APCO
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TECH TRENDS REPORT

MENA 2021

TECHNOLOGY PREDICTIONS
from APCO MENA

www.apcoworldwide.com

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THE APCO MENA TECHNOLOGY PRACTICE

APCO Worldwide's Technology Practice advises a wide range of organizations in the technology industry around the globe. In the MENA region, specifica ly, APCO has worked with leading technology clients.

Our team of communication and policy experts consults on key and forward-looking technology policies, issues, and opportunities that span the MENA region's unique media landscape and distinct regulatory ecosystem. We function as true strategic partners to our clients, helping them raise their profiles through message development, campaign execution, media relations, stakeholder mapping and engagement, advisory and risk assessment, analytics and artificial intelligence, as well as crisis response, and market entry. We think globally and execute locally, drawing on an integrated network of cross-cultural strategists and practitioners to successfully service clients across markets. Our strong network of technology stakeholders includes academia, futurists, business councils, government entities, and tech companies from across the region. Our efforts help our clients maintain robust performances year on year.

THE APCO MENA TECHNOLOGY TEAM

SHARON ALVARES

SENIOR ACCOUNT DIRECTOR

Sharon Alvares is a senior account director at APCO Worldwide and oversees the Technology Practice and is based in Dubai. She has led several strategic, award winning multi-faceted campaigns and initiatives.

Prior to moving to the UAE, Ms. Alvares worked at one of India's leading PR agencies, LOWE Lintas, managing the finance portfolio. Her specialties are public affairs, corporate communications, strategic advisory, strategic communications and crisis management.

Ms. Alvares is currently pursuing a course in Public Policy from the London School of Economics and Political Science (LSE). She holds a bachelor's degree in Information Technology (BSc I.T) and an MBA in Marketing from the University of Mumbai in India.

DR. ABDULLAH H. SAHYOUN

HEAD OF AI & DIGITAL TRANSFORMATION

Abdullah Sahyoun is the head of AI & Digital Transformation at APCO Worldwide and is based in Dubai. He brings more than ten years of data analytics and artificial intelligence (AI) expertise combined with five years of project management and consulting experience. His focus lies in the integration of modern technologies into projects to create cutting-edge solutions for problems facing our clients.

Prior to joining APCO, Dr. Sahyoun worked in different areas and sectors. Starting his career conducting research in pharma/biotech companies, he then moved to lead the risk analytics and AI practice at Ernst & Young (EY) across Germany, Switzerland and Austria to deliver innovative advisory solutions to global key players in the automotive and pharmaceutical sectors.

Dr. Sahyoun is fluent in English, German and Arabic. He also speaks French on a basic level. He holds a PhD in Computer Science & Machine Learning from the University of Leipzig, Germany.

ALEXANDER M. WEGNER

ACCOUNT DIRECTOR

Alexander M. Wegner advises government clients in Saudi Arabia and the wider Arabian Gulf region on brand building and reputation management. He is a member of the GCC Crisis and Technology Practices.

Prior to joining APCO, Mr. Wegner was a project manager at Richard Attias & Associates (RA&A) where he served as technology partnerships lead for the Future Investment Initiative (FII).

Previously, Mr. Wegner worked as a communications consultant across the Arabian Gulf region and Germany, advising corporate and government clients on corporate communications, crisis communications, reputation management and digital engagement.

Mr. Wegner holds a Master of Arts in Political Theory from the University of Chicago and a Bachelor of Science in Foreign Service from Georgetown University School of Foreign Service. He is active in the Global Shapers Alumni Network at the World Economic Forum (WEF), a Fellow at the Royal Society for Arts (the RSA), and a member of the Chicago Council on Global Affairs. Mr. Wegner also supports a Kenyan social entrepreneur as a longtime One Young World Ambassador and Peer Mentor.

ABOUT APCO MENA'S TECH TRENDS REPORT! 2021

Over the past years, the MENA region has seen a significant increase in the adoption of technology as a means of powering growth but there still is plenty of underutilized potential. Prior to the pandemic, numerous developments across the region shaped the technology industry: from the adoption of 5G and policies on data privacy to investments in cloud technology and Artificial Intelligence (AI). Human experience platforms have been gaining ground and investments in digital transformation, IoT, and machine learning have been driving automation and digital transformation alike. In the private sector, this has led to a growing demand for insights about the regulatory environment in the MENA region; in the public sector, this has fueled demand for in-depth analysis and advisory on trending technologies and influential players.

Given UAE Vision 2021 and Saudi Vision 2030, as well as the proliferation of other regional strategic blueprints and initiatives—the UAE appointing the world's first Minister of AI and launching the UAE Strategy for AI in 2017; Saudi Arabia launching the Saudi Data and AI Authority (SDAIA) in 2019 to accelerate economic growth and diversification—

spurring technological progress remains high on regional agendas.

Using the latest data and analytics tools to conduct an in-depth assessment of social media conversations and online news across the region, combined with a survey of technology thought leaders, APCO MENA's technology practice, led by Sharon Alvares, Dr. Abdullah Sahyoun and Alexander M. Wegner, created a forward-looking overview of the most consequential technology trends shaping the future today—prone to impact organizations in the private, public and non-profit sectors.

EXECUTIVE SUMMARY

In preparing this report, APCO carried out extensive qualitative research and conducted interviews with thought leaders from different industries to identify the topics that professionals from across sectors and industries perceive as being critical to the bottom-line of their organizations. Based on the research and interviews conducted, we identified five ends shaping the future of the technology industry, all of which are creating opportunities and challenges for effective communication in the wake of stakeholder capitalism.

