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THE ARAB WORLD ONLINE 2017

Digital Transformations and Societal Trends
in the Age of the 4th Industrial Revolution

In Collaboration With:





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Introduction - The Digital Arab World in 2020

How will the existence of one billion personal “Internet of Things” devices in 2021 affect Arab societies? What economic impact will 26.7 billion dollars of online monthly spending in the Arab region have? In 2021 how will 100% mobile penetration and 80% social media penetration rates in the Arab region transform the way people do business and interact with governments? These are some of the growth figures projected in this report based on the analysis of a decade of data related to information and communication technologies growth in the Arab region, as well as a current regional survey examining online usage trends, perceptions and concerns around a new breed of digital transformations in the Arab region.

By 2021, less than 4 years from 2017, it is projected that 47 million new internet users, 45 million new mobile broadband users and around 160 million new social media users will come online in the Arab region. Today, a new tidal wave of digital-age transformation is triggering historic societal changes across the Arab region. The main drivers of these radical changes are the rapid and large-scale digitization—and datafication—of Arab societies, the rise of smart cities implementations, the maturity of cognitive government approaches and the expanding impact of the “Fourth Industrial Revolution” (4IR)¹.

In the Arab world, many of these transformations are changing how societies in the region interact, how economies move and how governments deliver services, develop policies, interact with the public and address challenges of development in the digital age. One of the key societal ramifications of the 4th industrial revolution is the ongoing fusion of people’s physical and virtual lives and identities. Today, the digital traces of public behaviours, practices, preferences, sentiments and lifestyle trends, are not just a reflection of societies’ online or “virtual” tendencies. For a fast-growing generation of connected “millennials” in the Arab region, they are sometimes becoming more representative of actual “real-life” preferences, perceptions and practices. Businesses and governments across the region are taking note and are no longer overlooking the emerging online trends of individuals and societies in our region. This is evident in the maturity and adoption of big data-driven approaches in public policy formulation, the industrial-scale implementations of numerous artificial intelligence-operated technologies across business and government spectrum around the region, and most importantly the increased readiness and acceptance of these transformations by societies in the region. Within this context, it is critical for policymakers and business leaders to understand the societal trends, perceptions, behaviours and concerns of the public around the region. The euphoric fast-paced advancements that usually accompany new digital transformations have in the past led to numerous developmental and economic challenges. They have also triggered numerous ethical and societal dilemmas that drove policymakers scrambling to formulate policies, create regulations and put in place interventions and nudges to adapt to unpredicted changes in their societies and markets. This is evident in how the Arab region is still struggling with generational and gender-based digital divides, more than two decades after the introduction of the internet. Today, the Arab region stands at another milestone where a critical mass of the population have embraced advanced internet applications in every facet of life.

While there are numerous studies exploring business and government digital transformations and trends, there is a dearth of studies exploring the implications for these transformations on Arab societies. This report, a third in a pioneering series of regional studies on societal digital transformation in the Arab region, aims to draw a comprehensive picture of many aspects the Arab World’s next phase of digital transformation. It examines a wide spectrum of societal perceptions, preferences, practices and concerns related to a new breed of digital technologies related to the 4IR. Hence, the objective of this report is to inform policymakers and business decision makers in the Arab region on the scope

1. The definitions of the terms used in this report, including the 4th industrial revolution, artificial intelligence, smart cities, Internet of Things, among many others are provided in the Annex section.

and scale of these societal transformations. By doing so, it aims to contribute to evidence-based policy responses by governments, support business decision-making, and eventually contribute to efforts towards development and growth of the Arab knowledge economy in the ongoing era of the “4th Industrial Revolution” (4IR).

The Arab World’s Decade of Digital Transformation: 2010-2020

Twenty-six years ago, the world’s first ever website went “online”². At the time, few people in the Arab world had access to the early web and its predecessors of internet networks. Since then, a critical mass of people in the Arab region have embraced the internet in every aspect of life, connecting through hundreds of millions of devices to businesses, governments and to each other within their societies, and beyond. During this period, the ways people interacted, traded, socialized and consumed information, media and knowledge in the region changed dramatically, creating multiple waves of societal, cultural and economic transformations. These transformations affected economies, countries and government in the region, and beyond. They also widely affected how governments deliver services and formulate policies, and how they perceive and interact with citizens, changing traditional governance approaches in the region forever. Likewise, these changes also transformed the public’s expectations from, and the modes of interaction with their governments. During this period, the numerous digital technologies, applications and information channels grew at different scales, within variety of scopes, and with multifaceted impact. This growth was largely slow moving during the early part of the internet’s life in the region in the 1980s, 1990s and 2000s. However, it is in this decade that internet adoption by the public, businesses and governments has reached high levels of maturity in the region, creating critical masses of connected citizens, communities and customers, and triggering multiple tipping points. In this decade of digital transformation in the region, the Arab World stands at a critical juncture, where the internet is driving three interconnected waves of change:

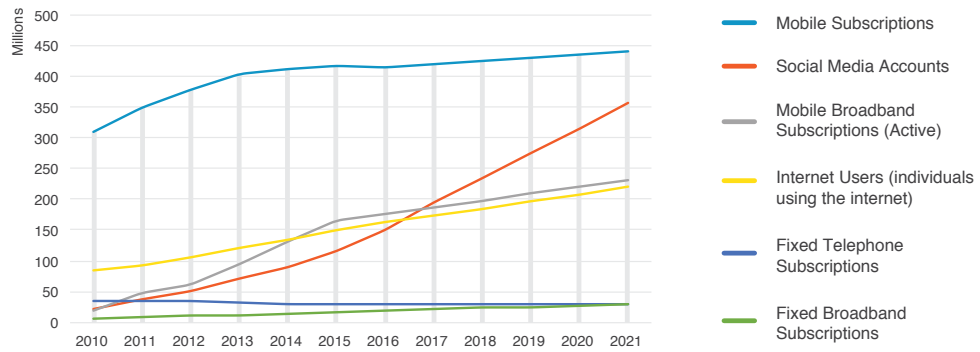
1. A developmental juncture: The emergence of an online critical mass of 173 million interconnected people online today is creating new opportunities for economic growth, development, information flows, as well as cultural and societal exchanges,
2. A demographic tipping point: The millennial generation of “digital natives”, with its universal embrace for digitization, increasingly driving business opportunities and growth, acquiring more leadership positions in businesses and governments around the region, and becoming the driving force within most regional labour markets. Globally, 70% of the online community is comprised of youth. ³In the Arab world, nearly 65% of those using the internet are young people between 15 and 24 years old.
3. A governmental paradigmatic shift, where an increasing number of governments in the region are reaching advanced levels of digital maturity and adoption, and acquiring high level of sophistication and capacity for internet governance and digital transformation.

Today, despite the numerous economic and developmental challenges, as well as violent conflicts and political tensions in the region, this critical mass of the population has become almost universally connected to the internet in an increasing number of countries. For example, in 2017 there are three countries with more than 90% internet penetration and 12 countries with more than 100% mobile phone penetration rates. According to our estimates, by 2020, usage of the internet is expected to reach universal adoption levels in at least 7 countries in the region.

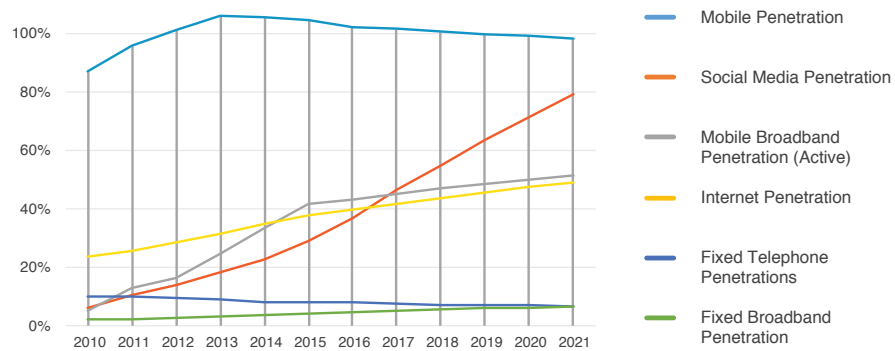
2. The first webpage was made available online on 6th of August 1992. A copy is available on the first “website” under the World Wide Web project: <http://info.cern.ch/hypertext>

3. ITU 2017

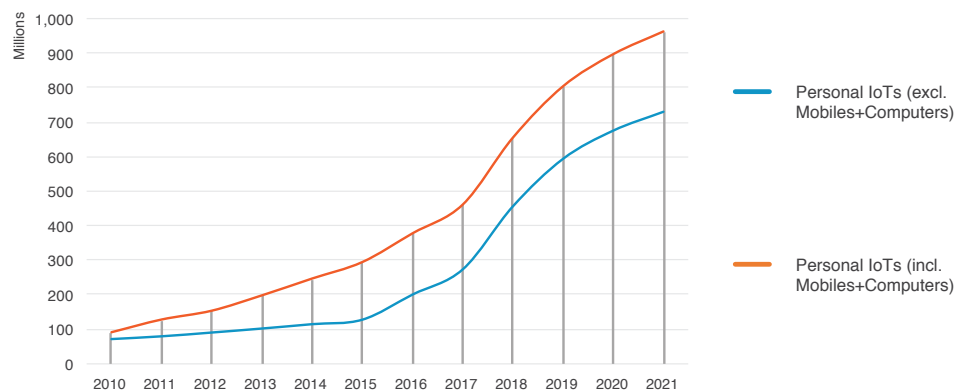
ICT Usage Growth in the Arab World 2010-2021



ICT Penetration in the Arab World 2010-2021



Personal Internet of Things (IoT) Growth in the Arab World 2010-2021



	Cumulative Growth (2010-2020)	2010 (million)	2017 (million)	2020 (million)
Fixed Telephone Growth 2010 - 2020	-13.9%	34	29.7	29.8
Mobile Subscriptions Growth 2010-2020	40.7%	309	420	435
Internet Users Growth 2010-2020	148.9%	83.5	173	208
Fixed Broadband Growth 2010-2020	308.7%	6.6	20	27
IoT devices (personal)	866.4%	87	459	896
Mobile Broadband Growth 2010-2020	1,132.9%	17.8	186.4	220
Social Media Growth 2010-2020	1,373.2%	21.3	193	314

Sources: IoT data is based on analysis of survey data (N=~20K) and ITU 2017 data - Telecom usage data are calculated based on data from ITU (2010-2017) – Social media growth data is based on data from the Arab Social Media Report 2017.

Why do these numbers matter? One reason is development and growth. The United Nation's 2030 agenda for achieving the sustainable development goals (SDGs) embeds the use of information and communication technologies (ICTs) as key components within its roadmaps for achieving a considerable portion of these goals. Forward-looking estimates here aim to provide regional policymakers, businesses and the information society at large with data estimates that may help in identifying policy challenges, gaps, and responses⁴. However, while the datasets and survey findings presented here and the forward-looking projections point to wide-scale digital transformations in the region—something evident in urban life, education, healthcare, economic activities and governance across the Arab region—there are still numerous barriers blocking societies in the region from achieving their full potential and taking advantage of the many opportunities presented by the fourth industrial revolution era. These challenges are highlighted in the survey findings based on public views by internet users around the region.

Population of the Arab World

By the end of 2017, the overall population of the 22 countries of Arab World would have surpassed 414 million. It is projected to reach 440 million by 2020.

Population Growth Rates: By 2020, the population of the Arab World would have grown by around 23% in a decade since 2010. Between 2010 and 2017, the Arab World's population has been growing at an average rate of 2.3% annually, a growth rate projected to continue until 2020.

4. The projections provided here are based on quantitative analysis of established longitudinal ICT developmental indicators and a series of mass surveys run across the region in 2016 and 2017.

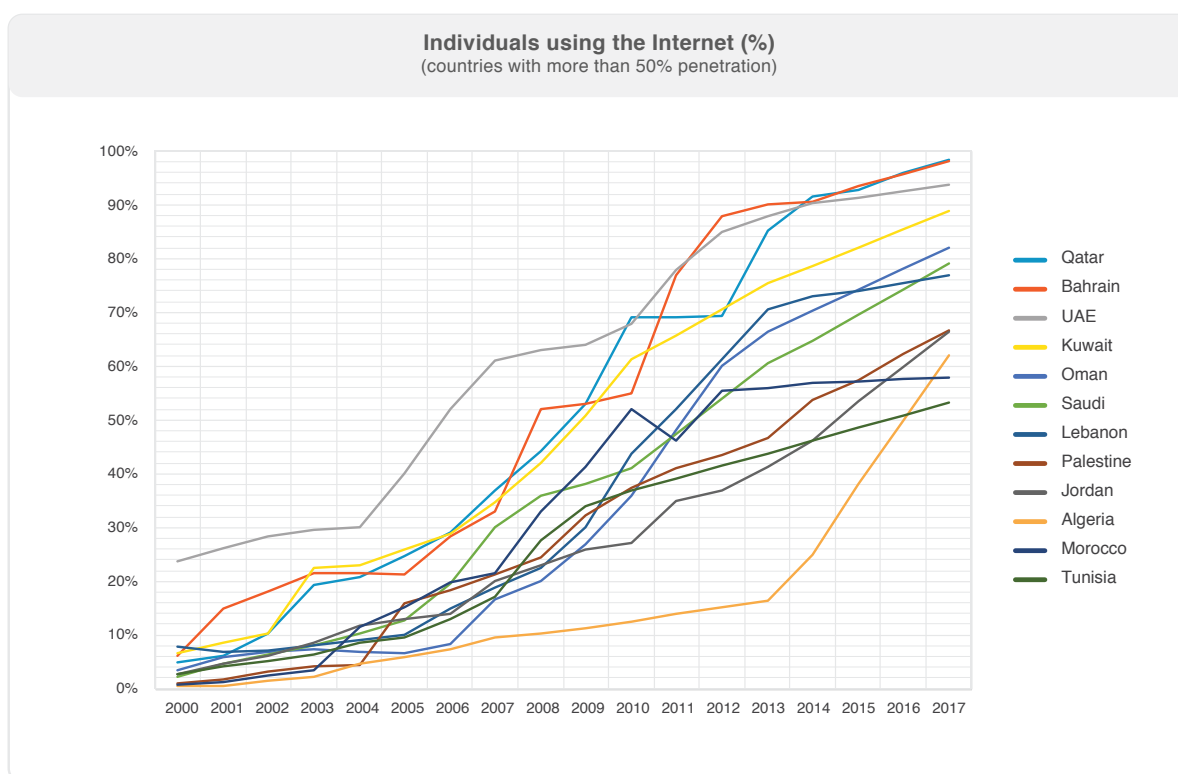
Connectivity and ICT Adoption in the Arab Region in 2017

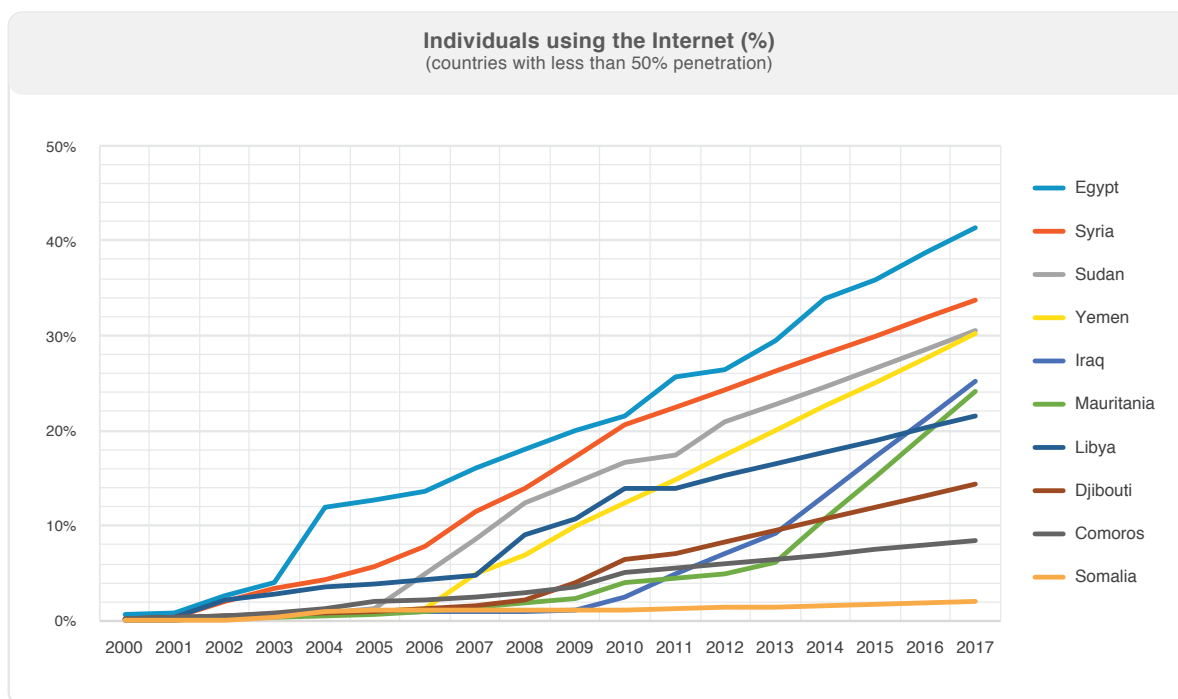
• Internet Penetration:

- By 2017, the penetration of internet users in the Arab region reached 42% of the population. By 2020, it is projected that one in every two Arabs (or around 49% of the population) will be using the internet.

• Internet Users:

- Today, there are around 173 million internet users in the Arab region. By 2020, the number of individuals using the internet in the Arab region is expected to exceed 208 million.





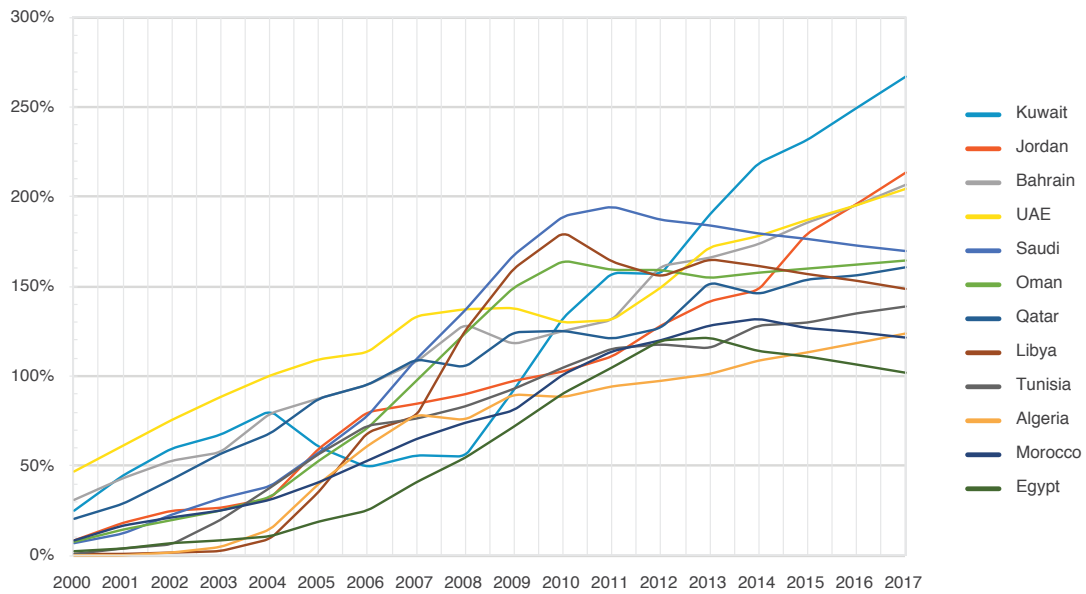
- **Mobile Penetration:**

- Today, mobile phone penetration rates in the Arab world reached saturation at 101%, and it is projected to plateau around the same level of penetration rates until 2020.

