now discussing if and how they should leverage the public cloud capabilities, including edge computing capabilities, services, and placement.

The cases listed in this paper involve decisions that have to take place now, and if not well-strategized, they will have a long-term network effect on the CSP's business plans.

But the mother of all battles is still the same as CSPs had previous to this crisis. The transformation from CSPs to DSPs, as authors explain in section 3.3. Namely, this means being capable of responding to the changing demands of their clients, fostering and being part of larger ecosystems based on much more complex business models, offering not only connectivity but a wide spectrum of digital products and agile services, perhaps thinking beyond the borders of their own networks and infrastructure, and therefore increasing the value for their end customers, partners and shareholders.

This paper also depicts that an effective approach to transformation requires CSP's leadership teams to define a business vision and strategy, aligning the management organization, assess the present, and guide the transformation to the target state with a clear execution roadmap, re-orienting their workforce, networks, process, and tools to embrace the transformation program. This means that CSPs will need to have aligned the four pillars shown in Figure 5, being the business strategy, the key structure over which the other pillars must rest and always avoid the common misconception that if a company deploys an extra set of technologies, then digital transformation is done.

The pandemic crisis can force a sense of urgency to define and adopt the long-term business strategy and take advantage of the short-term opportunities, as proposed by Kotter. And doing it in the right way,

[20] https://www.prnewswire.com/news-releases/nations-first-emergency-drone-operation-for-hospitals-pandemic-response-launches-301065751.html
[21] https://techcrunch.com/2020/06/15/whatsapp-finally-launches-payments-starting-in-brazil/
[22] https://www.reuters.com/article/us-health-coronavirus-amazon-com-cameras/exclusive-amazon-deploys-thermal-cameras-at-warehouses-to-scan-for-fevers-faster-idUSKBN2200HT
[23] http://claro.pushdobem.com.br/novo-fluxo.html

without confusing operational efficiencies with the new business models that CSPs must generate to become DSPs.

Opportunities and the challenges are closely related and affected by these particularities such as region/country macroeconomics, strategy definitions, business models and scale, markets and competition, technologies, partnership strategies, transformation maturity, and internal cultures. Therefore, the transformation outcomes will depend on each CSP and how conservative or aggressive they move in the process, despite and exceeding the current crisis. As per the authors' experience, only a few CSPs design for a long-term strategy, leaving them prone to disruption from competitors. There are no magic recipes, short-cut solutions, or "silver bullets". Decisions will be needed with courage and an optimistic conviction that the transformation from CSP to DSP is possible.

The challenge is enormous and never-ending, like a "LONG AND WINDING ROAD"

Abbreviations

AI	artificial intelligence
BSS	business support systems
B2C	business to consumer
B2B	business to business
B2B2C	business to business to consumer
CPE	customer premises equipment
CSP	customer service provider
DSP	digital service provider
CAPEX	capital expenditure
EV/EBITDA	enterprise valuation/earnings before interest, taxes, depreciation, and amortization
GDP	gross domestic product
ICT	information and communications technology
IMF	International Monetary Fund
ISBE	International Society of Broadband Experts
IT	Information technology
LATAM	Latin America
ML	machine learning
NFV	network function virtualization
NPS	Net Promoter Score
OPEX	operational expenditure
OSS	operations support systems
OTT	over the top
RAN	radio access network
RGW	residential gateway
RODI	return of digital investment
ROC	return on capital
ROI	return of investment
SCTE	Society of Cable Telecommunications Engineers
SDN	software-defined networks
SLA	service level agreement
TCO	total cost of ownership
TTM	time to market
VPN	virtual private network

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