WE ARE ENTERING A NEW ERA OF MEDICINE

COMPUTING PROGRESS IS IN DANGER

THE FUTURE OF MOBILITY IS HERE

TECHNOLOGY IS REDEFINING REALITY

DISTRIBUTED CLOUDS AND SERVERLESS "SERVERS"

EXECUTIVE SUMMARY

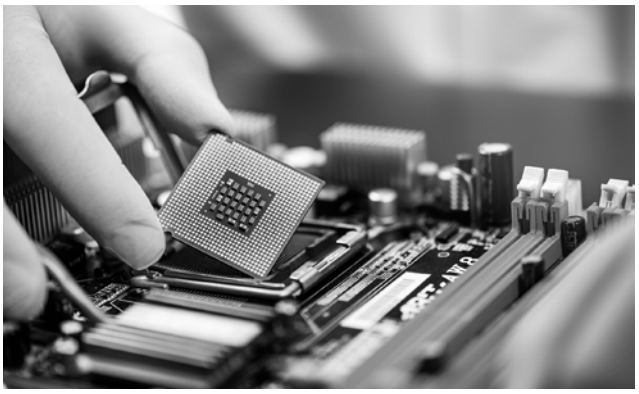
WE ARE ENTERING A NEW ERA OF MEDICINE

Hospitals and scientists are turning to new technologies to augment (and replace) human efforts. AI-driven systems are diagnosing patients faster and with greater accuracy, well before they reach the emergency room. The role of frontline care staff is being reshaped by computers that can monitor cases, analyze data and directly deliver basic care. During the pandemic, this technology has been particularly useful in maintaining social distance between staff and patients who could potentially spread the virus to those who are already ill. Perhaps most visibly, telemedicine platforms, which enable appointments to happen remotely, have witnessed a major surge in use. This trend looks set to continue as the healthcare industry deals with challenges to globalization and

increasingly isolated populations. The question now is to what extent these systems will replace, or augment, existing technologies.

COMPUTING PROGRESS IS IN DANGER

Advances in computing, which continue to be driven by Moore's Law, the notion that the number of transistors tasked to control electrical signals, doubles every two years, while both the size and cost of microchips continues to decline, are challenging the laws of physics. In fact, the cost of building fabs, factories to manufacture microchips, now amounts to billions of dollars, resulting in significant barriers to the entry and centralization of the chip-making industry. Furthermore, geopolitical developments impact the countries that are home to the three industry leaders – the United States' Intel, South Korea's Samsung, and Taiwan's TSMC – particularly, vis-à-vis China, is limiting the cooperation that innovation requires. National security and defense concerns further complicate relations between these countries. This report raises some key questions - What is



the medium-term outlook for computing? How can organizations in the chip-making industry and affi iated sectors respond to this development? In what ways can these organizations leverage marcomms to their advantage?

TECHNOLOGY IS REDEFINING REALITY

Augmented Reality (AR) and Virtual Reality (VR) are no longer confined to the gaming industry, but have found their way into a wide range of sectors. Combined with growing and ever more densely populated digital networks, AR and VR are shaping a growing, billion-dollar industry. However, experiencing AR and VR still requires screens and headsets that limit the extent of their adoption. Mixed Reality (MR), which like VR tends to require headsets and similar to AR, overlays virtual reality on physical reality, further blurs the boundaries between physical and virtual reality. As technology continues to advance, making this distinction will become increasingly harder and at one point, perhaps impossible. How does this redefined reality affect the ability of organizations to engage with customers and stakeholders?

Might MR enable organizations to better differentiate themselves from competitors in crowded digital spaces? Is the future of marcomms experiential?

THE FUTURE OF MOBILITY IS HERE

In 2019, Elon Musk—the visionary founder of electric car giant Tesla—announced his plan for one million robo-taxis on the streets by the end of 2020. Although his bold prediction did not come true, the autonomous vehicle sector (and subsequently Tesla's share price) has seen surging interest from investors and governments around the world. This is the case nowhere more so than in the UAE and KSA, where the country's desire to become a global technology powerhouse has combined with regulatory reforms to catalyze the rapid roll-out of self-driving vehicles. Yet now, despite being on the cusp of introducing Level 5 automation—vehicles which are fully capable of driving autonomously with no human intervention—with full government backing,

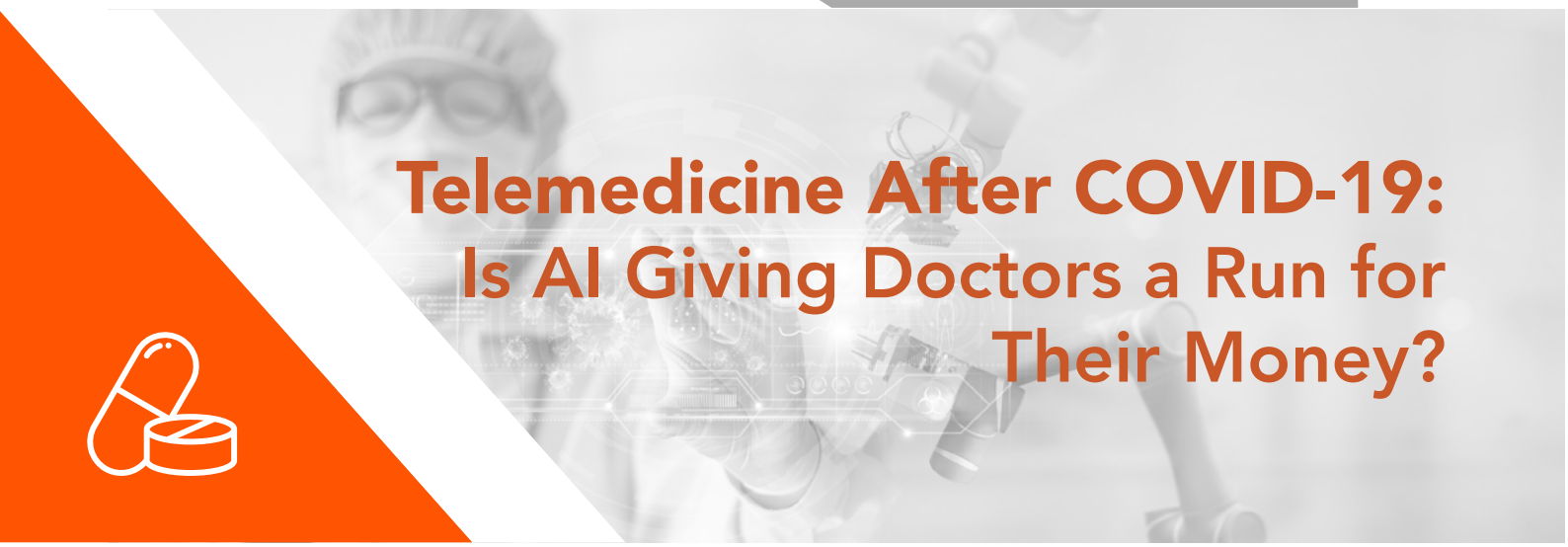
the sector faces one of its toughest challenges: the matter of morals. How will the region's regulators and consumers respond to these critical questions?