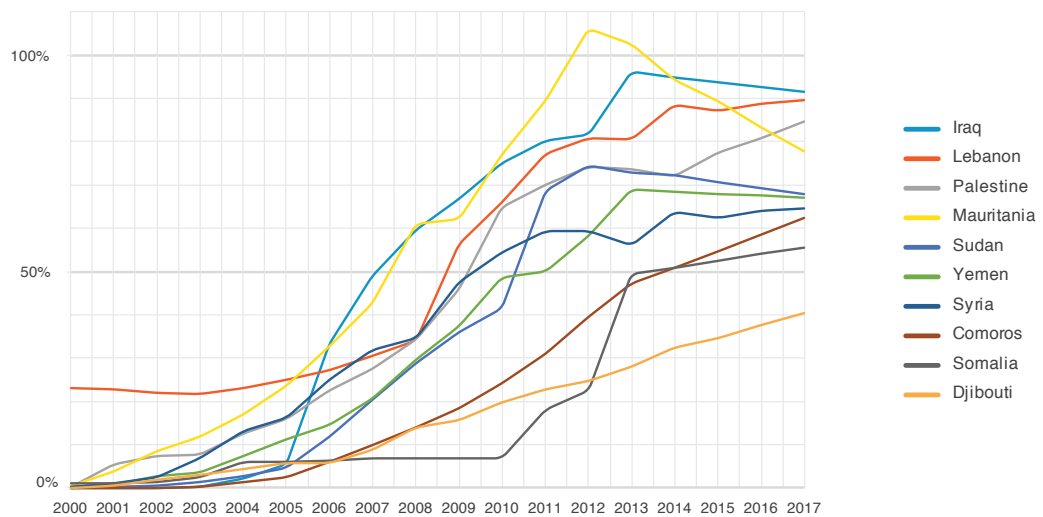
- **Mobile Subscriptions:**

- Back in 2012, the number of mobile subscriptions in the Arab region surpassed the number of people living in the region for the first time. In 2017, the number of mobile subscriptions has surpassed 420 million.
- Today, there are 5.7 million more mobile subscriptions in the Arab region than there are people.
- By 2020, mobile phone subscriptions in the region are estimated to surpass 435 million subscriptions. This is excluding other devices connected to the internet through mobile subscriptions, such as personal IoT devices.

Mobile Subscriptions in the Arab World
(countries with more than 100% penetration rate)



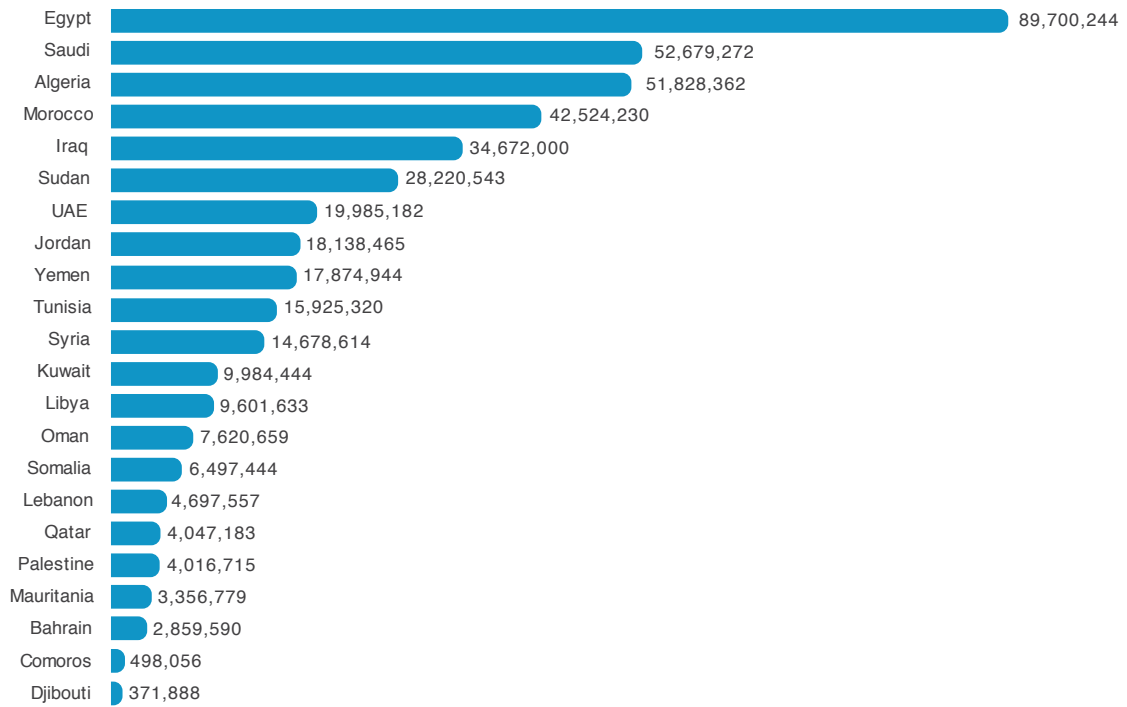
Mobile Subscriptions in the Arab World
(countries with less than 100% penetration rate)



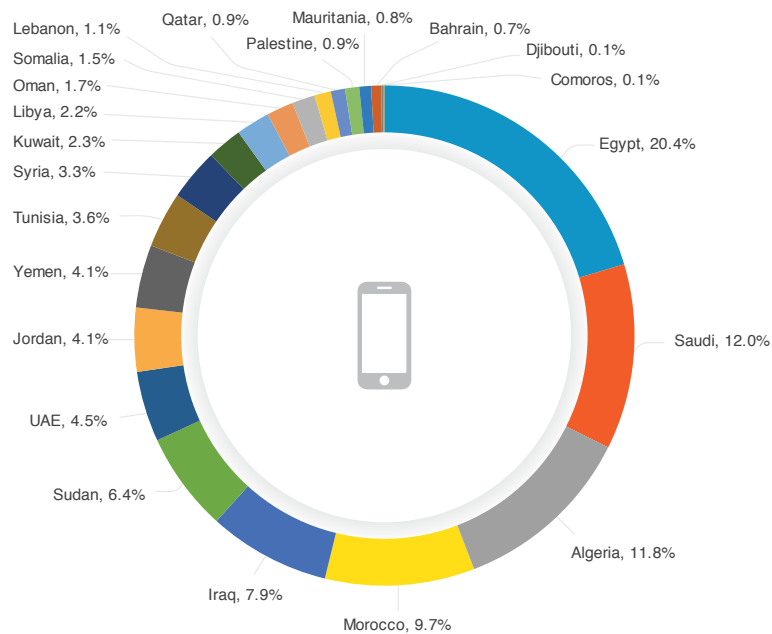
- Mobile Growth:**

- The year-on-year usage growth of mobile subscriptions in the Arab world is projected to slow down to 1.2% in 2020, a significant drop from around the 12% annual growth rate back in 2010. This indicates that the region may have come close to the saturation of mobile phone subscriptions.

Number of Mobile subscriptions in the Arab World 2017



Distribution of Mobile Subscriptions in the Arab World



- **Broadband**

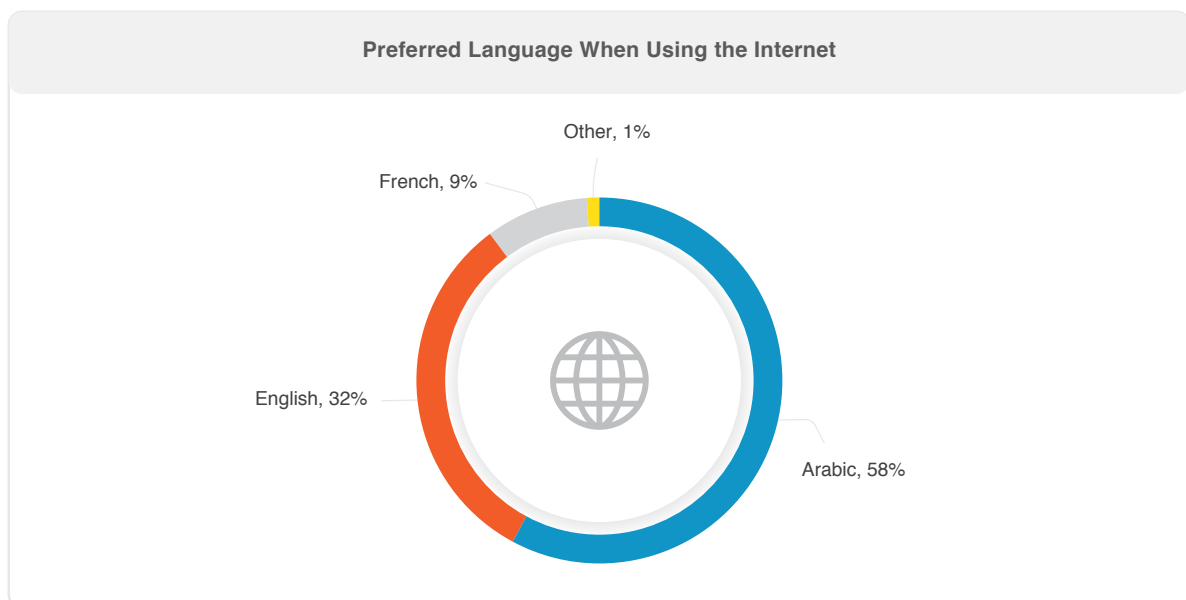
- **Fixed Broadband Penetration:** The penetration of fixed broadband has increased from less than 2% in 2010 to 5% in 2017. It is expected to reach 6.2% in 2020.
- **Mobile Broadband Penetration:** The story of mobile broadband is different. The penetration rate of mobile broadband subscribers has boomed from 5% in 2010 to almost 47% in 2017. This number is expected to grow to almost 50% in 2020. This makes mobile broadband connections to the internet one of the fastest growing channels for digital connectivity in the region.
- **Mobile Broadband Subscriptions:** The number of mobile broadband subscriptions grew from 17.8 million in 2010 to reach 186.5 million in 2017. It is expected to continue to reach 220 million in 2020.

- **Fixed telephone lines**

- Fixed telephone subscription continue to be in decline. The number of land telephone subscriptions has dropped in the region from 34 million in 2010 to 29 million in 2020. Its penetration rate in the region will drop from almost 10% in 2010 to around 6.7% in 2020. This slowing trend is an indicator that telecom connectivity is becoming predominantly mobile.

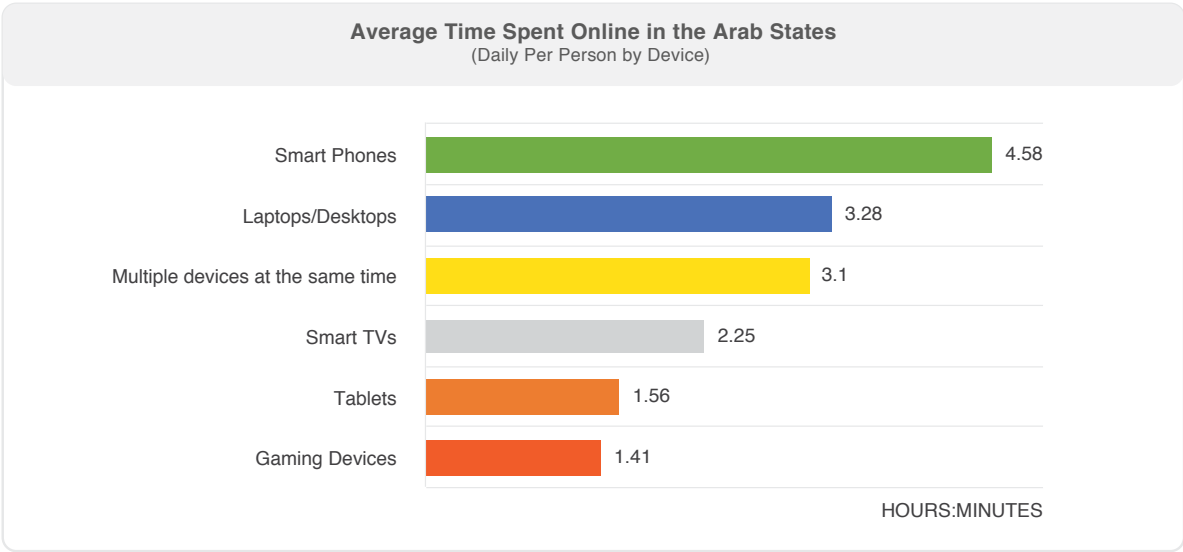
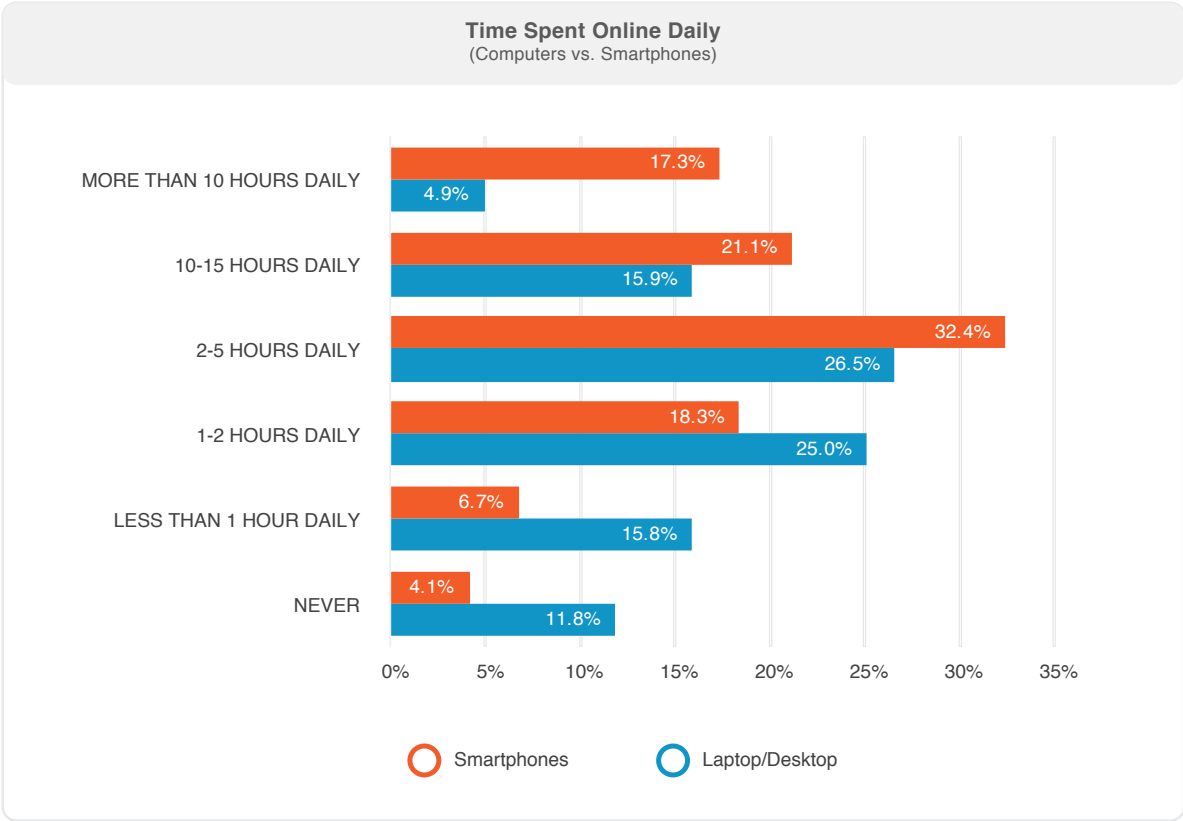
Online Trends and Behaviours in the Arab World in 2017

- **Arabic Language Online:** Arabic is the preferred language for the majority of internet users in the region. However, only 58% of respondents reported that they prefer to browse or consume content in Arabic while online. Meanwhile, 32% of internet users in the region prefer English, 9% prefer French (mostly in North African countries) and 1% prefer to browse in other languages.

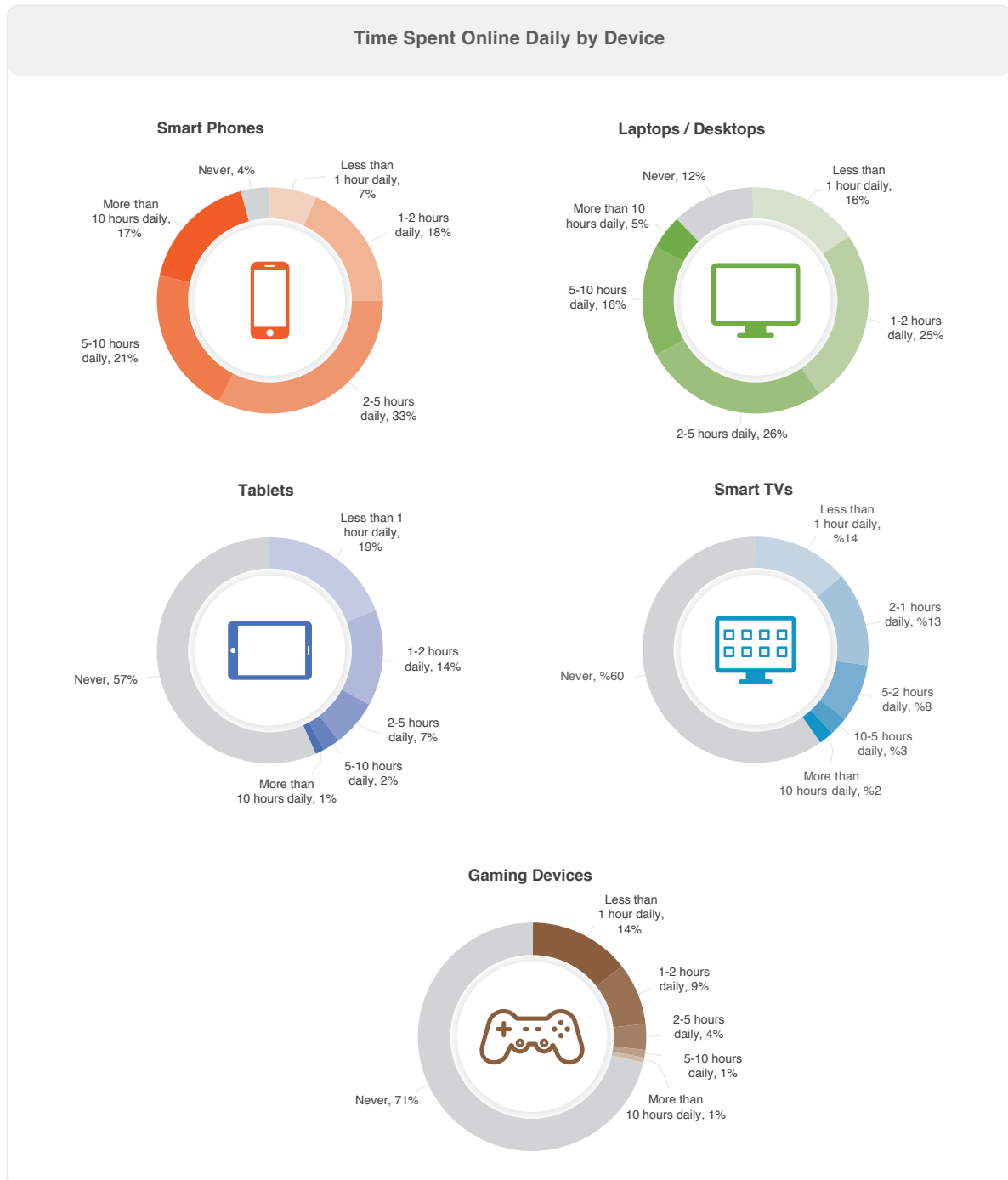


The smart phone today is the most popular point of access to the Internet for majority of Arab users

- **Devices and Time:** The smart phone today is the most popular point of access to the Internet for majority of Arab users. Phones have surpassed desktop or laptop computers in terms of time spent accessing the internet in the Arab World daily. Overall, people spend more hours on their phones accessing the internet, compared to time spent online through laptops, desktop, tablet computers and gaming consoles combined.

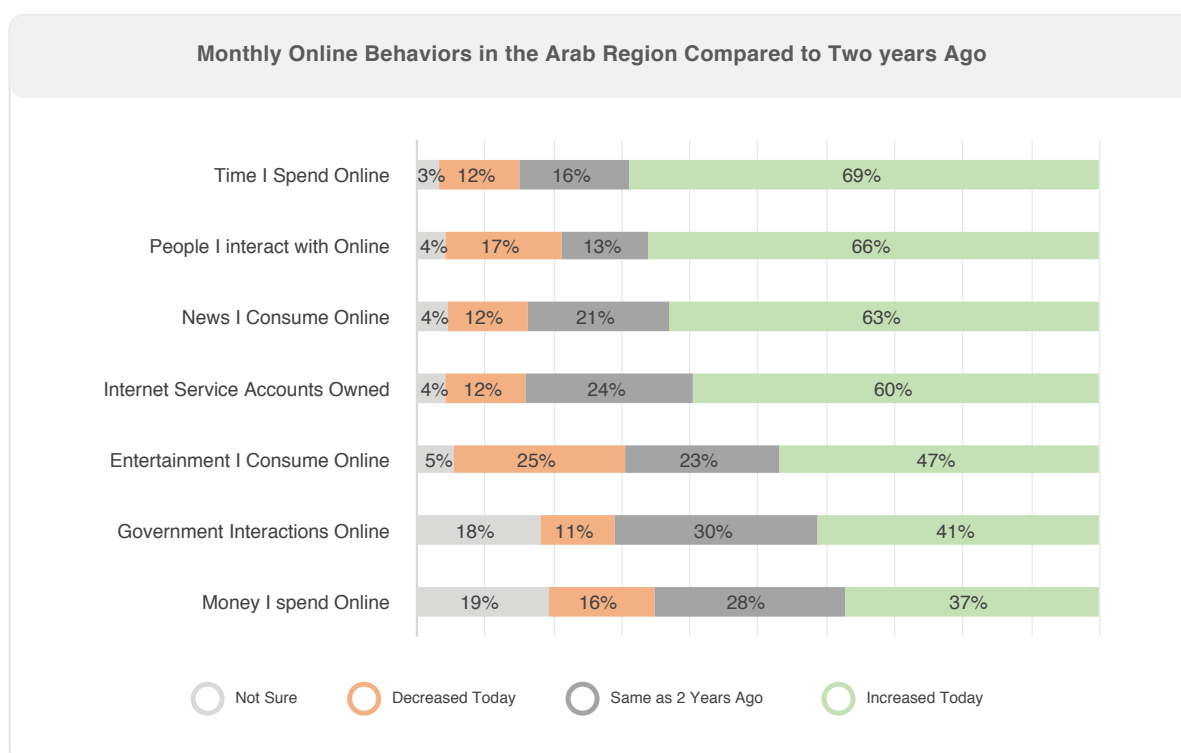


- **Smart Phones vs. Computers:** More than 70% of people in the region spend 2 or more hours online on their internet-connected phones, compared to 47% spending the same time using their computers (laptops and desktops), with 17.3% spending more than 10 hours online through their phones on daily basis.

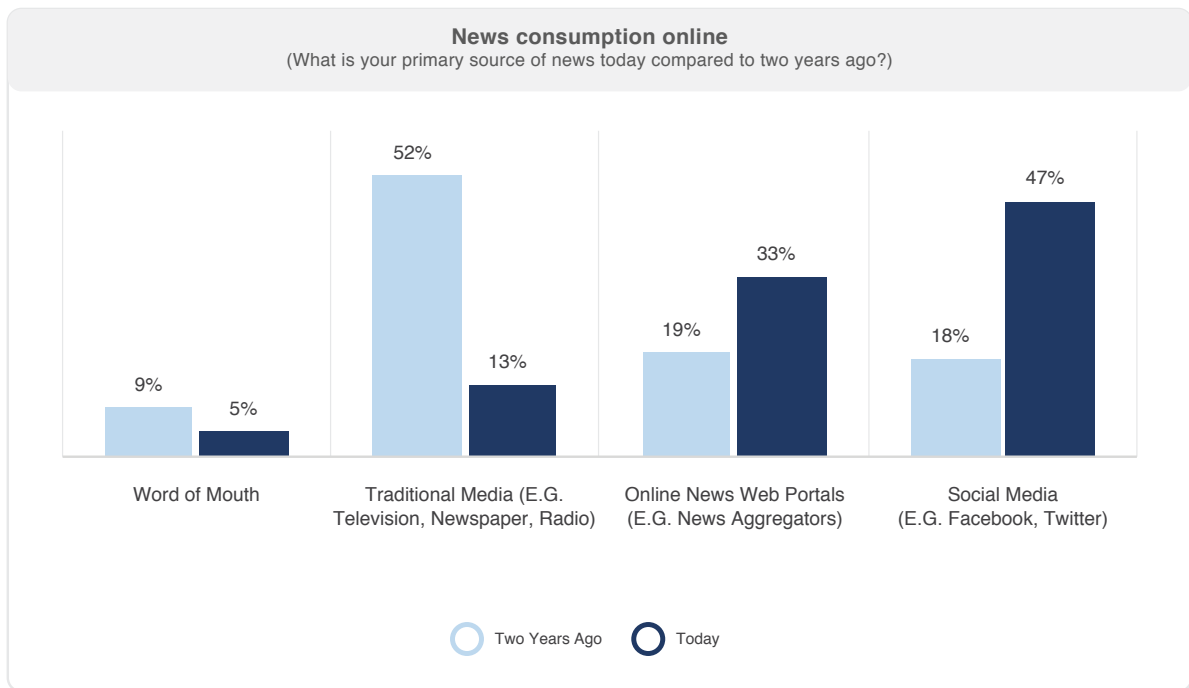


Convergence between Virtual and Real lives in the Arab World

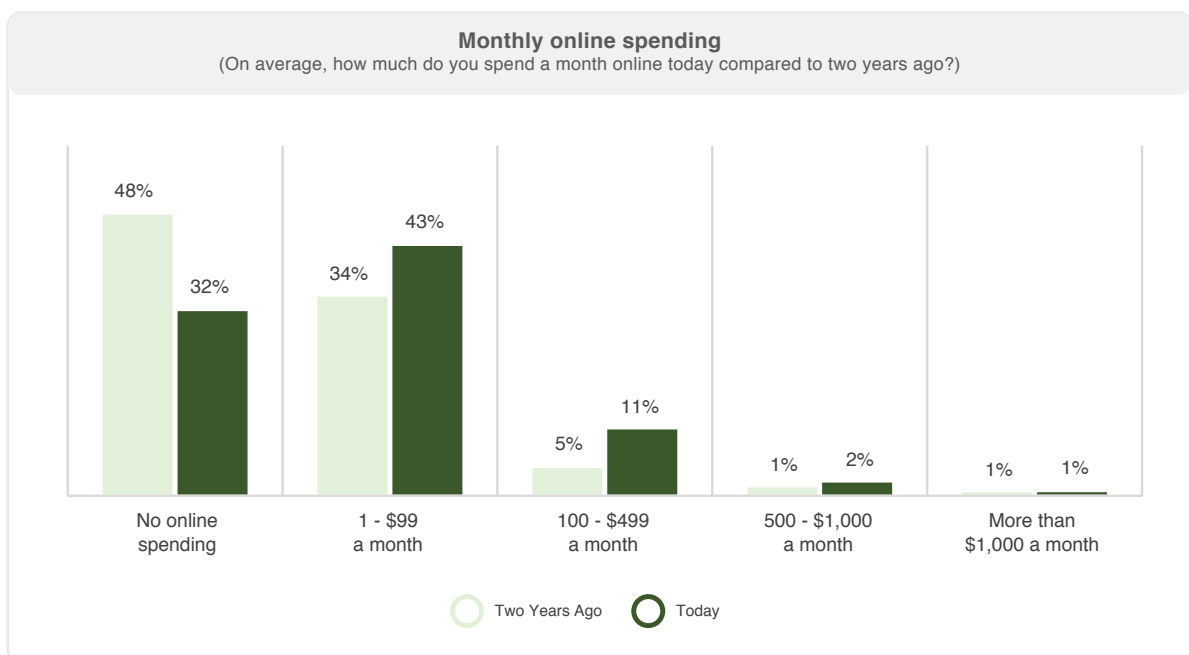
- **Online Behaviours - Today Compared to Two Years Ago:** Overall, there is a clear growth in people's online activities in the region. There is a growth in time, money and people interactions online, as well as in the consumption of news, entertainment and interactions with government



- **Time Online:** According to our survey respondents, 69% of internet users in the Arab world said that they have increased the time they spend online today compared to two years ago (12% saying that the time spent online has decreased, and for 16% it remained the same).
- **People Online:** Likewise, 66% said that they are interacting with more people online today compared to two years ago (13% saying that the time spent online has decreased, and for 17% it remained the same).
- **News Consumption Online:** Around two thirds of internet users in the region (63%) said that they have increased their online news consumption compared to two years ago (12% saying that the time spent online has decreased, and for 21% it remained the same).



- Digital Government Interactions:** Around 41% of internet users in the Arab region have increased their online interactions with governments over the internet (11% saying that the time spent online has decreased, and for 30% it remained the same).
- Online Spending:**
 - Monthly Spending Online:** On average, according to the survey respondents, the average internet user in the Arab region spends around 74 dollars monthly online through the different online venues, up from around 44 dollars monthly two years ago.



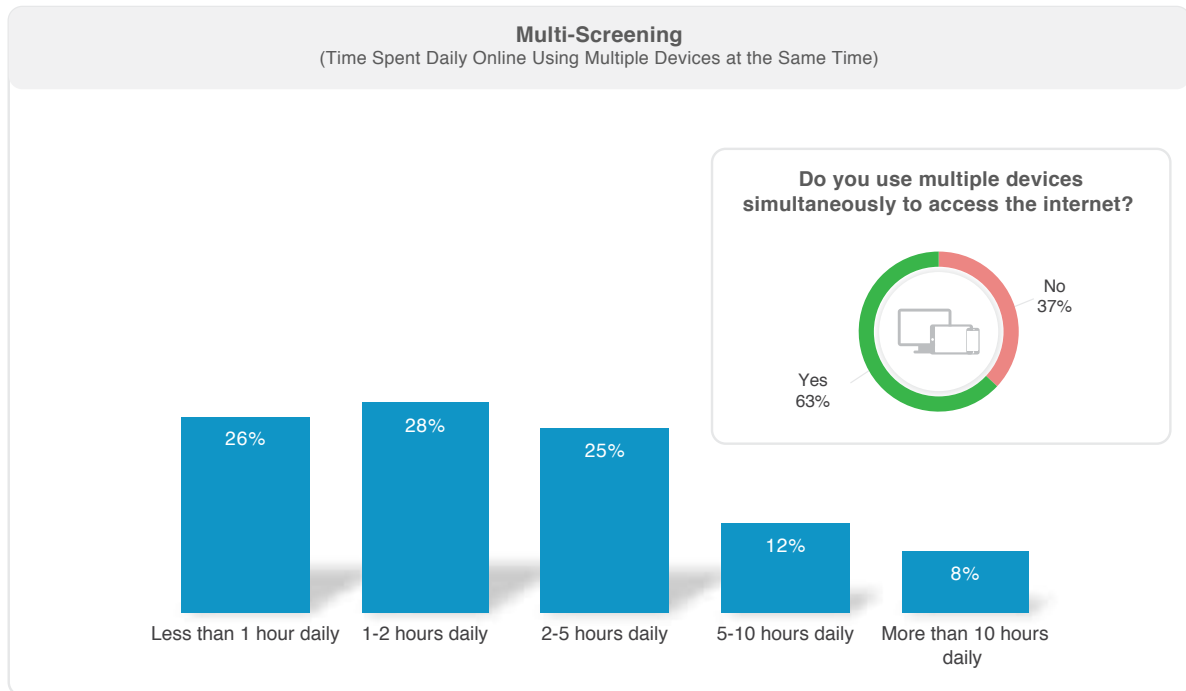
Estimated online monthly spending has increased from 2.7 billion dollars two years ago, to 7.3 billion dollars today

- Average Regional Spending Online:** Collectively, the estimated online monthly spending has increased from 2.7 billion to 7.3 billion dollars compared to two years earlier. This is based on average online spending habits of the percentage of internet users who said that they spend money online, on purchases, subscriptions, etc. as reported by our survey respondents.



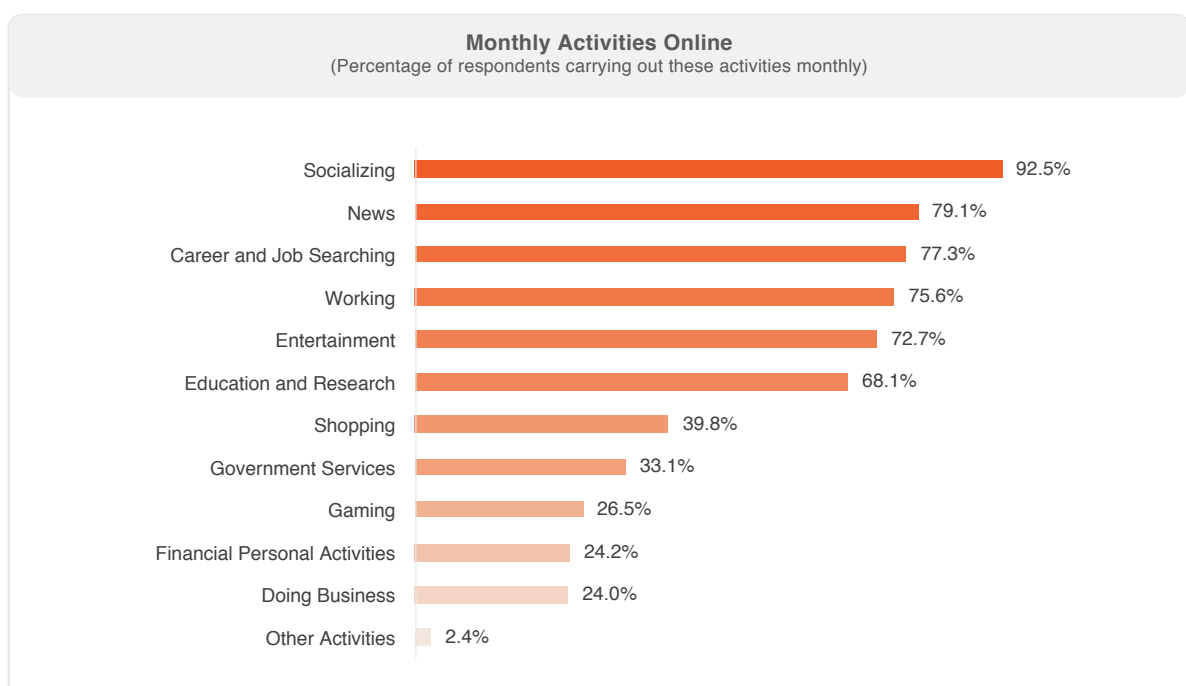
- Number of People Spending Online:** The number of people who said they spend money online has increased by 16 percentage points during the past two years according to our survey. Around half of internet users in the Arab region (48%) said that two years ago they did not use to spend money online. Today, only 32% said that they still do not spend money online.
- Growth of Spenders Online:** More than a third of internet users in the Arab region (37%) said that they have increased their online spending over the internet today compared to two years ago (16% saying that the time spent online has decreased, and for 28% it remained the same).

• Multi-screening:



- Around 63% of Arabs use the internet through multiple devices (more than one device) at the same time. For example, by browsing the Internet on a laptop, communicating through WhatsApp, and watching streaming video on Smart TVs at the same time.
- On average, people in the Arab region spend 2 hours a day accessing the internet through two or more devices at the same time.

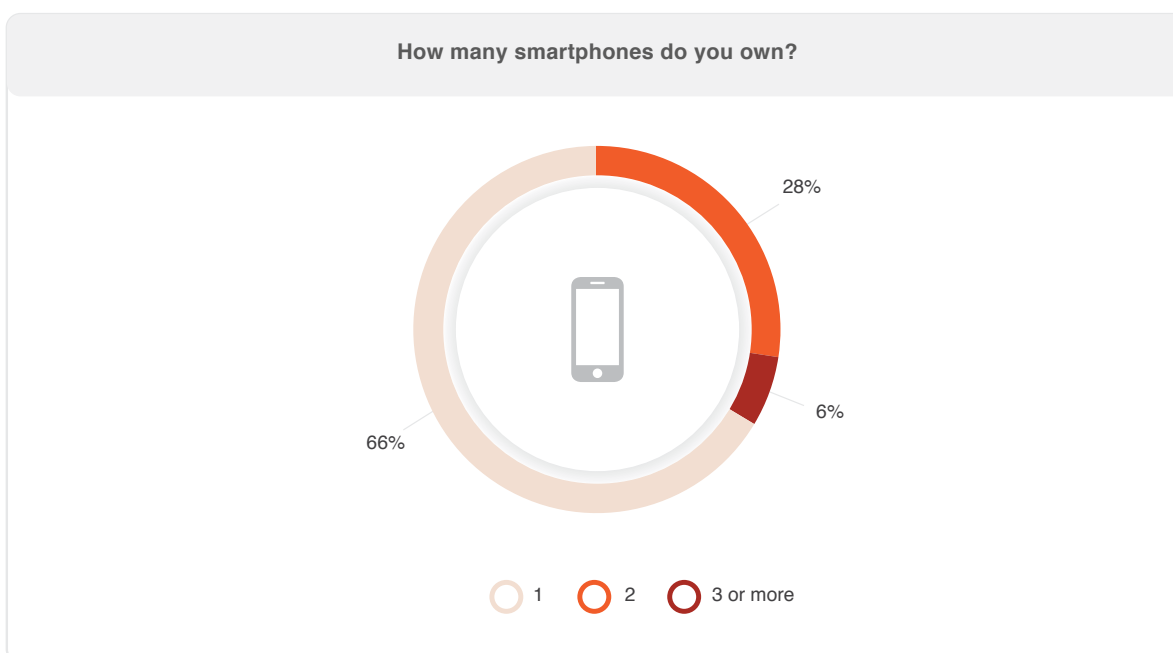
• Monthly Online Activities in the Arab Region:



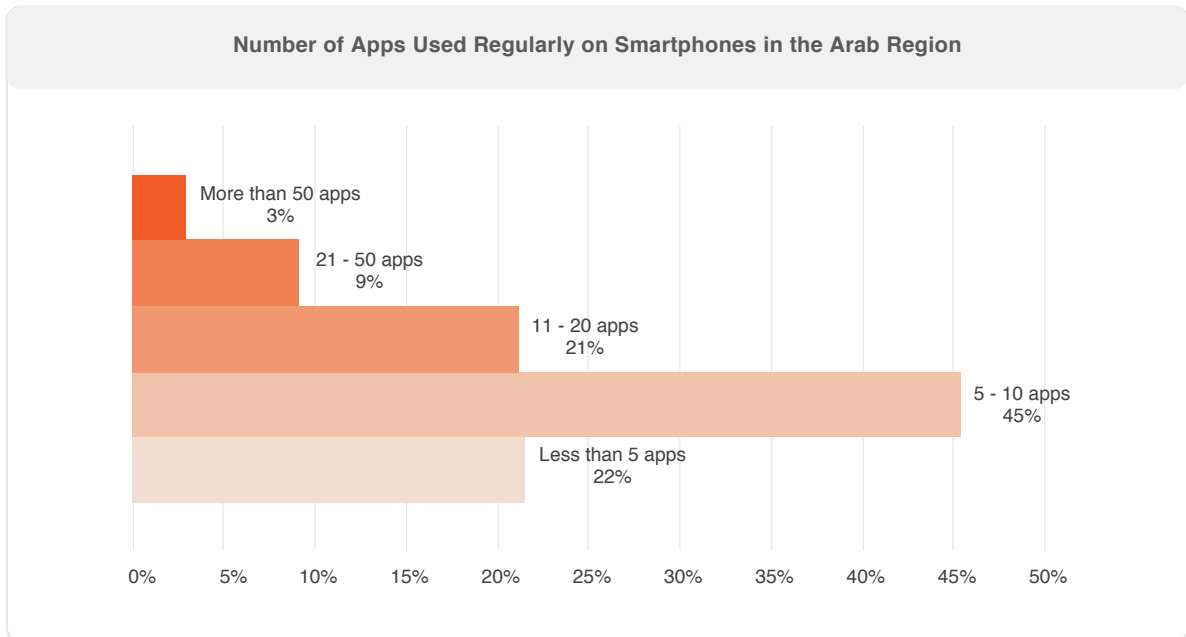
- **Socializing:** The internet is almost universally used to fulfil social needs by internet users in the Arab region. This includes socializing and communicating with friends, families and others. More than 92% of respondents use the use the internet for socializing on monthly basis, making it by far, the most popular online behaviour.
- **News:** News consumptions is the second most popular activity online. Around 79% of people said that they consume news online on monthly basis.
- **Jobs, Career and Work:** Around 77% of internet users in the region use the internet for career-oriented goals on monthly basis, such as sharing their CVs, submitting job applications or updating their bios online. Similarly, around 76% use the internet monthly for their work activities
- **Entertainment:** Consuming music, video and multimedia online is practiced monthly by 72% of internet users. Meanwhile, 26% use the internet monthly for gaming purposes.
- **Educational and Research Activities:** Around 68% of internet users perform educational activities monthly online, including researching, taking online courses, etc.
- **Government Services:** Only 33% of internet users in the region use online government services online on monthly basis.
- **E-Commerce:** Around 40% of respondents across the region said that they do online shopping and retail activities at least once a month.
- **Financial transactions:** Only 24% of respondents in the region perform personal financial transactions online on monthly basis, and another 24% perform business-related transactions, such as trading, selling or buying.