DISTRIBUTED CLOUDS AND SERVERLESS "SERVERS"

Recent advancements in cloud solutions have resulted in a profound transformation of computing. Serverless cloud provides a model in which the cloud providers dynamically allocate and charge the user for the resources that have been used to run a piece of code. Serverless cloud has been adopted widely around the world due to its scalability, pay-for-value model, and versatility, enabling companies to build more agile and innovative solutions without having to worry about infrastructure costs, time to market, maintenance, and support. You can now put your desk in the "server room." But every novel technology brings with it a set of challenges. Loss of control and oversight over the backend, security and privacy, and architecture complexity are major challenges for serverless cloud adoption. How does this technology help companies accelerate their

application deployment? What can cloud providers do to pave the way for companies to adopt these technologies? And will government institutions be involved in country-wide, data-related policies?

TRENDS



Telemedicine After COVID-19: Is AI Giving Doctors a Run for Their Money?

FACTS

The global telemedicine market is expected to reach **US $185.6 billion by 2026**

CAGR of 10.8% over the next five years in he MENA region

83% of patients expect to use telemedicine after the COVID-19 pandemic eases.

74% of millennials prefer virtual appointments to in-person visits

40% of telehealth encounters report technical issues, according to a 2020 study.

This includes poor audio **19%**
Poor video **13%**
& audio interruption **9%**

VIEWS

"Digital insurance now is a must, not a nice-to-have."

–Michelle Grosso, Democrance

"For the telecom and networks industry, understanding the expectations and requirements of stakeholders can create new opportunities for customized services and networks. This could spur the kind of telecom innovation that is going to facilitate end-to-end integration of AI-powered medical services on smart phones."

–Zakaria El Rhezaoui, Nokia

"There is an urgent need for specialist innovation or digital transformation officers at hospitals, tasked with finding process pain-points and implementing new ways of working—well before exploring technologies that could take their solutions to the next level. And, with transparency and accountability being more important than ever, medical directors should be forward-thinking and drive process efficiency; for instance, should patients be allowed to own their data? This will give patients the sense that they are in control of their own care throughout the medical journey."

–Arejie Al Shakar, Al Waha Fund of Funds

DESCRIPTION

The healthcare industry has long been a bedrock of technological advancement, driven by human desire to extend and improve the quality of life. From Rene Laennec's invention of the stethoscope in 1816 to the rapid development and rollout of a COVID-19 vaccine, development moves at an astounding pace—not least due to modern health challenges like antibiotic resistance, longer lifespans and the obesity epidemic.

Today, hospitals and scientists continue to turn to new technologies to augment (and replace) human efforts. AI-driven systems are diagnosing patients faster and with greater accuracy, well before they reach the emergency room. The role of frontline staff is being reshaped by computers that can monitor cases, analyze data and directly deliver basic care. During COVID-19, this technology has been particularly useful in maintaining social distance between staff and patients who could potentially spread the virus to those who are already ill. Perhaps most visibly, telemedicine platforms, which enable appointments to take place remotely, have witnessed a major surge in use. Now, this trend looks set to continue as the healthcare industry deals with challenges to globalization and increasingly isolated populations. The question now is to what extent these systems will replace, or augment, existing technologies.

PERCEPTIONS

Analysis of online conversations by APCO Worldwide's data team suggests that consumers in the MENA region are undecided on telemedicine. Although four times as many posts about the technology were positive than negative, the vast majority remained neutral.

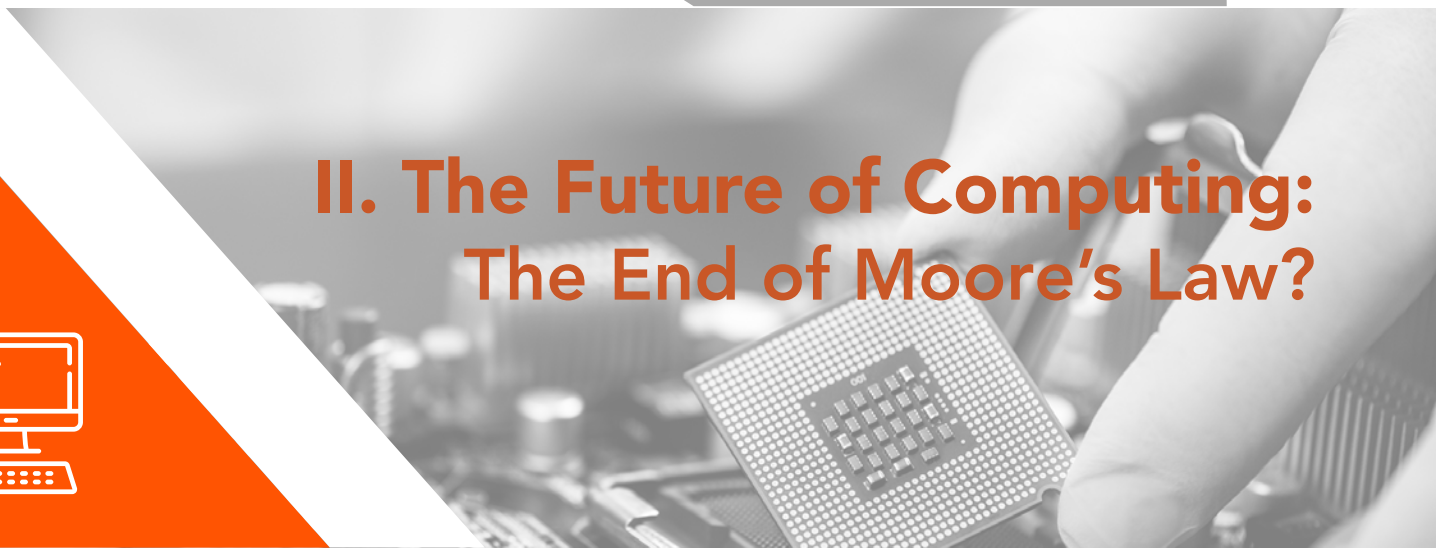
Key discussion points include ease of access to doctors at leading facilities around the world, but users were also interested in how telemedicine could enable appointments locally.

However, social media conversations tended to focus on health technology in the here and now, rather than as a solution beyond the COVID-19 pandemic.

PREDICTION

By necessity during the COVID-19 era, virtual versions of physical services have become a part of day-to-day life. Human interactions have been reduced to near-zero in a bid to comply with social distancing rules, driving the rapid digitalization of services previously thought inconvertible to the tech age. Yet while it may be convenient to receive groceries at the touch of a button, do patients really want to communicate with doctors via sometimes shaky internet calls? And can AI realistically be expected to one day deliver sometimes life-changing news and diagnoses in a compassionate way?

The reality is much more nuanced. While video appointments and robot doctors (recently introduced in the region during the COVID-19 pandemic) may already exist, the true benefits of telemedicine can be found in much more advanced areas. Take the example of remote surgery, where the physical distance between doctor and patient is bridged using robots—enabling complex procedures to happen remotely from anywhere in the globe. Many countries in the Middle East are attempting to become medical tourism hotspots by promoting cost-effective access to advanced medical care. We believe that by increasing the use of telemedicine technologies, regional nations can achieve this goal without would-be patients ever leaving their home countries—something that is paricularly important amid the current era of travel restrictions and partial deglobalization. While uptake among local customers may be sluggish, international trade will drive the growth of these platforms and subsequent interest from investors. As regional regulators adapt to the challenges posed by these new medical technologies, deft handling of stakeholders and public affairs will be ever-more critical. Time will tell if the wider Middle East market will follow the doctor's orders—whether virtual or physical.



II. The Future of Computing: The End of Moore's Law?

FACTS

The market capitalization of the world's listed chipmakers exceeds US $4 trillion	Fivefold increase since 2016
Intel, Samsung, and TSMC are the only firms capable of producing advanced chips	80% of global chipmaking capacity reside in Asia
Keeping up with Moore's Law requires significant investment in high-tech factories	- The typical cost of such a factory is between US $3 billion to US $4 billion - TSMC's 3-nanometer chips factory completed in 2020 cost US $19.5 billion
Chip manufacturers are still able to downsize chips	- As of 2021, so-called five-nanometer chip are best in class - Three-nanometer chips are expected in 2022
Geopolitical tensions between China and the US are impacting the industry	- As are domestic demands to protect and create jobs

VIEWS

"The technology of making chips—called process technology—is getting to be very expensive.

For us in the UAE, it is important to have a computing platform that we own. Ownership eliminates our dependance on x86 and ARM-based processors, enabling us to introduce features we care about, control security and resilience, and mitigate supply chain threats—especially political ones."

–Dr Shreekant Thakkar, Chief Researcher, Secure Systems Research Center, Technology Innovation Institute

DESCRIPTION

Progress in computing has been driven by Moore's Law, the 1965 notion by American engineer Gordon Moore that the number of transistors—used to control electrical signals—on an integrated circuit, or microchip, doubles every two years, while the cost of computers declines. In other words, because of a reduction in the size of transistors, Gordon anticipated the exponential growth of microprocessors, the central processing units on a microchip, fueling advances in computing. In recent years, as the size of transistors and microchips has continued to decrease, concerns have been raised about the sustainability of that development, the suspicion that this reduction in size might soon come up against the laws of physics. And, indeed, the cost of a fab, the factory producing microchips, is increasing by about 13 percent a year, and now amounts to billions of dollars, resulting in high barriers to entry and the ongoing centralization of the chip-making industry.

Aside from the laws of physics and the prohibitive cost of fabs, geopolitics is threatening Moore's Law. Given the strategic importance of microchips for national intelligence and defense, the world's largest economies have a strong interest in becoming or remaining competitive in chip-making, while beating back competition. Thus, the growing trade wars between the United States and China could lead to fierce competition in this domain too, and hamper the pace of computing progress.

PERCEPTIONS

When we analyzed conversations about computing among social media users in the Arabian Gulf region, we found that Saudi Arabia accounted for nearly 60 percent of these conversations, followed by the UAE with approximately 27 percent. Prominent topics included Saudi Arabia's newly launched Artificial Intelligence (AI) strategy and the 2020 Global AI Summit held in Riyadh.

Interestingly, there was no discussion about the prospects of Moore's Law, which attests to the fact that computing progress is taken for granted, despite the growing number of obstacles it encounters. In fact, without Moore's Law, discussions about AI, quantum computing, and other trending topics are largely meaningless; all of these depend both on transistors and microchips.