The Apps Economy

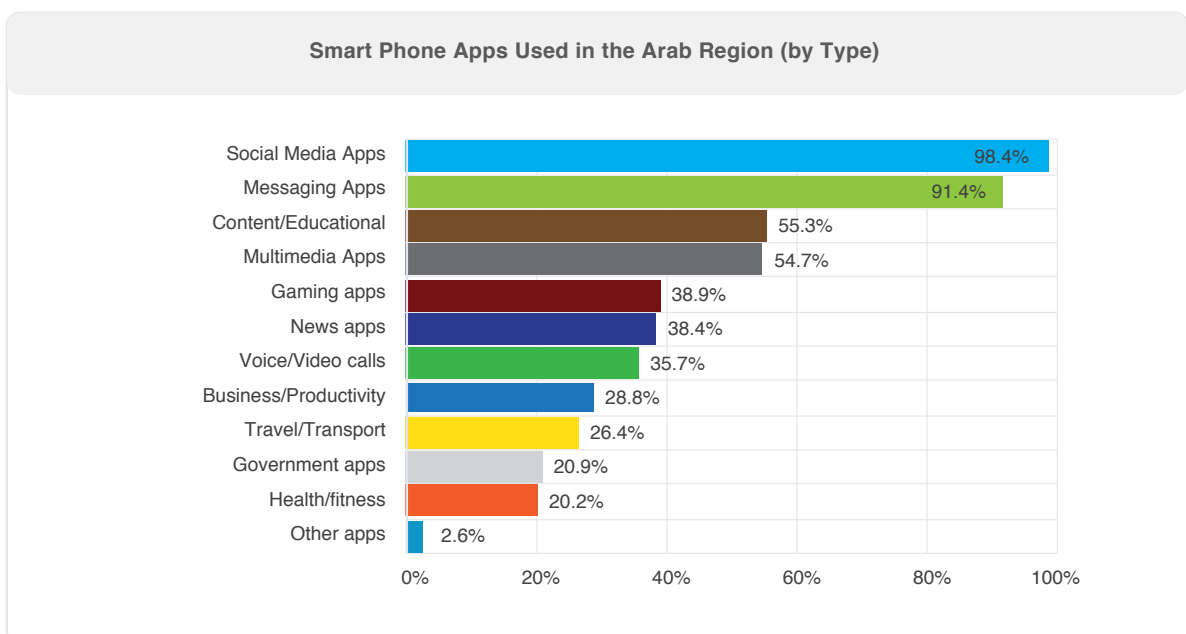
- **Smart Phones Ownership:** More than 66% of respondents own one smart phone, among those who said that they own smart phones. Around 28% said that they own two smart phone devices, and 6% said they own 3 or more smartphone devices. In comparison, there are 206 million mobile broadband subscriptions in the Arab region in 2017.



- Number of Apps used by Smart Phone Users:** Around 45% of smart phone users in the region use 5-10 apps on regular basis, while 21% use 11-20 apps regularly (a similar percentage use less than 5 apps regularly), and 9% use 21-50 apps, and only 3% use more than 50 apps regularly.



- Average Number of Apps by a Smart Phone User:** On average, the smart phone user in the Arab region uses 12 apps on regular basis.
- Most Used Apps:** Almost every smart phone user uses at least one social media app (98%) in the Arab region, and 9 out of 10 (91%) users use an instant messaging apps. These two types are the most used by smart phones owners in the region by a far margin. Educational and content apps came third (55% of users), followed loosely by multimedia apps (54%). Gaming, news and voice/video calling apps are used by a third of smart phone users.

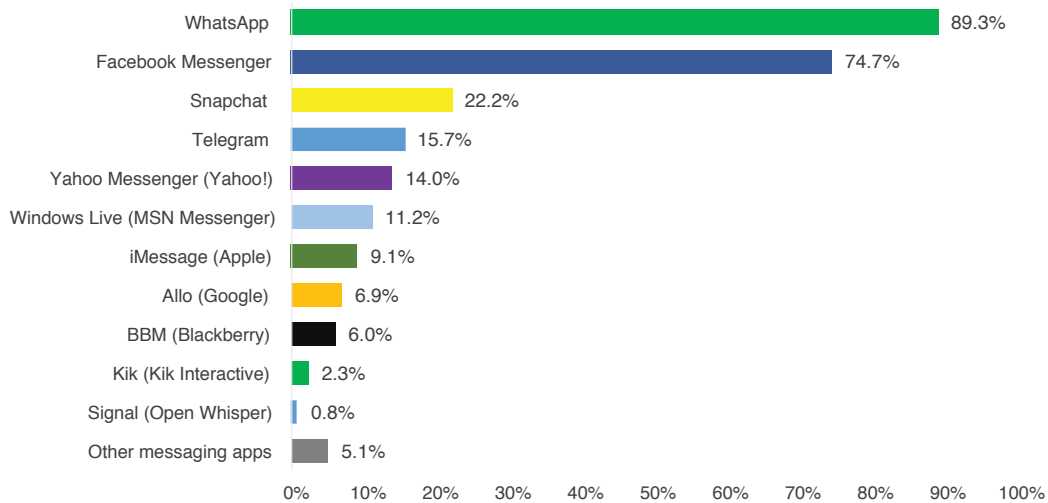


Instant Messaging Apps

Whatsapp (89%) and Facebook Messenger (74%) are by far the two most used instant messaging apps by internet users. Snapchat comes far at third place with 22% of users

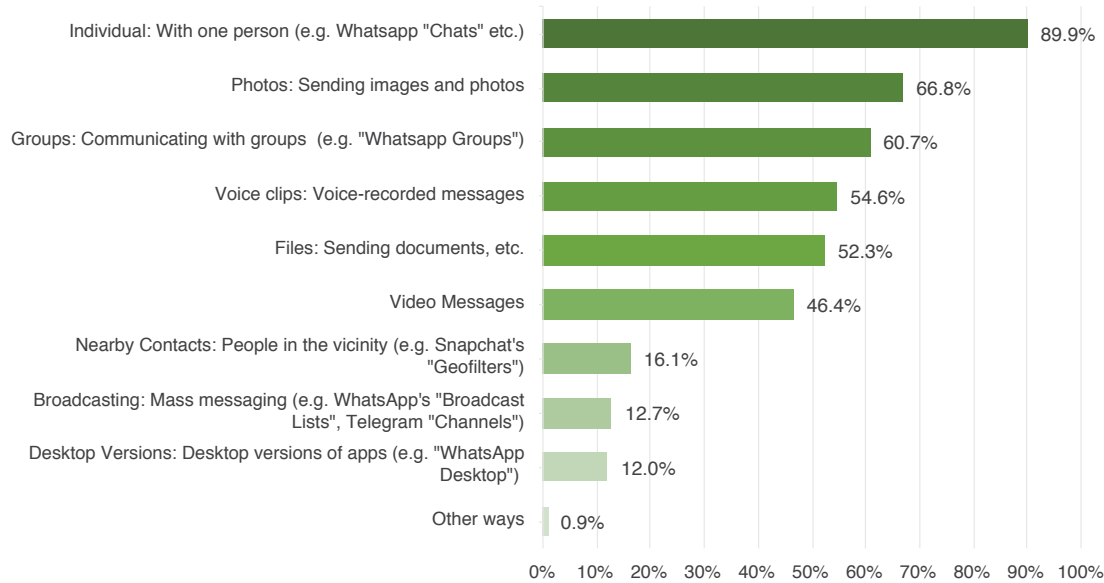
- **Most Used Instant Messaging Apps:** Whatsapp (89%) and Facebook Messenger (74%) are by far the two most used instant messaging apps by internet users. Snapchat comes far at third place with 22% of users, followed by Telegram (15%), Yahoo Messenger (14%) and Windows Live (11%). Other messaging apps such as Apple's iMessage and Google's Allo and Blackberry's BBM come next below 10% each.

Messaging Apps Used on Smart Phones in the Arab World 2017



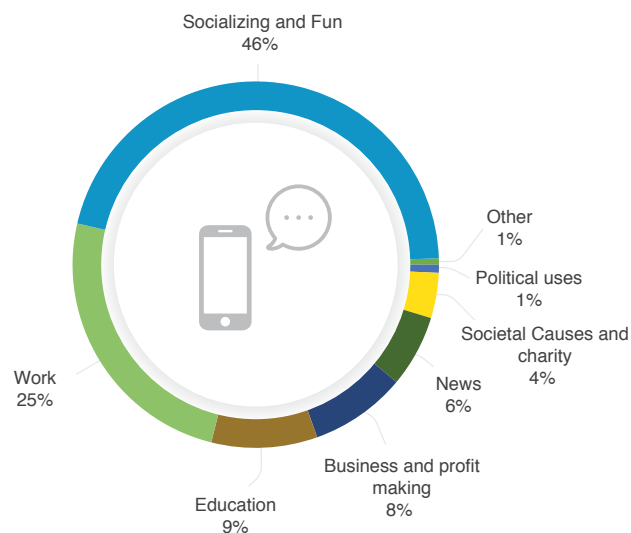
- **Methods of Communication on Instant Messaging Apps:** Instant messaging apps are mostly used for individual communication. 9 out of 10 users (90%) use messaging apps to communicate with a single user. This is followed by photos sharing (66%), group communication (60%) and voice clips (54%).

Messaging Apps Uses in the Arab World 2017



- **Primary Reasons for Using Instant Messaging Apps:** Around half (46%) of Arab users of instant messaging apps do so to socialize and have fun. 25% primarily use for work, 9% for educational purposes, and 8% use messaging apps to generate income and profit.

Primary Reason for Using Messaging Apps in the Arab World

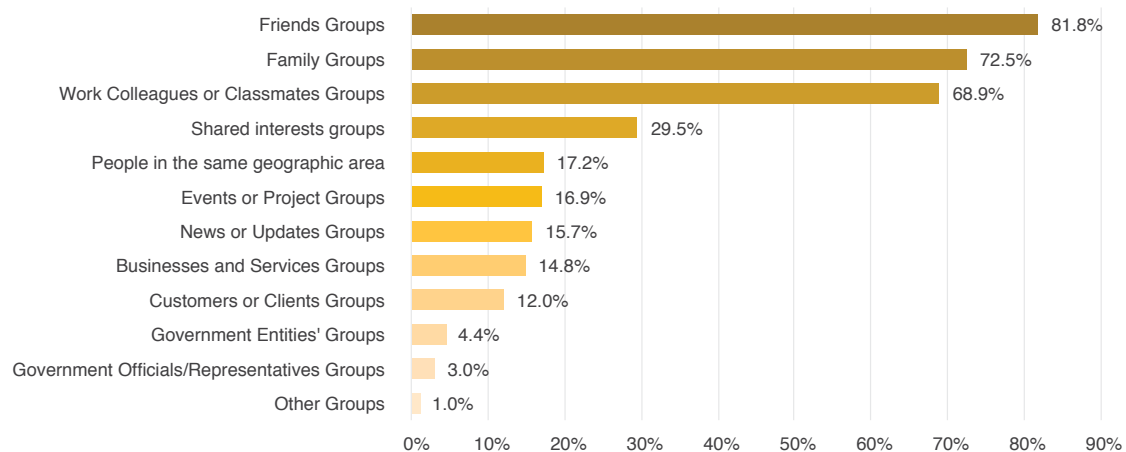


- **Uses of Groups in Instant Messaging Apps:** Out of those who use group communication on instant messaging apps, 8 out of 10 communicate with friends. Family groups come next with 72% of users stating that are part of groups with their families on instant messaging apps.

Around 69% of instant messaging users in the region are members and users of groups dedicated to work-related matters

- **Work Groups in Instant Messaging Apps:** Around 69% of instant messaging users in the region are members and users of groups dedicated to work-related matters. Around 14% use groups on instant messaging apps for business-related matters, 12% for customer service.
- **Government Groups in Instant Messaging Apps:** Only 4% of users said that they use instant messaging groups to communicate within groups dedicated for government entities, and 3% are parts of groups related to government official or representative.

Groups Usage on Messaging Apps in the Arab World



- **Encryption on Messaging Apps:** Most instant messaging apps today are equipped with high levels of peer-to-peer encryption which supposedly provide secure communications. Two thirds of instant messaging apps (68%) users said that they do feel more secure on encrypted messaging apps. However, 29% said that encryption didn't change how they feel on the level of security on messaging apps.

Encryption on Messaging Apps

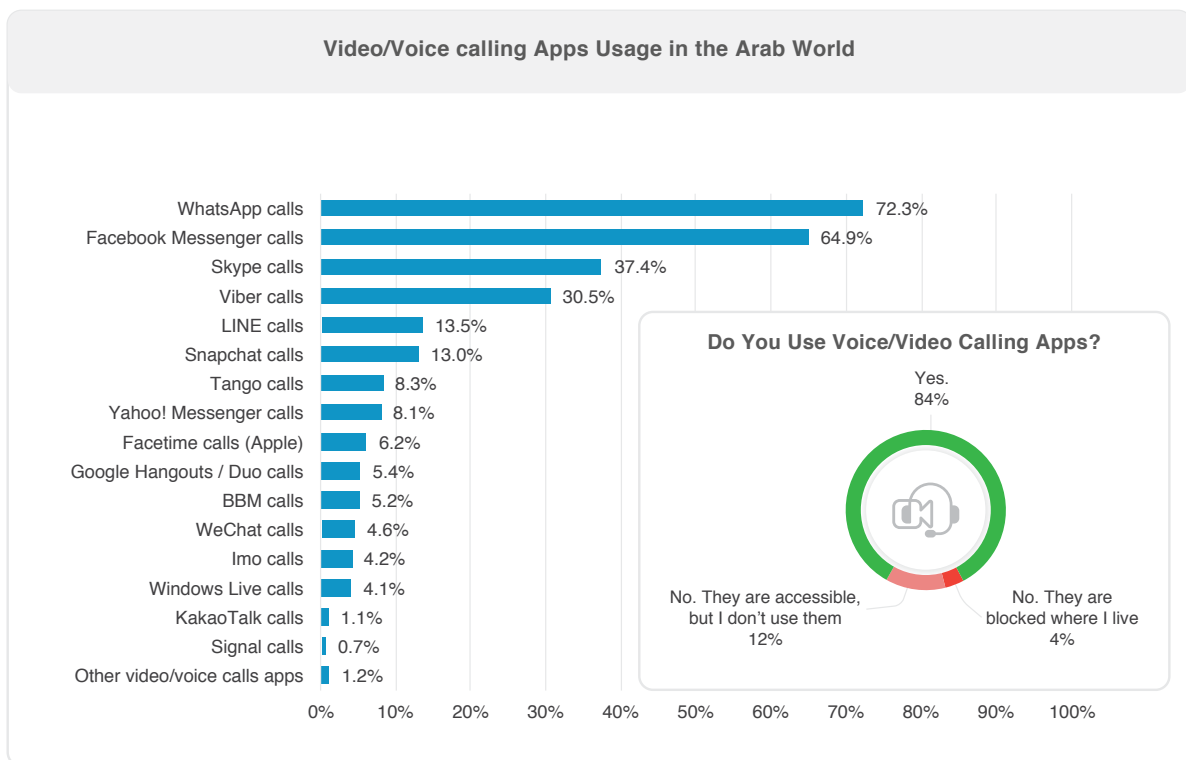
(Do you feel more or less secure while communicating on encrypted messaging services)?



Voice and video calling are popular and feasible online methods of communication (for work and personal reasons) that became popular during the past decade. This is greatly related to the increase in internet bandwidth availability and its low cost. Both voice and video calling are seen as important tools of communication for small businesses and youth.

84% of internet users in the region said that they use voice or video calling apps

- **Penetration of Voice/Video Calling Apps:** Around 84% of internet users in the region said that they use voice or video calling apps. Among the those who said they don't use voice/video calling apps, 12% don't prefer to use them voluntarily, and 4% said that they can't use them because they are blocked by a service provider.
- **Most Used Voice/Video Calling Apps:** Whatsapp again is the most used app for voice calls among internet users in the region (72%), followed by Facebook Messenger (64%) and Skype (37%).

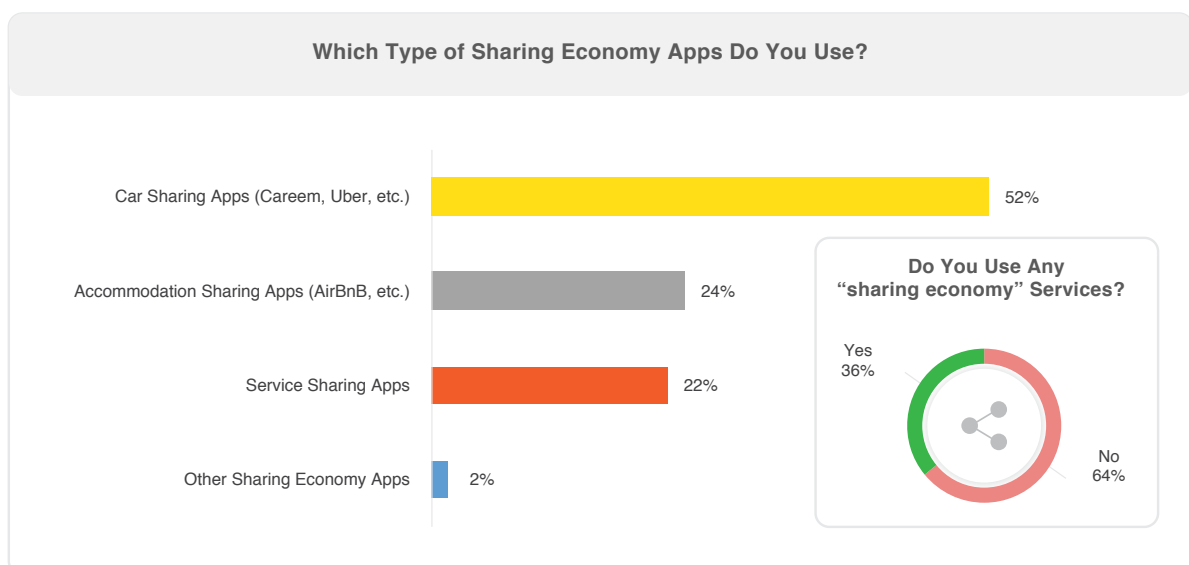


- **Time Spent on Voice/Video Calling Apps:** Around 3 out of 4 of those who use voice/video calling apps do so for small amounts of time (24% for less than an hour a month, 22% do it for less than 1 hour a week, and 27% for less than 1 hour a day). Most people use it for less than an hour a day. In contrast, 3% of users use these apps for more than 5 hours a day.