PREDICTION

We expect geopolitical tensions between the United States and China to persist under the Biden administration and suspect that these will contribute to a slowing-down of Moore's Law that will adversely affect computing progress. Because of the extent to which the microchip industry is centralized, and considering the growing, if not prohibitive, cost of building fabs, cooperation between the industry's players is going to be crucial, balancing the development of increasingly popular specialized chips with their multipurpose counterparts, which will require innovation.

In light of national security concerns, proactive communications and stakeholder engagement between chip makers and national governments as well diplomatic engagement among governments is going to be crucial. This requires an in-depth understanding of stakeholders, the industry landscape, the geopolitical context, as well as domestic voter concerns. This in turn would form a comprehensive basis for effective communications strategies, designed to deepen collaboration and mitigate the growing risk that Moore's Law will grind to a gradual, painful halt.

III. Mixed Reality: A New Era for Marcomms?

FACTS

The global Mixed Reality market is projected to reach

US $4bn by 2026

The education sector is likely to drive much of the growth

VIEWS

"The ongoing COVID-19 pandemic has changed life and work profoundly with unprecedented short- and medium-term implications. But, across countries and communities, we have taken on adversity with ingenuity, leveraging the growing volume and sophistication of science and technology to develop vaccines at record-speed, redefine the ways we work, reinvent how we engage with friends and loved ones, and much more. Without a doubt, the future will continue to be shaped by the dual force of science and technology, and, increasingly, the task at hand will be governing that force prudently, as some of its adverse effects—from Zoom fatigue to social isolation—have made abundantly clear. Having effectively risen up against this pandemic, the risks science and technology pose are anything but unsurmountable."

–Dr. Ashraf Mahate, Chief Economist Trade and Export Development, Dubai Exports

"Based on the findings of our recent 'Arab Youth Priorities' study, which surveyed 7,000 young people from 21 Arab countries, we expect that emerging hybrid-reality modes of learning, working, and communication are not only here to stay but will grow, expand, and evolve exponentially. The COVID-19 pandemic has already accelerated this development."

–Sadeq Jarrar, Acting Managing Director, Arab Youth Center

"We could not agree more with the notion that 'technology is redefining reality.' For that very reason, we have Big Data and Artificial Inte ligence (AI) programs in our pipeline and are working with industry leaders like IBM on bringing these programs to life in the corporate world."

–Andy Philips, COO, University of Wollongong Dubai

DESCRIPTION

The growing dependency on the internet and ongoing advances in technology have blurred the line between physical and virtual reality. Initially, digital content was two-dimensional, accessible via screens, but has since become three-dimensional, leveraging headsets and other devices. Whereas Virtual Reality (VR) entails a complete immersion into digital worlds, Augmented Reality (AR) overlays virtual elements on physical reality. Unlike VR, which requires users to wear a headset, AR can be experienced by viewing physical reality through a screen, be it of a mobile device or tablet. Considering the growing popularity of stakeholder capitalism, effectively reaching stakeholders is going to be paramount for organizations across sectors and industries. As digital networks become more and more populated, organizations will have to differentiate their content to spark the interest of consumers, gain their trust, and build brand loyalty. Mixed Reality will be integral to this transformation, enabling experiential communication, and disrupting marcomms practices.

PERCEPTIONS

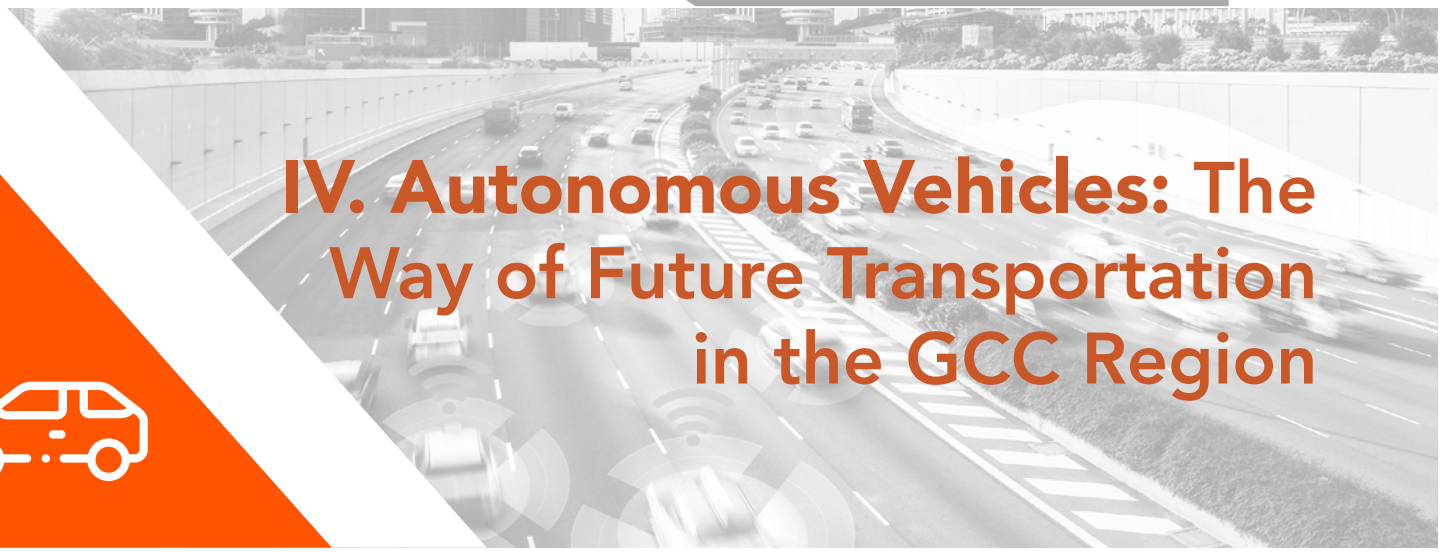
When we analyzed conversations about Mixed Reality among users in the Arabian Gulf region, we found that most users primarily associate AR, VR, and MR with the gaming industry. About 73 percent of these conversations were neutral in tone with 65 percent of them driven by users in Saudi Arabia and users in Kuwait driving 15 percent of these conversations. With respect to Saudi Arabia, users showed particular interest in Unbox CMO Saudi 2020, the first-ever dedicated virtual event for marketing, public relations, communications, and content leaders in Saudi Arabia.

Overall, awareness about the significance of AR, VR, and MR outside of the gaming industry appeared low among contributors to online conversations around these topics in the GCC. This is concerning, considering that these technologies are proliferating and will have a significant impact on marcomms for organizations across sectors and industries. Understanding consumer preferences and leveraging this understanding to effectively reach and impact key stakeholders is going to be critical for organizations who wish to differentiate themselves and maintain their competitive advantage. Thus, integrating MR into marcomms strategies is the clever way forward.

PREDICTION

We see the onset of Mixed Reality as a seismic event and expect the blurring of the boundaries between physical and virtual reality to completely transform marcomms for organizations across sectors and industries. Making effective use of social media and other digital marcomms tools will no longer be enough to enable organizations to extend and retain their customer base and stakeholder network. As digital networks become more condensed, so to speak, organizations must prioritize, first, audiovisual content and, second, experiential communication to differentiate themselves from competitors, deepen their competitive advantage and maintain brand relevance.

We expect that as stakeholder capitalism continues to take hold, the success of organizations will increasingly depend on an in-depth understanding of their customers, stakeholders and the wider market and a steadfast commitment to digital transformation. We see an increasingly uncertain future ahead.



IV. Autonomous Vehicles: The Way of Future Transportation in the GCC Region

FACTS

The World Health Organization estimates there are **50 million** car-related injuries annually.

Human error is responsible for **95%** of these cases.

The UAE plans to make a quarter of all transport autonomous by **2030**

According to McKinsey, by this year **20%** of cars sold globally will be autonomous.

Autonomous vehicle technology will result in **80%** fewer cars on the road.

VIEWS

"In the short- and medium- term future, we will increasingly see customers buying cars from innovative technology companies, as opposed to car dealerships and traditional manufacturers. Technology companies are certainly influencing he automotive industry in more ways than one. We are likely to witness the entire ecosystem transforming to support this tech adoption, as electric vehicles, autonomous vehicles, and other new-age automobiles require advanced infrastructure to thrive. In keeping with the evolving landscape, Abdul Latif Jameel Motors is committed to continuous sector innovation through integrating solutions to ensure mobility transformation and keep our customers at the cutting-edge of automotive tech."

–Munir Khoja, Managing Director, Marketing Communication, Abdul Latif Jameel Motors

"This is the decade of hyperloop! No doubt.
We will see Virgin Hyperloop commencing operations sooner than any of us can imagine. The future of hyperloop mobility is at our doorstep, not in the realm of science fiction.
Here in the Arabian Gulf region, governments are seizing the opportunity to connect cities, countries, and continents. They have the vision, the resources and the determination to make hyperloop a reality for the region and the world."

–Tim Wilkinson, Executive Director, Strategy & Growth, Virgin Hyperloop

"At UPS, we are passionate about adopting alternative fuels for our fleet, inclu ing hybrid and electric vehicles. Additionally, we have immense experience in enabling commerce around the globe, connecting and serving 220 countries, which allows us to play a key role when it comes to mobility. The transition to clean energy and technologies is a priority for both UPS and the UAE; it is also well aligned with the UAE Green Agenda 2030 and the National Climate Change Plan 2017-2050."

–Christina Struller, VP Public Affairs, Indian Subcontinent, Middle East, and Africa, UPS

"As we head into the decade of action and look to meet both the Paris Agreement climate goals and the UN's Sustainable Development Goals, the growing number of electric vehicles (EV) will have a profound impact on the carbon emissions associated with our energy systems. They hold the key to unleashing synergies between clean transport and low-carbon electricity.
In the GCC, and specifically the UAE, the ambitious economic diversification efforts underway, in parallel with the Energy Strategy 2050 mean that cleaner, greener transport options will play a central role in accelerating our energy transition."

–Her Excellency Dr. Nawal Al-Hosany, IRENA

DESCRIPTION

In 2019, Elon Musk—the visionary founder of electric car giant Tesla—announced his plan for one million robo-taxis on the streets by the end of 2020. Although his bold prediction did not come true, the autonomous vehicle sector (and subsequently Tesla's share price) has seen surging interest from investors and governments around the world.

In global indices, like KPMG's annual Autonomous Vehicles Readiness Index, the UAE and Saudi Arabia frequently rank highly among other major global players including Singapore, the Netherlands, Norway, and the United States. Nearly half of UAE residents say they would be likely to own a self-driving car in the next five years if it were available to them, while successful road tests have taken place in Masdar City and the northern emirate of Sharjah. The country's Minister of State for Artificial Intelligence, Omar Bin Sulatan Al Olama, has even suggested that Tesla would be "welcome to come and start in Dubai." Yet now, despite being on the cusp of introducing Level 5 automation—vehicles which are fully capable of driving autonomously with no human intervention—with full government backing, the sector faces one of its toughest challenges: the matter of morals.

Engineers, policymakers and professors have long been debating dilemmas that are traditionally pinned on drivers. Who should be given a ticket if an autonomous vehicle speeds—the manufacturer or the owner? More substantially, when faced with the choice during a collision situation, should a driverless car spare outside pedestrians or its own passengers? For many years, these quandaries have been pushed down the road as mere theoretical discussions to be resolved at a later date. But now, as car makers inch ever closer to full autonomy, how will the region's regulators and consumers respond to these critical questions?