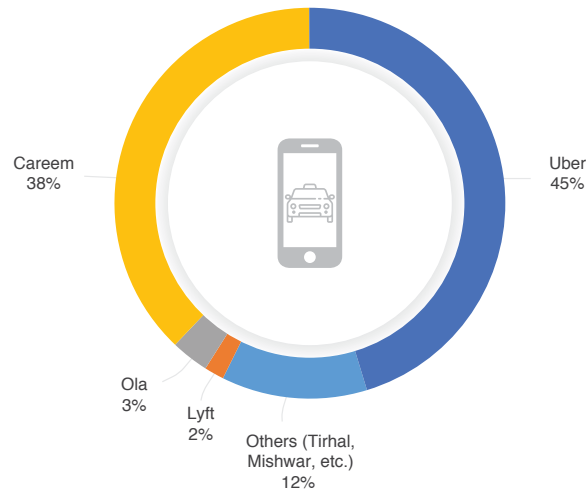
Sharing Economy Services

- **Sharing Services Penetration:** Only one third of internet users in the Arab region said that they use one or more sharing economy services apps. 64% said that they don't.
- **Types of Sharing Services:** Car sharing applications are the most popular type of sharing economy services in the Arab world. Of those who said that they use sharing services overall, more than half (52%) said that they use car sharing services like Careem and Uber. 24% use accommodation sharing services, such as AirBnB and 22% use services sharing tools



- **Car Sharing Apps:** Among car sharing applications Uber (45%) and Careem (38%) are the most popular in the region. Other less popular international car sharing apps in the region include Ola (3%) and Lyft (2%). Local alternatives are also popular on country levels, such as Tirhal and Mishwar in some Arab countries.

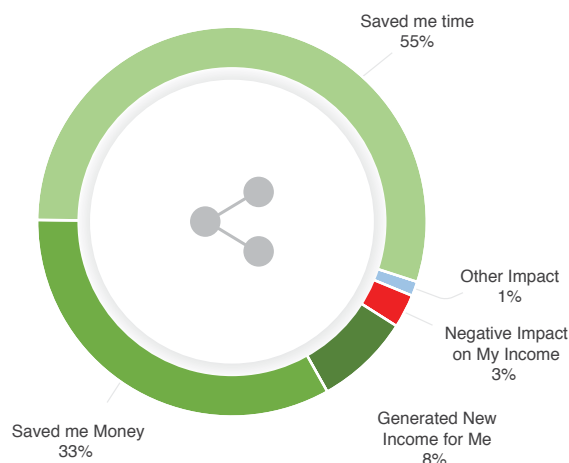
Which Car Pooling / Sharing Apps Do You Use?



Over 96% of users said that they personally experienced positive impact out of sharing apps

- **Impact of Sharing Economy Apps:** Perceptions on the impact of the sharing economy apps is overwhelmingly positive in the Arab region. Over 96% of users said that they personally experienced positive impact out of sharing apps: 55% said that it saved them time, 33% saved them money and 8% said that they have personally generated income from delivering services on sharing economy apps. On the other hand, 3% of users said that there is negative impact on the income of the users, mainly due to these services affecting their existing sources of income negatively (for example, taxi drivers, hotel owners, etc.)

Impact of Sharing Economy Services on You



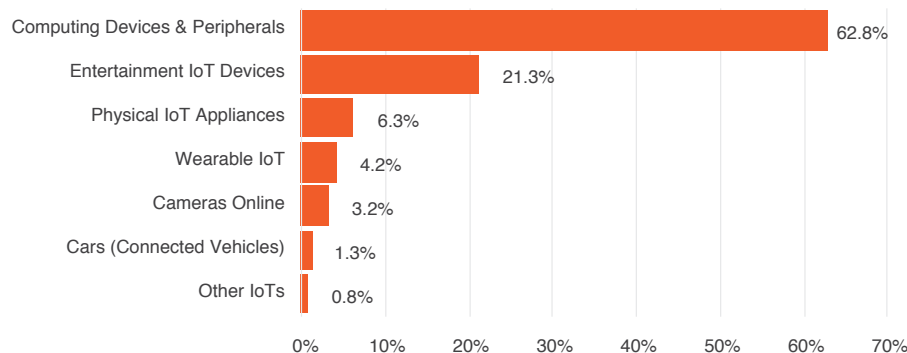
Internet of Things and Smart Living in the Arab World

The “Internet of Things” (IoT): In 2008, the number of devices connected to the Internet surpassed the number of humans in the world. Today, there is an estimated 90 billion internet-connected devices, or 12 internet-connected devices for every human on earth, a number expected to grow to 26 per person by 2020. In the Arab world, by 2017, the number of personal internet-connected devices has surpassed the number of humans in the Arab region according to our survey-based estimate.

By 2017, the number of personal internet-connected devices has surpassed the number of humans in the Arab region

- **IoT Devices:** We estimate the number of personal IoT devices in the Arab region to be more than 460 million devices in 2017. This is projected to almost double to around 890 million in 2020. This includes only personal IoT devices and smart things used in the region, and excludes machine-to-machine IoT devices and industrial sensors and actuators⁵.
- **IoT Penetration:** Today, the penetration of personal IoT devices, or the number of personal IoT devices per internet user, in the Arab region is 4.6 devices. This puts the penetration of IoT devices in the Arab region at 117%. In other words, there is an average of 1.2 Internet devices for each person living in the Arab world today. In comparison, today there are around 11.6 Internet-connected devices per each person living on the planet.
- **Computing Devices:** According to our survey, almost 2 in 3 internet-connected devices in the Arab world are computing devices (63%), such as smart phones, tablets, personal laptops and desktop computers.

Personal "Internet of Things" Devices (by Type)



- **Smart Homes:** Smart home IoTs, such as home appliances that connect to the internet and other domestic internet-enabled systems, such as personal security systems and smart meters are only used by 17% of the users in the region. Although, only 1% of internet users in the region use smart energy or internet-enabled security systems.
- **Internet-enabled Vehicles:** Only 1.3% of internet users in the region said that their personal cars are internet-enabled.

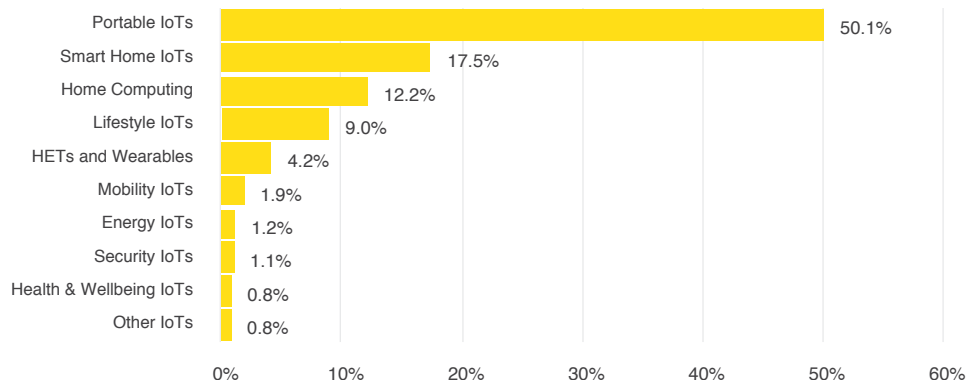
The number of personal IoT devices per internet user, in the Arab region is 4.6 devices

5. Our estimate is based on two surveys of 30 thousand internet users in total in the Arab world, as well as official basic ICT data indicators in the region by international organizations.

There is around 1.2 Internet devices for each person living in the Arab world today. In comparison, today there are around 11.6 Internet-connected devices per each person living on the planet.

- **Smart Homes:** Smart home IoTs, such as home appliances that connect to the internet and other domestic internet-enabled systems, such as personal security systems and smart meters are only used by 17% of the users in the region. Although, only 1% of internet users in the region use smart energy or internet-enabled security systems.
- **Internet-enabled Vehicles:** Only 1.3% of internet users in the region said that their personal cars are internet-enabled.
- **Wearables and Human Enhancement Technologies (HET):** Wearable IoTs, such as smart watches, smart bracelets, smart shoes, etc. are used only by 4.2% of internet users in the region.

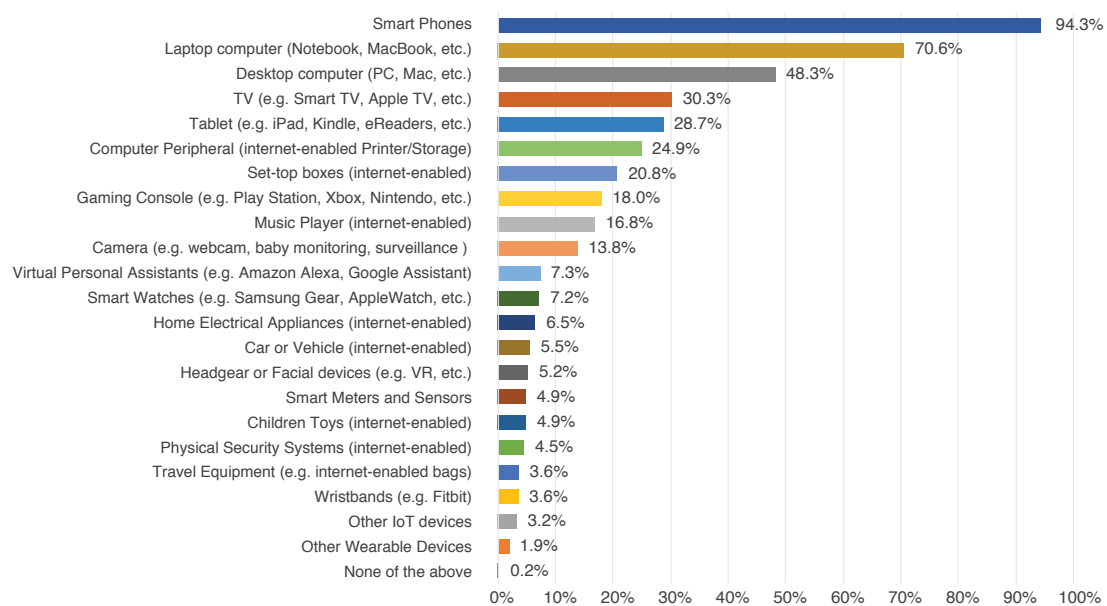
Personal "Internet of Things" Devices (by Usage)



- **Other IoT devices:** Other than computing devices and smart phones, internet devices used for entertainment are the most widely used personal IoT devices. These includes smart TVs (30% of users), set-top boxes, gaming consoles and music players.

Only 1.3% of internet users in the region said that their personal cars are internet-enabled

IoT Devices Ownership in the Arab Region 2017

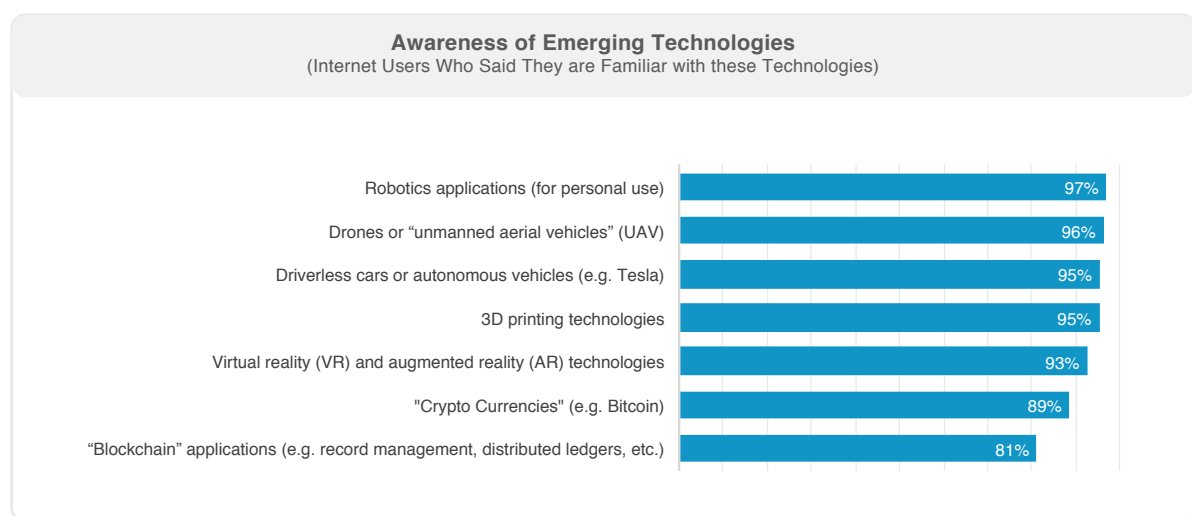


(survey self-reported -N=~20K)

Emerging Technologies and the 4th Industrial Revolution

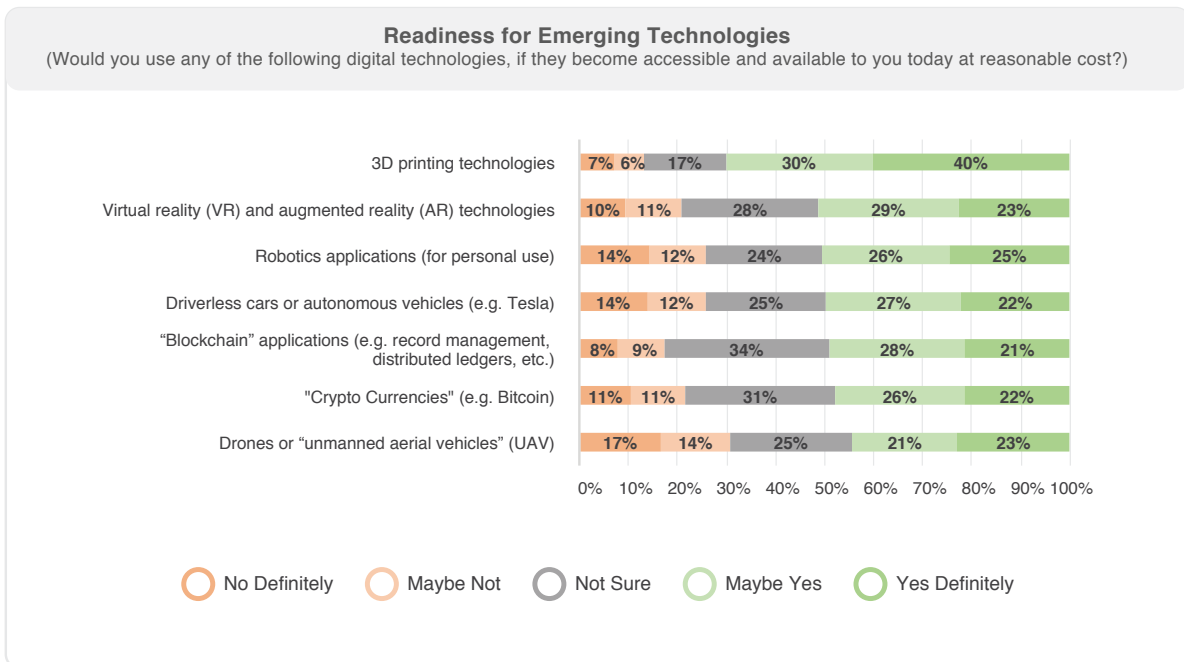
Awareness about Emerging Technologies

Our survey shows a high level of awareness by Internet users in the Arab region about new technologies emerging globally as key drivers of the 4th industrial revolution. Only 1 in 10 internet users in the Arab region said that they are not familiar with robotics technologies, drones, driverless cars, 3D printing and VR/AR technologies. However, 2 out of 10 said they are not familiar with Blockchain technologies.



- **Robotics, UAVs, Driverless cars, VR/AR:** More than 90% of respondents reported that they are aware, or familiar with, the following new technologies robotics (97%), drones (UAVs) (96%), autonomous and self-driving cars (95%), 3D printing technologies (95%), virtual reality and augmented (VR/AR) (93%).
- **Blockchain / Cryptocurrency applications:** Blockchain applications and cryptocurrency technologies have scored lower levels of awareness by internet users in the Arab region. Around 89% are aware of cryptocurrencies such as bitcoin, and 81% heard or aware of other Blockchain applications.

Readiness for the 4IR: When asked about their willingness to use emerging technologies if they are made available and accessible at reasonable costs, societal readiness for using robotics technologies, drones, driverless cars, 3D printing and VR/AR technologies and blockchain applications differed widely:

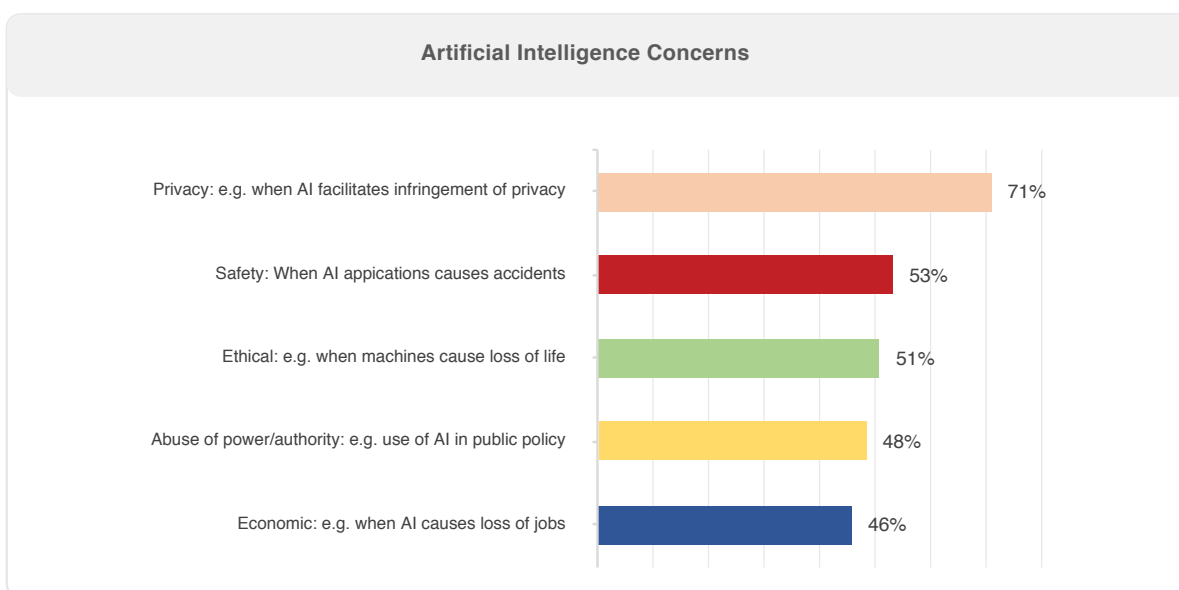


- **3D Printing:** Readiness for 3D applications is clearly the highest in the region among 4IR technologies. More than 70% of internet users in the region said that they are willing to use 3D printing applications if made available at reasonable costs (only 13% said that they will not use them).
- **Robotics:** Almost half the respondents viewed robotics applications for personal uses as something they are willing to use if they are made available at reasonable costs (26% said no).
- **Virtual/Augmented Reality:** Like robotics, half the respondents (50.3%) said that they will use VR/AR applications if made available at reasonable costs (21% will not).
- **Driverless Cars:** Readiness for using autonomous cars is also clear among half the respondents (49.6%) in the region. Around 25% said they are not willing to use driverless vehicles.
- **Blockchain and Cryptocurrencies:** Blockchain and cryptocurrencies scored the highest levels of uncertainty in terms of respondents' readiness to use them. Around one in three (34%) respondent said that they are not sure if they will use Blockchain applications even if they are made available and accessible to them at reasonable costs today (31% uncertain about cryptocurrencies).
- **Drones and UAVs:** Readiness for using UAVs and drones is the lowest in the region compared to the other emerging technologies, according to our respondents. Around 44% said they are willing to use "unmanned aerial vehicles" (UAV) or drones. These devices also scored one of the highest rejection rates compared to the other technologies (30% said they are not willing to use them)

Concerns about Emerging Technologies: Technological advancements usually associated with the 4th industrial revolution have provoked a wide spectrum of economic, political, privacy, security and ethical concerns at a global level. The overwhelming majority of internet users in the Arab region also share many of these concerns. This is evident by the responses of the participants in our survey. More than 91% of respondents said that they are concerned about one or more emerging applications related to AI, AVs, UAVs, 3D printing, cryptocurrencies and sharing economy services. Only 8.7% of respondents said that they see no concerns around these emerging technologies.