PERCEPTIONS

Analysis of regional online sentiment about autonomous vehicles found that a quarter of conversations are positive – with Saudi Arabia dominating the topic (60.3 percent) followed by the UAE (29.3 percent).

These results are to be expected given the focus on developing self-driving cars in these two countries, although social media posts also show a high level of interest in global developments outside of the region (for example in China, where self-driving cars are being heavily tested).

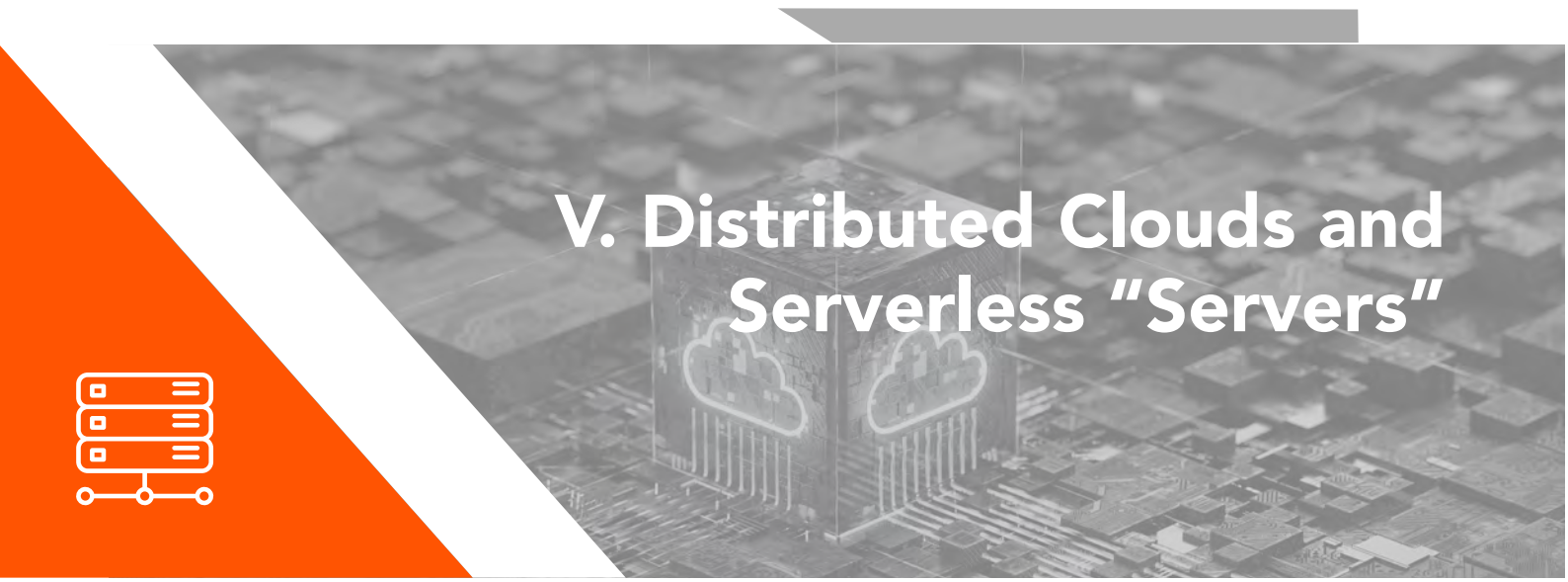
Most conversations regarding autonomous vehicles in Saudi Arabia relate to the Kingdom's technical capabilities, opportunities created by Vision 2030 and the competitiveness of the economy in welcoming tech-driven industries. The moral questions facing the sector featured in very few posts.

PREDICTION

Self-driving vehicles are not new in the region – Abu Dhabi has been testing versions of the technology for many years in the sustainable Masdar City, for example. That long-standing relationship with manufacturers and artificial intelligence experts has given Gulf governments a deep insight into the challenges that come with adoption of autonomous technology.

And self-driving vehicles are just the tip of the iceberg. Groundbreaking mobility solutions like Virgin Hyperloop have gone from idea to prototype at an astonishing pace and, following a series of successful passenger tests, are now at the brink of large-scale rollout. No longer is the Arabian Gulf region merely a testing ground; it is a blueprint for future-forward mobility solutions: from hyperloop to electric vertical take-off and landing (eVTOL) concepts.

Within the GCC, the UAE, and Saudi Arabia in particular have shown they are quick to move when it comes to pivoting regulation, accommodating frequent developments in fast-moving sectors like FinTech and blockchain. Now, to ensure a smooth start for autonomous vehicles on the region's roads, regulators must be prepared to address the complex moral challenges that come with the self-driving vehicle territory. By leading in this area, countries have an opportunity to set global precedent and become the first in the world to introduce this much-anticipated technology. We expect that it will still be years before full Level 5 autonomy is rolled out—but smaller changes (for example the automation of specific vehicle functions) will arrive much more quickly. In the long-term, once critical moral questions are addressed, back-seat driving will become the norm.



V. Distributed Clouds and Serverless "Servers"

FACTS

More than 50 percent of data generated by the enterprise business will be held and processed outside a typical single cloud or central data center environment by 2022. By 2025, this number is expected to climb as high as 75 percent to 90 percent.

More than 75 percent of global organizations are predicted to run containerized applications by 2022

The serverless architecture market is expected to be worth around $21.1 billion by 2025

VIEWS

"Cloud Computing has become critical across industries—certainly for enterprise, government, and education—and is the fastest way of deploying new applications and technologies without investing in infrastructure and having to pay for maintenance. Billions of Edge devices are going to be connected to Cloud-based systems, which we see as one of the most consequential trends in terms of the deployment and management of smart cities and autonomous transportation."

–Dr Shreekant Thakkar, Chief Researcher, Secure Systems Research Center, Technology Innovation Institute

"As the world moves toward more agile and decentralized ways of working in the wake of the pandemic, smaller services firms are well-positioned for changing markets. Today, speed and flexibility are key, not scale. Cloud-based solutions will transform how we operate and power collaboration across internal and external stakeholders."