59% of internet users in the Arab region are concerned about AI applications in general

- **Artificial Intelligence (AI):** Artificial intelligence applications provoke the most concerns among people in the Arab region. This is clearly evident by responses to our survey of internet users in the Arab region. The three technological advancements that people are most concerned about are AI-based technologies. Respondents are mostly concerned about Artificial Intelligence in general, followed by autonomous vehicles and unmanned aerial vehicles (UAVs). In total 59% of internet users in the Arab region are concerned about AI in general or on AI-related application.



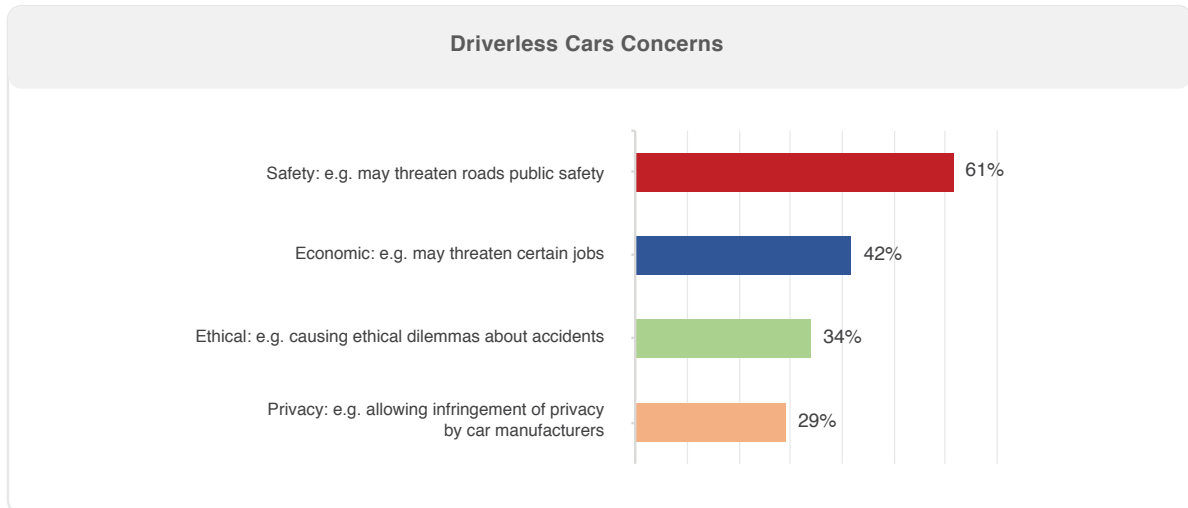
- **AI's Privacy Concerns:** Internet users in the Arab world are worried most about their privacy as artificial intelligence applications grow in sophistication and use. Around 71% of respondents expressed that they are concerned that advances in Artificial Intelligence applications will cause infringement of their privacy.
- **AI's Safety Concerns:** The safety of AI-based application is reported as a concern by more than half of the internet users in the region (53%). Comments point to concerns related to AI-based mobility and robotics applications which are reliant on artificial intelligence
- **AI's Ethical Concerns:** Similarly, more than half of internet users view that artificial intelligence may raise ethical concerns (51%). This is a widely debated challenge on a global scale.

- **Concerns about abuse of AI applications:** Other concerns related to AI include public concerns about the possible abuse of power when AI is applied in business or public domains (48% of respondents)
- **Potential Economics Victims of AI Applications:** A global debate about artificial intelligence is related to its potential for replacing humans with machines or programs that perform today's existing jobs at less cost and more efficiency. This is concern shared by 46% of users.
- **Artificial Intelligence-based Bots:** There are growing uses of "bots" online, including for commercial, governmental, political, entertainment and social needs. However, there are also growing concerns about the practices around artificial-intelligence bots online by businesses and governments⁶. According to our survey respondents, the use of AI-based bots for political purposes is what most people are worried about (53% of respondents). This is unlike all other uses respondents were asked about in the survey, which were viewed largely positively (these include customer service, commercial uses, virtual assistants, telephone marketing bots and gaming bots).

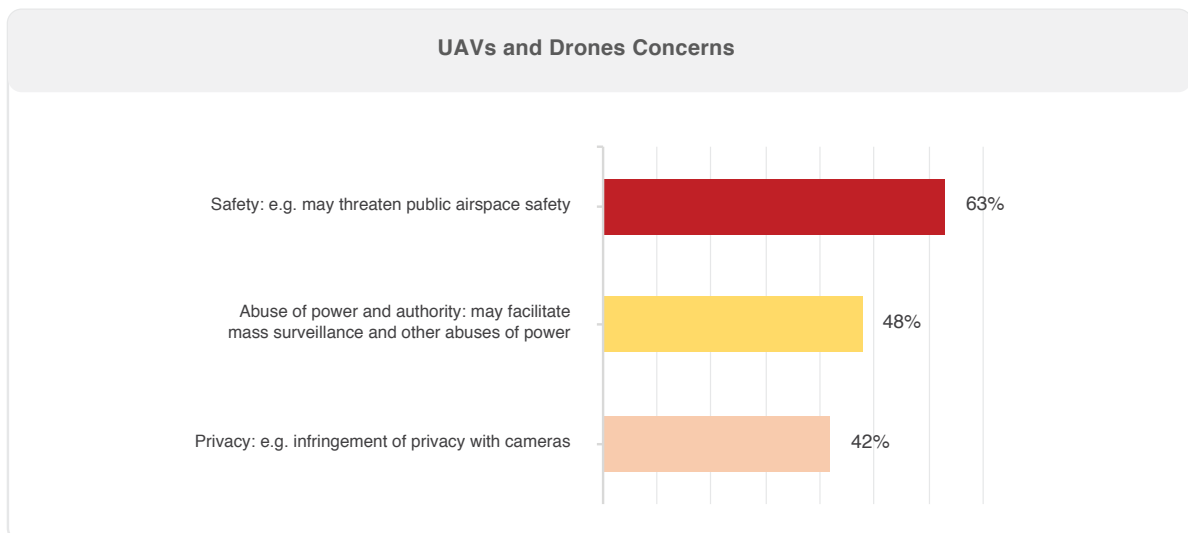


6. "Chatbots", "bots" or "social bots", refer to automated computer programs that imitate humans and engage in conversations with other users based on machine learning and artificial intelligence technologies.

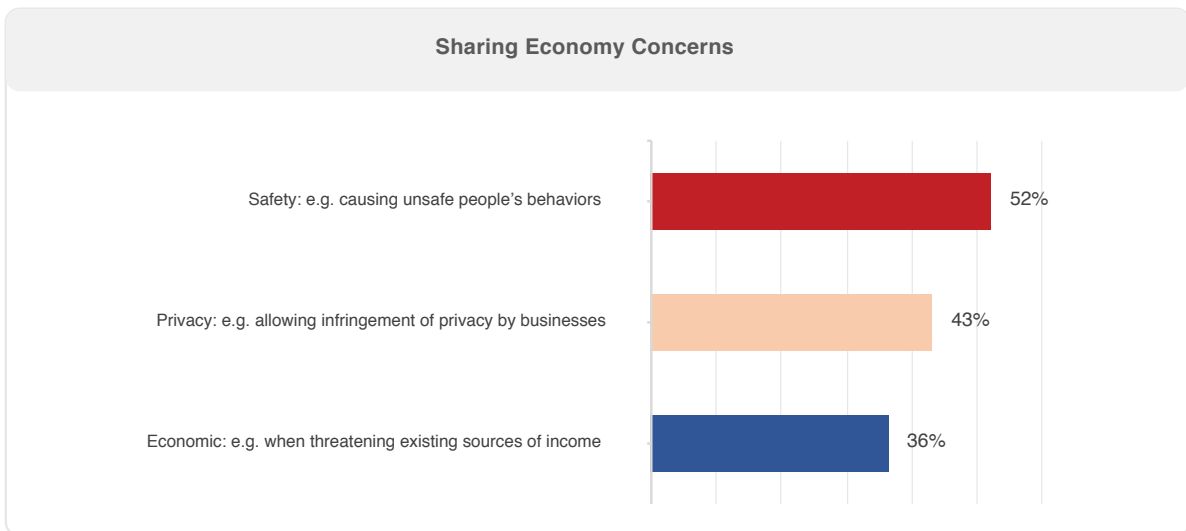
- **Driverless Cars Concerns:** The top concern about AI-enabled mobility applications is around safety (63% for UAVs and drones and 61% in the case of autonomous cars). Other concerns expressed around AI-enabled autonomous cars are around their potential economic impact on jobs, and less so about the ethical dilemmas that may emerge from accidents potentially caused by them.



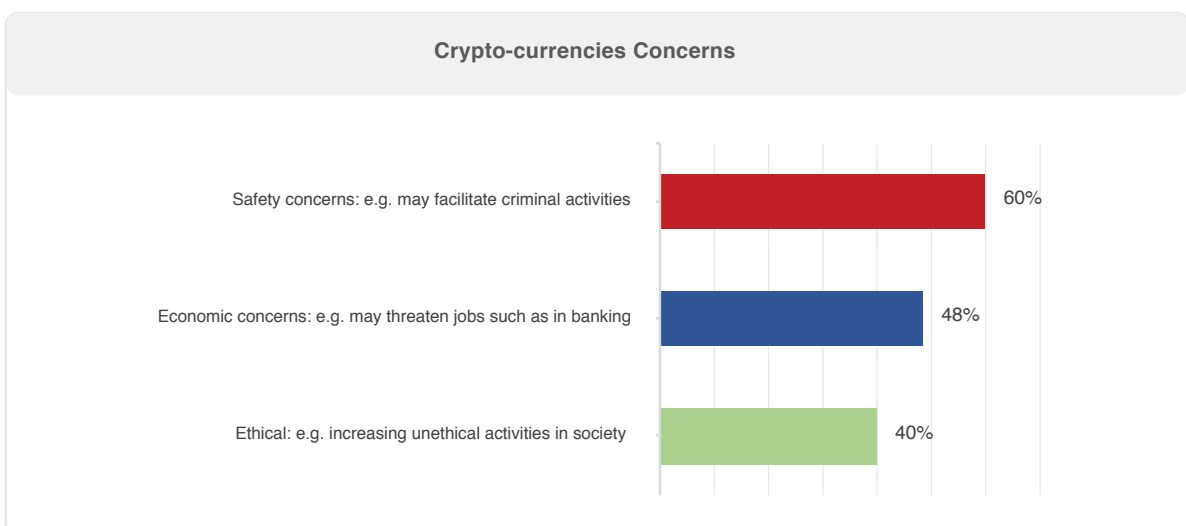
- **UAV/Drones Concerns:** Like autonomous cars safety is what most users are concerned about with drones and UAVs. However, unlike driverless cars, people are more concerned about potential abuse of power, such as for surveillance (48%) or infringement of privacy (42%) when UAVs become mainstream.



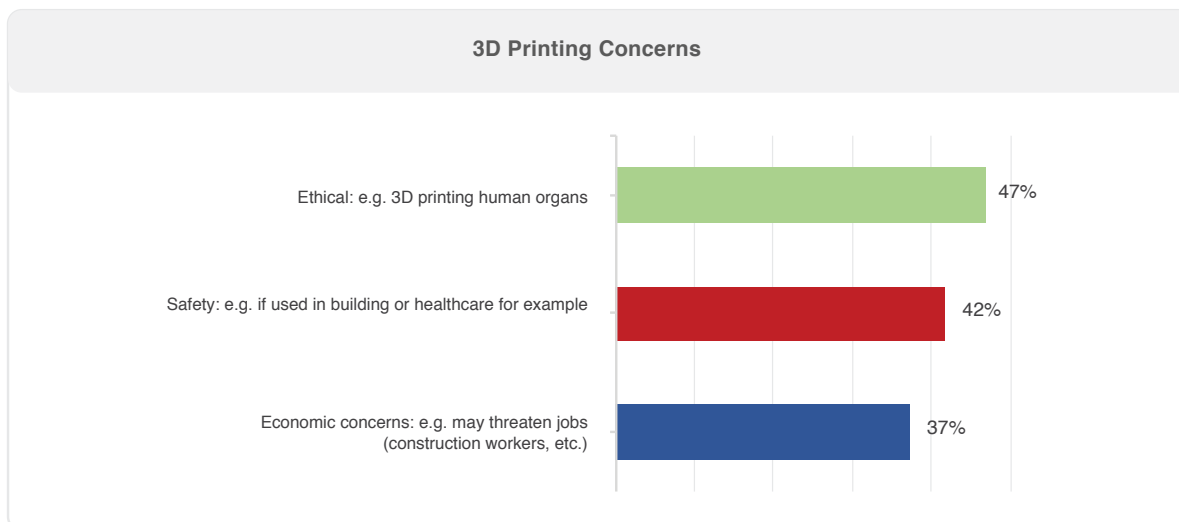
- Sharing Economy Services Concerns:** Most concerns shared by the respondents were related to the safety of sharing economy services, especially when sharing economy services can potentially allow risky behaviors or abuse or privacy issues. Unlike the dominant perception about the concerns related to sharing economy services, economic concerns were relatively low on the radar screen of the respondents to our survey (30%). There are global movements against sharing services such as carpooling and accommodation sharing which already caused some job and income losses to traditional service providers (such as taxi drivers and small hotel owners).



- Crypto-currencies Concerns:** By 2017, there are more than 900 crypto-currencies (such as Bitcoin, Ethereum, Ripple and Litecoin) traded online based on blockchain technology with growing userbase. Some financial institutions have warned that the growth of crypto-currencies in value could be a "speculative bubble". Numerous other concerns are shared about the rise of cryptocurrencies globally. Some of these concerns are related to safety, economic and ethical issues. In the region, people who are familiar with crypto-currencies are mainly concerned about safety implications, such as such untraceable currencies potentially facilitating criminal activities (60%). Other economic (loss of jobs in banking, money exchange, etc.) and ethical concerns, are also highlighted by respondents, such as these currencies possibly enabling the increase of unethical financial activities.

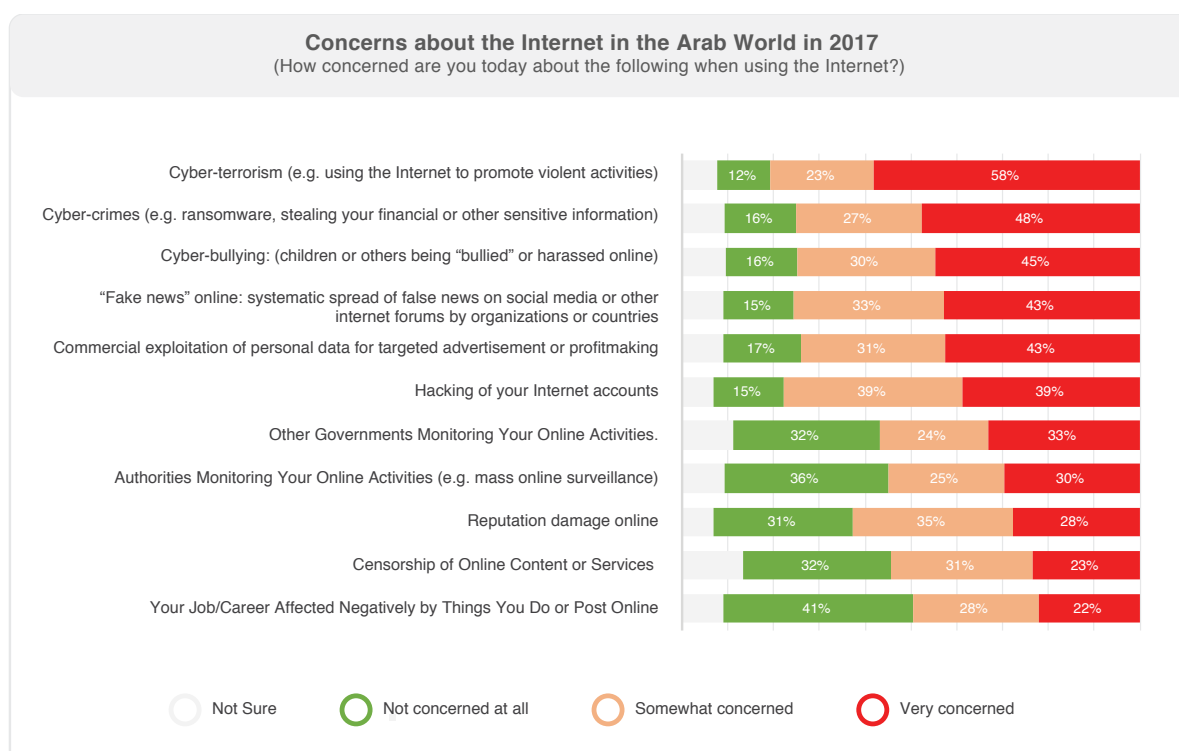


- **3D Printing Concerns:** 3D printing has the most level of support by internet users. Yet, around half of the respondents (47%) have concerns related to ethical implications on 3D printing, including 3D printing human organs for example. Other concerns are related to safety (when used in healthcare for example) as well as economic concerns related to job losses, such as when 3D printing is use construction work.



Cybersecurity and Cyber-threats

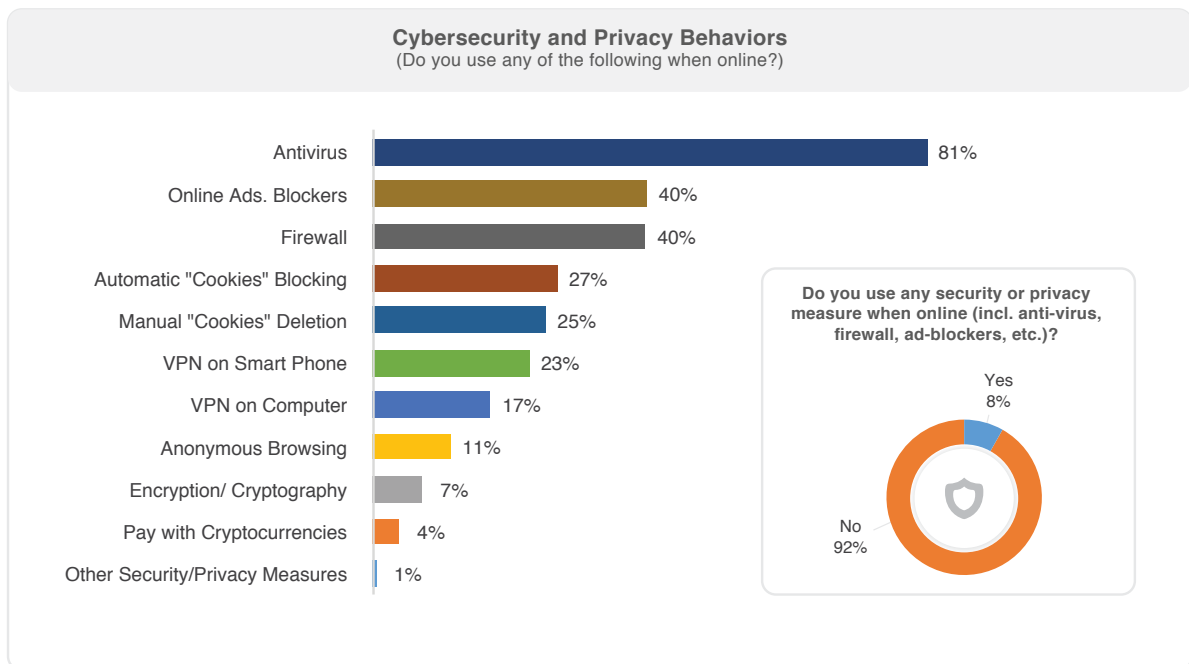
- **Concerns about the Internet:** The top five concerns internet users in the Arab region have when online are: 1) Cyberterrorism, 2) cybercrimes, 3) cyberbullying, 4) “fake news” online, and 5) commercial exploitation of internet users in the region. Above 40% of users expressed that they are “very concerned” about each of these threats.



Top five concerns for internet users in the Arab region:

1. Cyberterrorism
2. Cybercrimes
3. Cyberbullying
4. "Fake news" online
5. Commercial exploitation of internet users

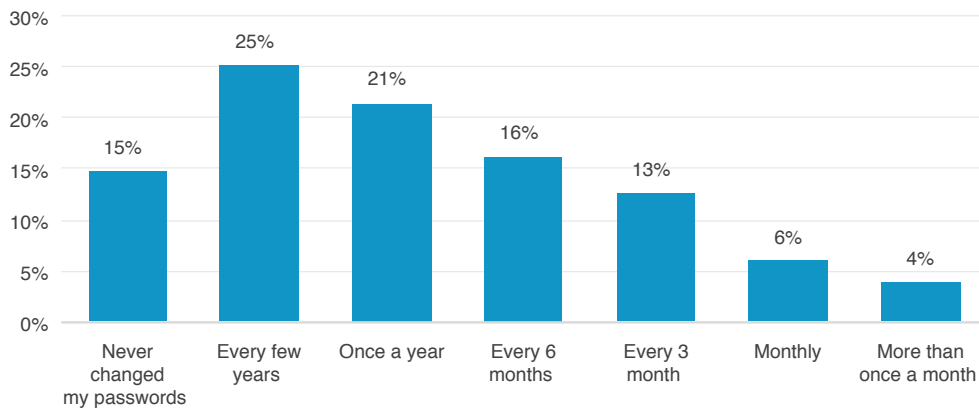
- **Cyberterrorism:** Cyber-terrorism is the number one online concern for the majority of internet users in the region. Four out of 5 internet users are concerned about cyberterrorism in the Arab region (81%) with 58% stating that they are very concerned.
- **Cybercrimes:** 75% of internet users in the region according to our survey are concerned about cybercrimes online.
- **Other concerns online:** While still shared by around 50% of users, the following are the least concerns highlighted by internet users across the Arab region: Other governments monitoring activities online (57% somewhat or very concerned), own government monitoring (55%), reputational damage caused by online activities (63%), censorship of content and services (54%) and negative impact of activities online on one's career (50%).
- **Cybersecurity Practices:** Around 8% of internet users in the region said that they do not take any cybersecurity measure when online. This includes, not using anti-virus, firewall, privacy tools, anonymization, encryption applications or even steps related to minimize personal data breaches.



Four out of 5 internet users are concerned about cyberterrorism in the Arab region

- **Passwords:** On average, around two in three internet users in the region (62%) change their passwords once a year, or less often. Alarminglly, around 15% of internet users in the region said that they never changed their password since creating their internet services accounts.

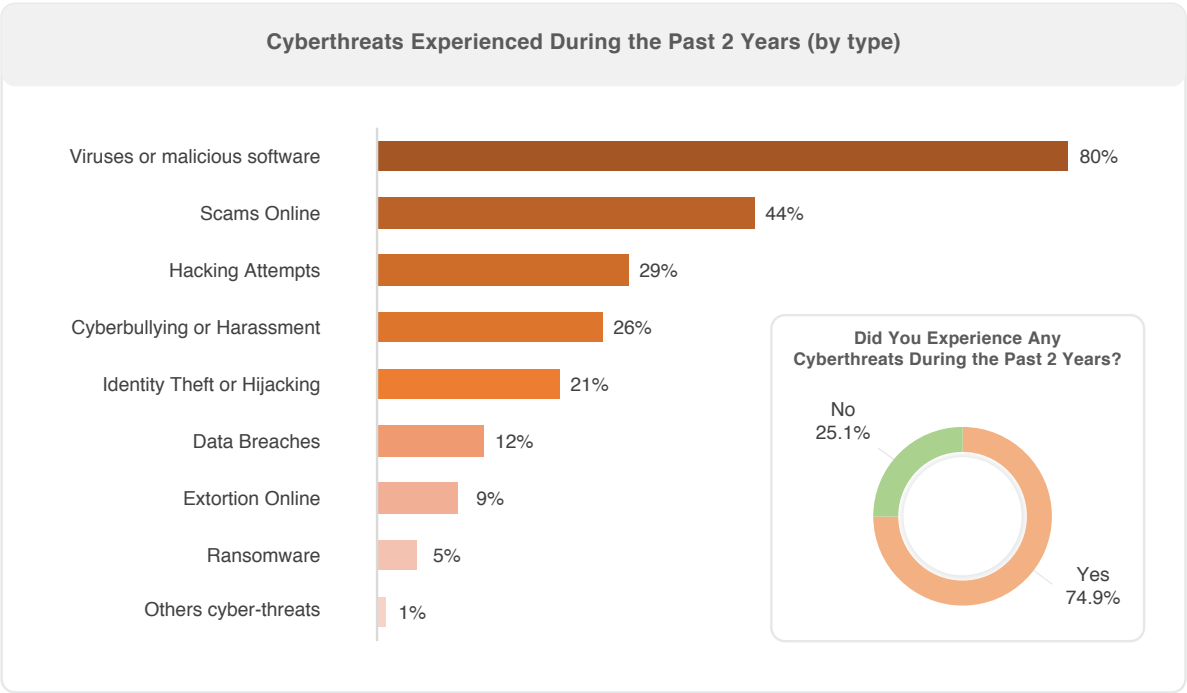
On average, How Often Do You Change Your Internet Accounts Passwords?



- **Antivirus applications:** One out of five internet user in the Arab region does not use an antivirus application when online (81% of respondents).
- **Firewalls:** Only 40% of respondents said that they use “Firewall” applications when online.
- **Privacy and Behavioural Data:** Around 40% of respondents said that they take steps to block behavioural advertisements, which usually entail data collection, profiling and possible breaches of privacy. These steps include using advertisement-blocking tools, automatic or manual “cookies” management.
- **Anonymization and VPNs:** Around 23% of respondents in the region said that they use Virtual Private Networking (VPNs) tools on their smartphones, and 17% on their laptops or desktop computing devices. Another 11% said that they use anonymous browsing tools and applications.
- **Encryption and crypto-currencies:** Only 7% of internet users in the region use encryption applications (such as encrypted email applications) and less than 4% said that they use encrypted payment tools.

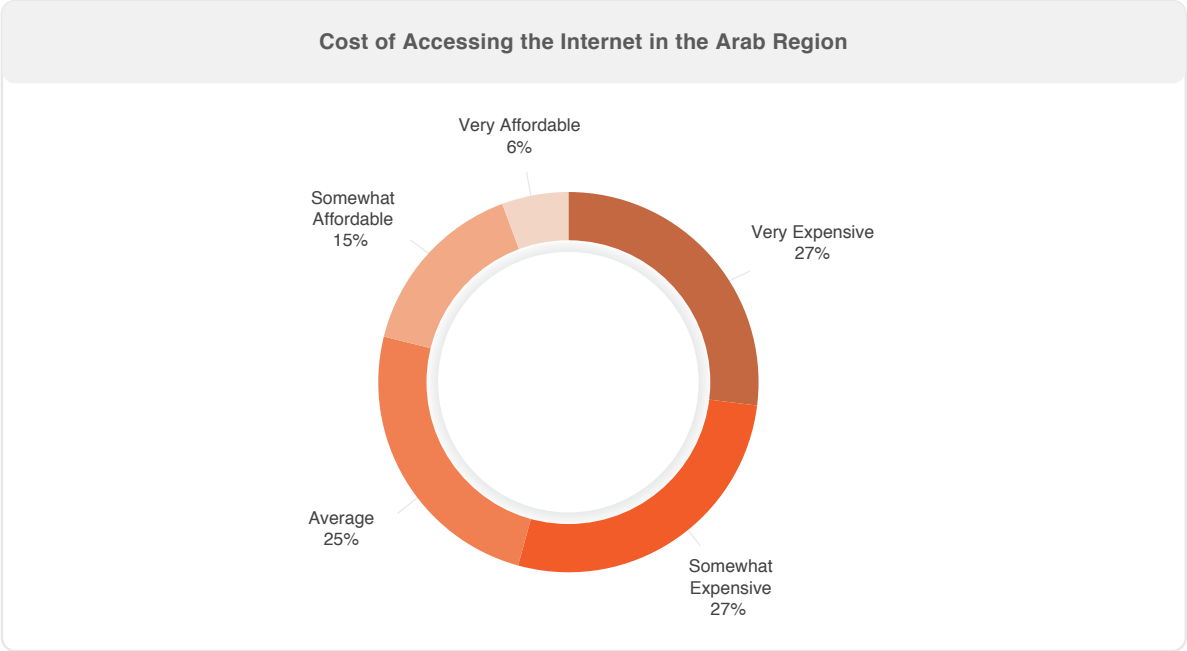
Three out of four internet users in the region (75%) said that they have experienced at least one type of cyber threats during the past two years

- Cybersecurity Threats Experienced in the Past Two Years:** On average, three out of four internet users in the region (75%) said that they have experienced at least one type of cyber threats during the past two years. These include viruses, scams, hacking, bullying, harassment, identity theft, data breaches, extortion or ransomware.

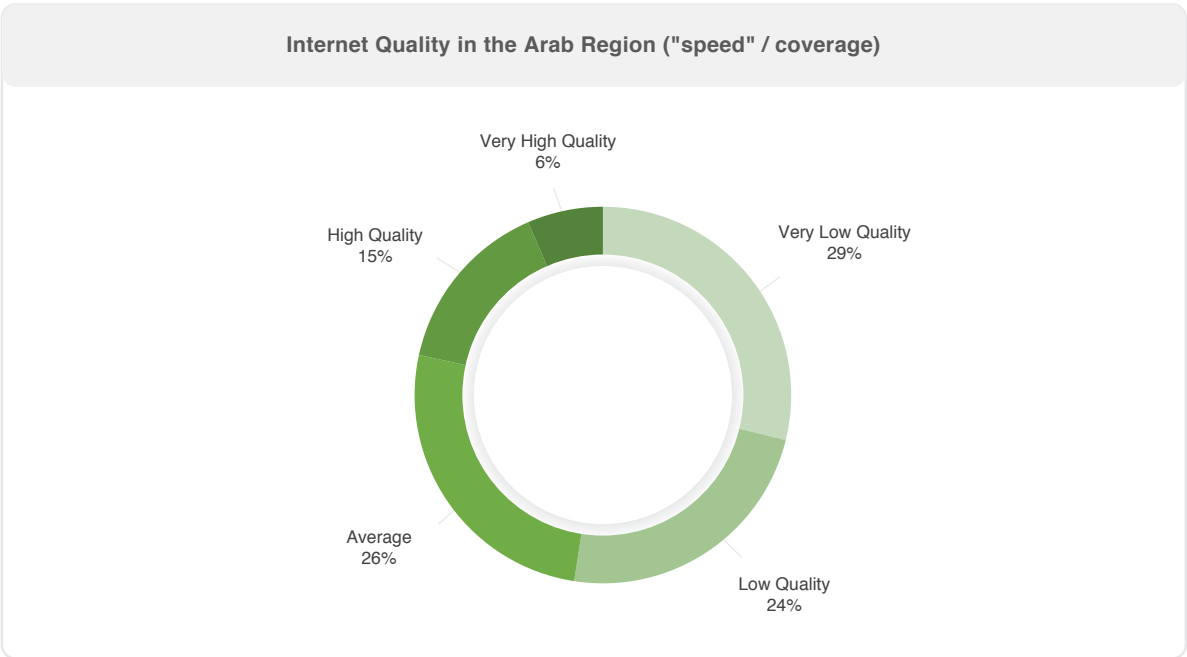


- Types of Cyber Threats:** Viruses and malicious software continue to dominate the cyber threats affecting internet users in the region. Around 80% of respondents who said that they experienced cyber threats during the past 2 years said that they have been affected by viruses or malicious software, followed by online scams (44%) and hacking attempts (29%).
- Cyberbullying and harassment:** One in four internet user in the region reported experiencing cyberbullying or harassment online (26% of respondents).
- Cybercrimes:** Identity theft and hijacking was the most reported cybercrime by internet users in the region (21%), followed by extortion online (9%), and ransomware (5%).

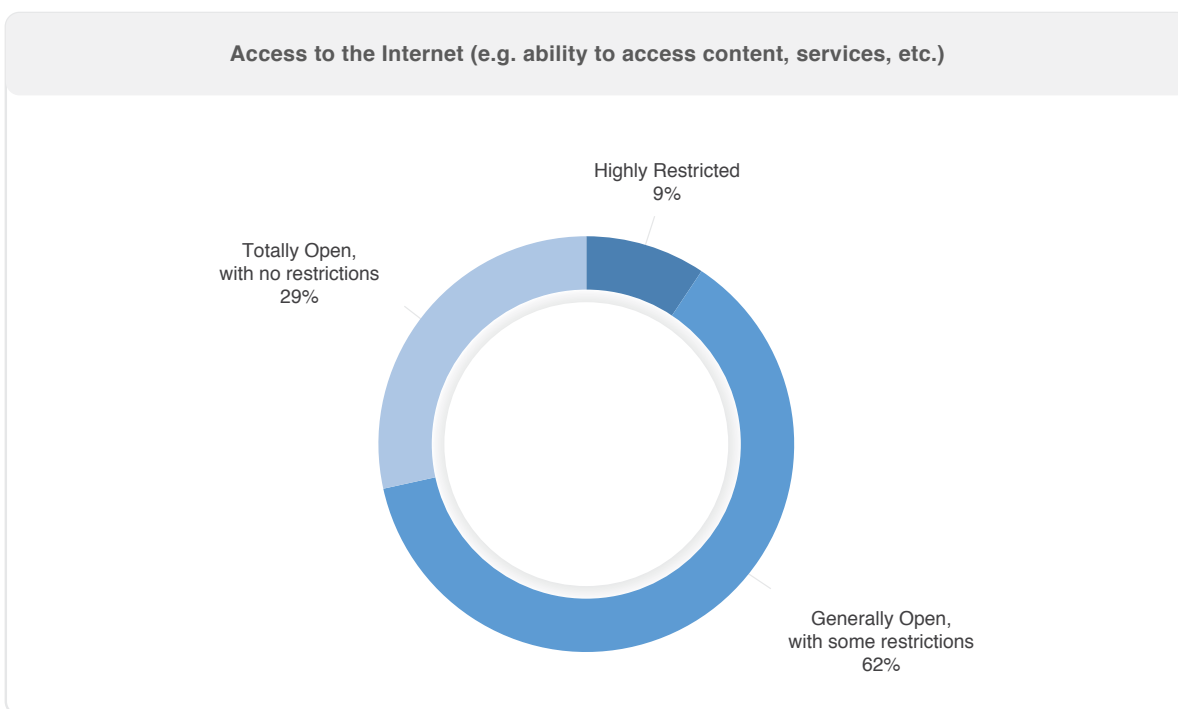
- **Cost of Accessing the Internet:** Around 45% of internet users in the Arab region stated that accessing the internet is “very expensive” or somewhat expensive” (27% each). Those who thought the internet is affordable were a minority in the region (6% very affordable 15% and somewhat affordable).



- **Quality of Internet Usage:** Similar to cost, the majority (53%) of internet users in the region stated that the quality of accessing the internet, in terms of “speed”, or bandwidth and coverage is low (24%) or very low (29%).



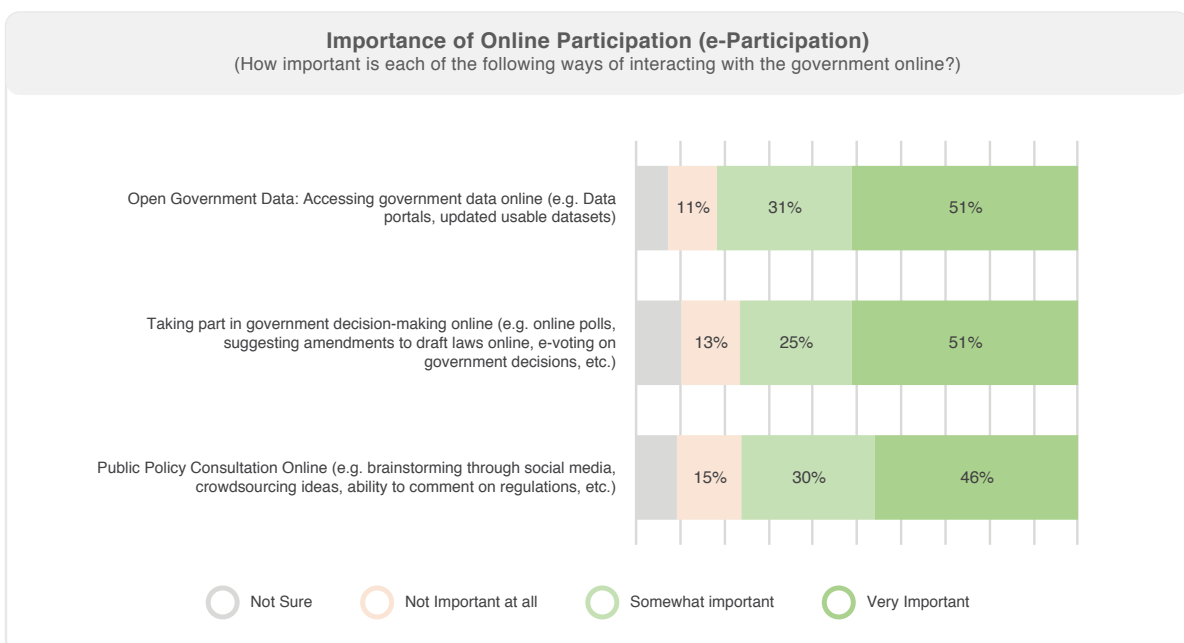
- **Access to the Internet:** Accessing the internet and the restriction on content and services was less of a concern by the internet users in the region. Only 9% of respondents thought that the internet is highly restricted where they live, while 62% thought its mostly open with some restrictions, and 29% thought it is totally open with no restrictions where they live.



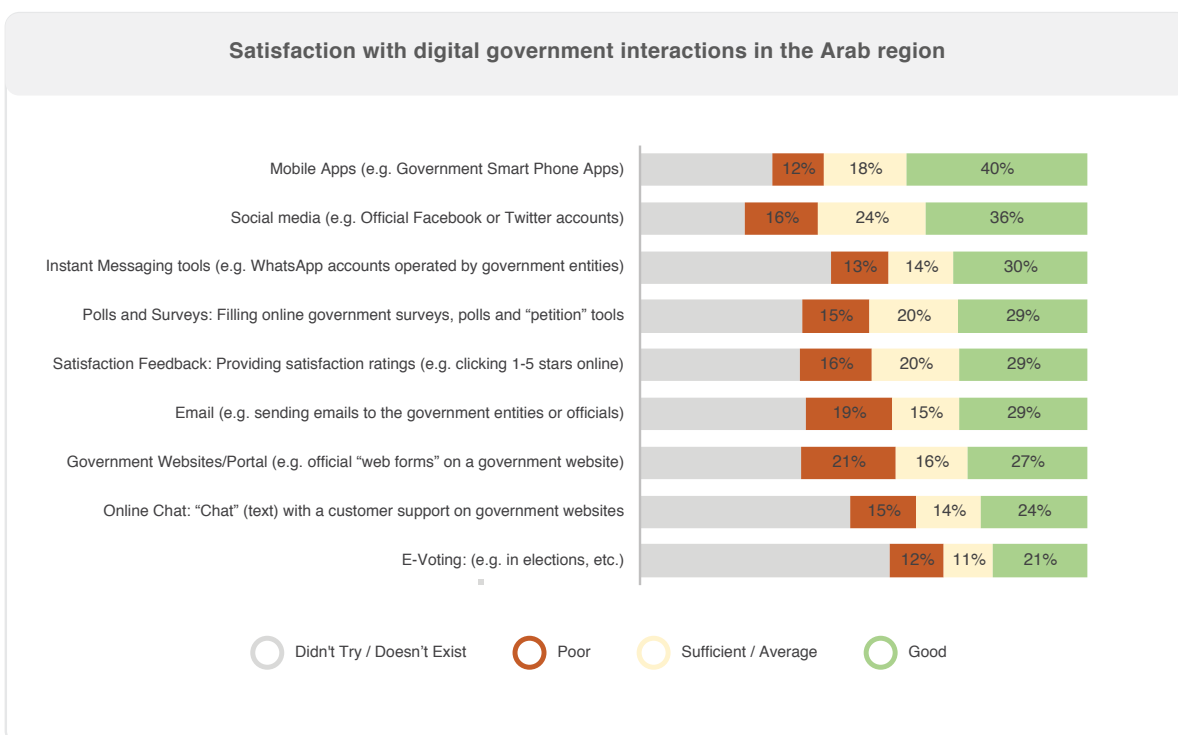
Open Data and Digital Government Interactions

The adoption of digital government approaches in the region is growing in scale and sophistication. These include the traditional utilization of internet applications for service delivery, utilizing a magnitude of online channels for public engagement, as well as more advanced government applications involving utilizing big data in decision-making and public policy formulation. While internet-based service delivery channels have advanced rapidly across the Arab region, whether through web channels, mobile channels or even social media and messaging channels, open government data and electronic participation in policymaking and decision making are considered less advanced in many parts of the region. Save few examples in the region, the open data revolution is yet to catch up among governments. Having a developed, functional and comprehensive data initiative by the government is one of the most important pillars for economies and societies to take advantage of the fourth industrial revolution. Many of the advanced technological applications highlighted in this report would not be functional if the data is not made available, in most cases by government, and if there is no operational data ecosystem that mandate the collection and provision of data by government and businesses as an enabler for the data economy. As the user-base of internet and social media users grow in the region, the survey results show societal maturity and strong readiness to take advantage of open data initiatives, as well as public willingness to engage in policymaking online.