–Christa Botha, Director, Communications Africa & the Middle East, Sage

"Distributed cloud computing, and serverless technology are the primary drivers of digital transformation and exponential growth across industries. Edge-computing will serve as the foundation of success in the smart economy."

–Spokesperson, G42 Cloud

"Companies that were only meant to transition to cloud-based solutions in three to five years had to transition in a mere six to 12 months, in order to safeguard their business."

–Michelle Grosso, Democrance

"The topic of cloud-based solutions is very relevant. Going serverless is a cloud-native development model. It enables developers to build and run applications without having to manage servers."

–Spokesperson, Alibaba Cloud

DESCRIPTION

Distributed cloud is the application of cloud computing technologies to interconnect data and applications served from multiple geographic locations. Gartner defines distributed cloud as "the distribution of public cloud services to different physical locations" and identified it as a top 10 trend for 2020.
Distributed cloud is a form of cloud services infrastructure that uses smaller, individual clouds, each with their own processing capabilities, to perform a variety of services for customers across a single network. However, ownership, operation, governance, updates, and evolution of the services remain the responsibility of the originating public cloud provider.
A distributed cloud emphasizes extending cloud services to edge devices and customer data centers. This new model provides all of the services available at a central cloud data center at the edge. It is the next generation of cloud computing and retains the advantages of cloud computing while extending the range and use cases for cloud.

Adopting a distributed cloud architecture has the following benefits and enterprises must give it serious thought:

- Ensures better bandwidth and less latency due to the advantage of having smaller cloud service processing units closer to the user source
- Ensures compliance with local data regulations and policies
- Enhances data security
- Offers redundancy in the case of emergencies
- Improves performance and customer experience
- Supports innovative technology due to better processing power
- Offers centralized control with local processing

PERCEPTIONS

The conversations around serverless clouds that are discussed in the region have been thoroughly analyzed using various AI techniques. This analysis showed us that KSA and the UAE are dominating the conversational landscape where major players in the cloud computing market have been mentioned, e.g., Oracle, Microsoft, and Alibaba with a tendency towards hybrid clouds as the future of cloud trends in the region and an emphasis on Saudi Arabia working towards being a hub for cloud computing technologies in the region. Most of these discussions are driven by the recent investments and projects of Alibaba and Oracle in the Kingdom. In addition, Qatar and Oman have been mentioned in some of the conversations as well. Most notable is the fact that Oman Data Park has been mentioned for the third time in a row in the Gartner Hype Cycle for IT under Public Cloud Computing. Nevertheless, many of the discussions were also around the understanding of the difference between private and public clouds and the different features that each one provides in terms of flexibility, availability, security and cost savings.

PREDICTION

Distributed cloud will help enterprises seeking new opportunities to reach customers in dispersed environments and needing location-specific services with reduced latency. Performance and security in the age of IoT and AI, are primary concerns and requirements, and a distributed cloud architecture offers enhanced levels of both. By managing data across several smaller clouds, enterprises can ensure lesser disruption to their business in the event of a cyber-attack while improved performance enables faster and smarter decision making.
Flexibility, cost efficiencies and scalability are key factors in today's world, where remote working or hybrid working models are gaining traction. IT is the backbone of most businesses today and securely and reliably managing enterprise IT infrastructure are ever growing challenges which can be successfully mitigated through distributed cloud solutions.
Governments globally and some in the region, especially in the space of defense, finance, education as well as big conglomerates are spending and investing huge sums of money in virtualization infrastructure. We anticipate this becoming a priority given the huge technological shift in processes and work the past year.
For the reasons stated above and more, 2021 will certainly see enterprises diving headfirst into the distributed cloud. That being said, certain geographies in the region have yet to set a framework of policies and regulations in protecting data, streamline data privacy across sectors and tighten laws and policies around cyber-security for cloud-based companies to have a safer environment to operate in.

CONCLUSION

As the volume of knowledge and the sophistication of science and technology increase, while the systems we build become more intricate, navigating a changing world is going to be more challenging than ever before in human history. For an advisory and advocacy communications consultancy like APCO Worldwide this means thinking as much about solutions to the range of challenges our clients encounter, as about the medium- and long-term questions that contribute to building a future-forward organization today, equipped for success tomorrow.

This report was an exercise in active listening: to our clients, to organizations across sectors and industries, to leading experts, and to the broader public. In listening to their views, priorities, aspirations, and concerns, we challenged our own assumptions about the state-of-affairs and trends likely to have the most profound impact on life and work in years to come.

You might not walk away from this report with a recipe for how to capitalize on the opportunities and mitigate the challenges your organization is facing. But we hope that you will walk away with a sense of wonder and a set of questions that will inform your day-to-day decision-making and the strategy of your organization in relation to the technology landscape.

We are not in the business of philosophy, but the philosopher Martin Buber once wrote: "All journeys have secret destinations of which the traveler is unaware." And while it might be true that both as individuals and organizations, we might never know our ultimate destination, we do have an obligation in this age of stakeholder capitalism, to take seriously the journey, listening to those impacted by our work, asking the kinds of questions that drive innovation and creative disruption, and embracing agility at a time when the world changes more rapidly than we can comprehend and react to. Growing calls for inclusivity are an asset, not a liability.

Effective communication is integral to organizations striving to succeed tomorrow, better enabling them to grasp what lies ahead, to leverage what is unfolding, and to learn from what has been. In that sense, not data, but attention is the new oil, fueling internal adaptation to the ever-next normal, and fostering the sustainability of brand awareness and loyalty. At APCO Worldwide we are keen to build future-proof partnerships with organizations across the board and hope this report acts as a question mark, as a conversation starter. Stay curious. Be bold!

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