- **Open Data by Government:** A majority of internet users (82%) in our survey realize the importance of data availability by government and consider open government data as an important element of interacting with their government (51% said it is very important).
- **Decision-making Online:** There are growing global practices where internet-based engagement have allowed better government decision-making processes that fit with societal needs. More than 76% of the respondents view that taking part in online engagement on government decision-making as important.
- **Public Policy Consultations:** Three in four internet users in the region (76%) also stated that online consultations regarding public policies are important to them. The possibilities of engaging through web channels, mobile devices and social media applications in public policy consultations, formulation and reform are clearly viewed as important by the public, or at least the internet users, in the Arab region.



- **Satisfaction with Digital Government Interactions:** The top three channels where respondents expressed the highest satisfaction when interacting with the government are: 1) Mobile apps, 2) social media channels and 3) instant messaging tools. Respondents reported being more satisfied while interacting with government over these channels.



- **Government portals:** While government portals and websites are considered the backbone of digital government services, it is seen as one of three bottom digital interaction channels with the government according to respondents.

Way Forward and Policy Responses

I – Understanding the Societal Foundations of the Fourth Industrial Revolution in the Arab Region

Digitization today is driven by mobile broadband adoption . The smart mobile phone is considered the hub of the personal IoT ecosystem, which include personal and household devices connected to the internet, such as artificial intelligence-driven things, smart watches, wearables, home appliances, vehicles, smart meters, lifestyle and entertainment systems, to name a few. The growth of IoT adoption coupled with the growth of mobile broadband subscriptions are the critical infrastructure of the fourth industrial revolution.

In itself, the fourth industrial revolution is characterized by an ecosystem of new technological advancements and information systems that effectively fuse physical, digital and biological beings. It is not necessarily defined by a specific set of advanced technologies themselves, but rather by the societal and market transformation that accompanies the adoption of these technologies, and the new systems, production, consumption, behaviours, interactions, policies and information flows emerging from these digital changes. Yet, there are numerous technologies associated with what has been defined as a critical juncture in the path of global development in the digital age. These technologies include artificial intelligence, robotics, internet of things implementations, 3D printing, autonomous and unmanned aerial vehicles, in addition to industrial-scale emerging technologies such as nanotechnology and quantum computing applications. In this survey, we explored the public perceptions—and concerns—towards some of these emerging technologies, specifically the public-facing ones. This report and its findings are a first-of-its-kind look into the trends, behaviours, views and concerns about these societal transformation by societies and individuals at a regional level.

Exploring the emerging societal trends accompanying these advanced technological applications based on artificial intelligence, internet of things, big data, is as important for policymaking as for economic and business decisions. Accessing and consuming data, information, content and services through the internet is no more confined to a web browser, a computer, or even a portable smartphone. Today, the hundreds of millions of things and objects connecting humans, machines and hybrid systems to the internet are changing societal and cultural norms. Measuring humans' connectivity to these smart structures, or evaluating their influence on societies, economies or governments requires sustained efforts and policy responses by governments. We have limited understanding of how people and things, in their individual human and virtual beings, and their structures of social networks, communicate, exchange data and influence each other through internet mediums. Such understanding is important if countries in the region are to take advantage of the opportunities presented by the fourth industrial revolution.

II – Development and the Fourth Industrial Revolution in the Arab World

There is a strong connection between development and the digital transformation brought about by the fourth industrial revolution and its associated technologies. For example, the UN 2030 Agenda of Sustainable Development, highlights how crucial the societal adoption of these digital technologies is for achieving the SDG goals. However, the UN also highlight several threats and risks that accompany digital transformations. The following table provide a summary of these technologies and their opportunities and associated risks. The findings of this report clearly highlight that the people in the Arab region see these potentials with some readiness and share these concerns.

Table: Crucial Emerging Technologies for the UN Sustainable Development Goals until 2030

Technology cluster	Crucial emerging technology for the SDGs until 2030	Opportunities in all SDG areas, including:	Potential threats, including:
Digital-tech	Big Data technologies; Internet of Things; 5G mobile phones; 3-D printing and manufacturing; Cloud computing platforms; open data technology; free and opensource; Massive open online courses; micro-simulation; E-distribution; systems combining radio, mobile phone, satellite, GIS, and remote sensing data; data sharing technologies, including citizen science-enabling technologies; social media technologies; mobile Apps to promote public engagement and behavioural change; pre-paid system of electricity use and automatic meter reading; digital monitoring technologies; digital security technology.	Development, employment, manufacturing, agriculture, health, cities, finance, absolute “decoupling”, governance, participation, education, citizen science, environmental monitoring, resource efficiency, global data sharing, social networking and collaboration,	Unequal benefits, job losses, skills gaps, social impacts, poor people priced out; global value chain disruption; concerns about privacy, freedom and development; data fraud, theft, cyber-attacks
Neuro-tech	Digital automation, including autonomous vehicles (driverless cars and drones), IBM Watson, e-discovery platforms for legal practice, personalization algorithms, artificial intelligence, speech recognition, robotics; smart technologies; cognitive computing; computational models of the human brain; meso-science powered virtual reality.	Health, safety, security (e.g., electricity theft), higher efficiency, resource saving, new types of jobs, manufacturing, education.	Unequal benefits, de-skilling, job losses and polarization, widening technology gaps, military use, conflicts.

Source: UN DESA 2016

III - Policy Directions and Societal Concerns

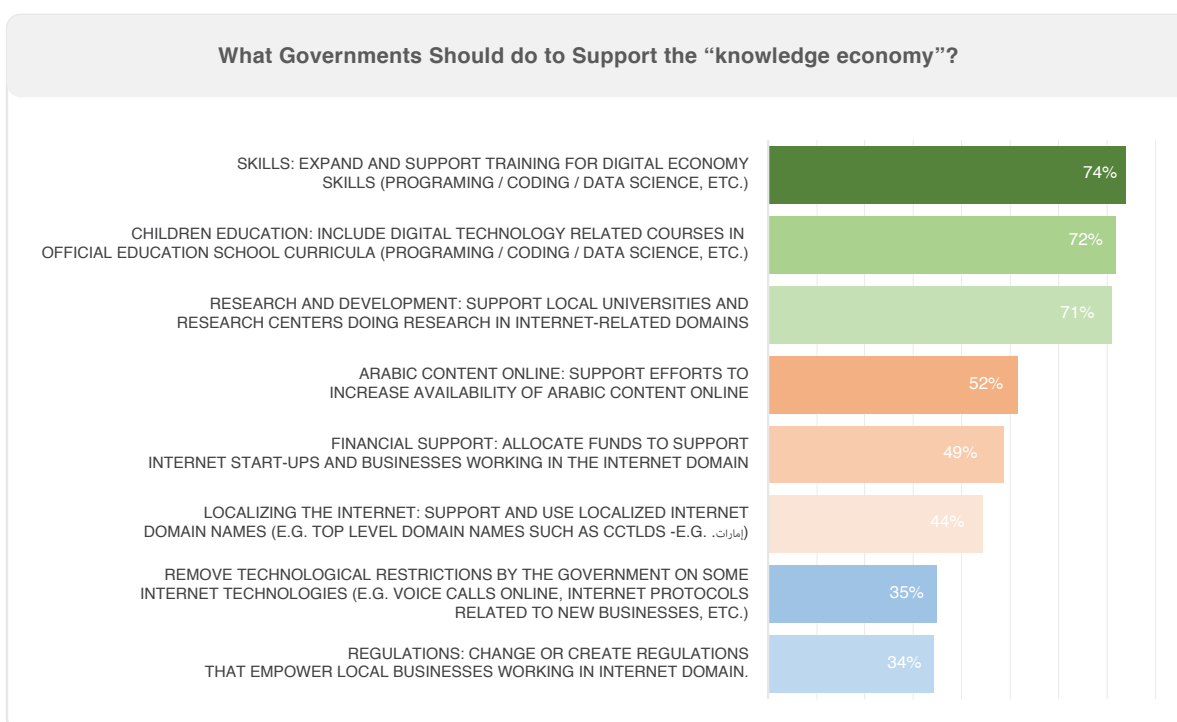
What are the priority policy responses for governments in the region to take advantage of the many opportunities related to the fourth industrial revolution? This survey does not explore the macroeconomic impact of the 4IR, which is widely addressed in numerous studies and economic analysis. However, it does explore public concerns and perceptions that are usually missed when designing policy responses. From a societal viewpoint, the survey findings highlight key areas where policy interventions or reform are required.

Ethics of the 4th Industrial revolution: One area that clearly emerged as an important priority for policy responses across the geography and demographics of our survey is the ethical implications brought about by advancements in artificial intelligence and its associated technologies. This is clear in the public perceptions and concerns of the many AI-related technologies by government, like machine learning applications such as bots, big data applications in government or autonomous mobility, among others. The ethical dilemmas emerging from these transformations are numerous for policymakers. This requires policy responses that take into account the local cultural sensitivities

and social norms and societal preferences. Regulation may or may not be sufficient or necessary. Any policy responses will need to balance the positive potential on the public good, and the negative implications for individuals and markets. These dilemmas are economic, cultural, societal and political. The policy responses on country-level may require dedicated institutions related to Artificial Intelligence and institutions dedicated to ethics and technology to continuously observe and tackle the emerging ethical implications and design fitting policy responses. More importantly, these dilemmas require societal engagements and inclusion policies where the public is fully engaged in designing the fitting responses that tackle the wide scope of ethical implications that no government alone can comprehensively capture.

Privacy, Data and Digital Transformation: The other priority areas of concern is the massive possibilities for privacy infringements enabled by the increased digitization of societies in the Arab region. The fact that numerous countries in the region lack developed data frameworks and regulations enable mass infringement of privacy, which in itself can lead to security risk, economic abuses and further ethical implications. The foundation for policy responses would be related to data. A well-structured data regulatory framework, whether on how data is collected and opened or how individual rights are protected is a critical foundation for development in the data economy. This is a priority area for governments in the region.

Skills, Education and Research: In our survey, we assessed potential policy responses by providing scenarios and assessing acceptance by internet users in the region. The findings point to a clear public appreciation of what is required for societies to take advantage of the opportunities presented by the 4IR, and what is needed to minimize the many risks and ease the concerns highlighted by our survey. Upskilling, children education and research and development, are the top three areas where policy responses are required according to our survey findings.



Upskilling and Education for the 4IR: Around the region, people highlighted that governments need to intervene to upgrade and enrich societies skillsets for the fourth industrial revolution and the knowledge economy. Policies that enable empowering the public with skills such as data science, coding, programming and advanced technical engineering is the top policy response highlighted by the public in our survey.

Children's Education for the 4IR: The advanced skills required for the next phase of digital transformation of the economies and societies in the Arab region require adoption from early stage. Children's education with the future in mind, is seen as a key priority by our respondents. People in the agreed that changing schools curricula and embedding coding, programing, applied math and data management is a priority for the next generation to be ready for the next phase of transformation.

Research and Development: Supporting research and development in local universities and centres of research was the third priority area highlighted by our survey respondents, something the Arab region does not dedicate enough resource for.

Digital Arabic Content: Lack of Arabic content online, whether educational or others, is a major barrier for a large portion of societies in the region to take full advantage of the opportunities presented today by the digital transformation. Initiatives are needed to increase availability of digital Arabic content.

Towards the Next Decade of Digital Transformation in the Arab Region

The aim of this report was to apply a longitudinal view and take stock of the ongoing decade of digital transformation in the Arab World. This was complimented with gathering societal insight on internet-triggered trends, behaviours, perceptions and concerns through a regional survey. Together, we hope that the comprehensive data provided in this report will support decision-making directions, inform policy responses, and most importantly trigger further questions on future policy and developmental directions in the region. These findings should complement the widely available data based on expert interviews and official government data. In many ways, the findings of this report provide more questions about the impact of digital transformation, than answers. Some of the findings for example, may provoke questions similar to the following ones:

- What societal and policy implications will emerge when machine learning, artificial intelligence and robotics applications become mainstream within Arab markets and government ecosystems? What will the future of public services be?
- What will the future regulatory frameworks look like in an age where the businesses' capacity for managing big data and predictive techniques reach sophisticated levels of maturity in the Arab region?
- How will societies and businesses react when smart city implementations, such as wide-scale IoT sensory networks and big data predictive analytics become ubiquitous and ever-present around the region?
- How will internet governance change when one billion IoT devices and sensors datafy wider and wider aspects of the lives of people in the Arab region?
- What market opportunities will be created, and which of the existing market structures will be the victims as the 4th industrial revolution expands across more countries in the region?
- How will societies deal with the multifaceted privacy, safety, security and ethical dilemmas of this digital revolution?
- What will the impact of future trends in digital governance and policymaking be?
- And finally, what are the needed policy responses for this ongoing transformation to contribute to advancing sustainable development goals in the Arab region?

One primary objective of this research is to empower the regional policy research community with data, with the hope that many will consider exploring such questions, take advantage of the findings and evaluate the developmental, societal and policy dimensions on both regional and country levels. On the other hand, for business leaders, entrepreneurs, SMEs and start-ups working in the digital domain, the findings provide a wealth of information on public perception, preferences and concerns about certain business practices and technological applications. These both assess the current states, the growth trends and highlight opportunities for the knowledge economy in the Arab region. Likewise, for policymakers, the findings provide valuable insight into public perceptions and concerns across the region related to a wide spectrum of emerging technologies, and how they are used in policymaking, service delivery and interaction with government. These provide a critical foundation for designing future policies and responses to emerging societal changes within the ongoing 4th industrial revolution.

Annex 1: Methodology

Notes on the Population:

Population at the Country-level: In calculating penetration rates, the UN population estimates were used. Using UN's definitions, the total population of the Arab region used in our research comprises people of all ages who were living in the country during the reference period, regardless of residency status or citizenship. The population data for the years 2010-2017 are actual population statistics. Population data for the years 2018-2020 are based on projections of population figures used is the latest edition of the UN's World Population Prospects: The 2017 Revision, issued by the United Nations Department of Economic and Social Affairs.

Palestine: Based on the population estimates by the UN of the State of Palestine, the population used here includes those living in Gaza, the West Bank and East Jerusalem.

Sudan: The population of Sudan used here does not include those living in South Sudan.

Syria and Yemen: Over the past few years, three countries in the Arab region witnessed significant population drops according to international organizations data, due to wars, civil strife and political turbulences. These countries are: Sudan, Syria and Yemen. Syria witnessed at least 11% drop in its population in shape of forced migration according to refugee relief organizations under the UN umbrella. Sudan also had around 24% drop in population due to the separation of South Sudan in 2011. Yemen's population has dropped by at least 1% as refugees fled the country due to war since 2015. The three countries have seen fluctuations in the numbers of digital technologies users across different platforms and channels at different stages during the past few years. Most likely, this is related to decrease in the actual population in these countries and new usage behaviors emerging from population fluctuations.

Basic ICT Indicators:

Basic ICT indicators between 2010-2016 were obtained from the International Telecommunication Union's Measuring the Information database. Data for the years 2017-2020 are projections primarily based on the country-level trends during 2010-2016. When available, more recent official data and future projections were evaluated for validation.

The Regional Survey

The regional online survey was administered in 22 Arab countries and ran in the third quarter of 2017. The respondents were proportionally represented according to the internet users breakdowns in all countries in the Arab region (Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, UAE, Yemen). The survey was administered via an online survey tool.

The data presented here was collected between August to October 2017. The survey represents the views of individuals who are actual internet users in the region. Overall, 19,869 people took the survey from the 22 countries of the Arab states and completed the optional sections based on their ICT usage preferences. Out of those, a total of 9,701 completed all questions, including optional ones, from the 22 targeted countries, a response rate of around 50%.

More than 85.2% of respondents chose to complete the survey in Arabic and 14.8% in English. Around 52% of respondents completed the survey using a smart phone, 46% using desktop or laptop computer, and 2% using a tablet computer.

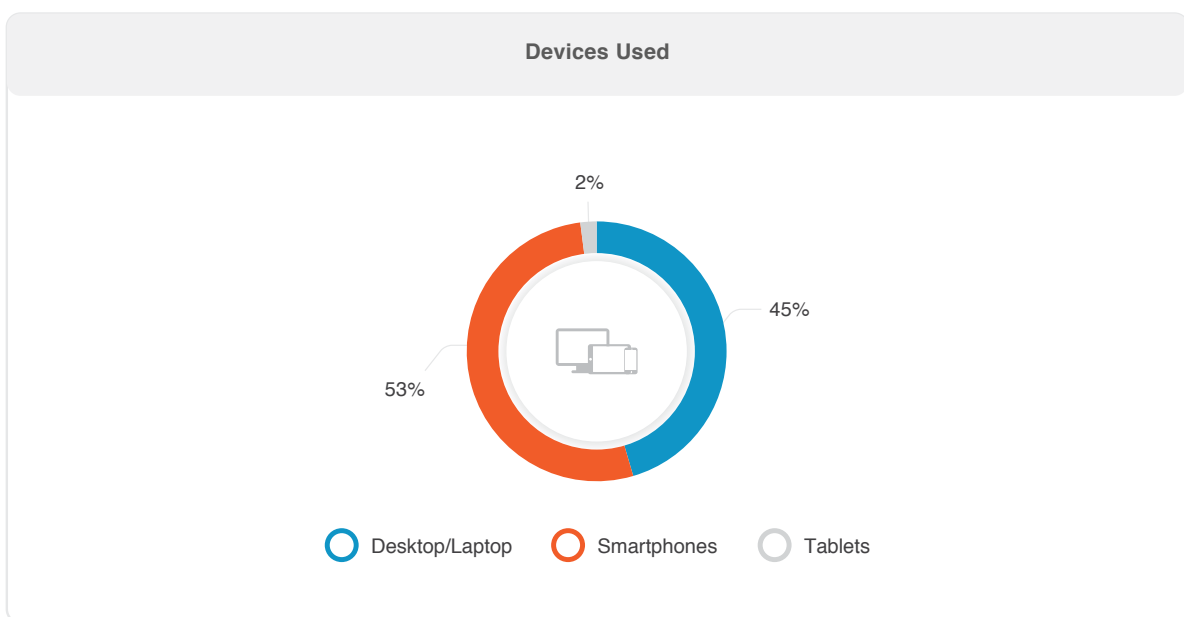
The sample was largely representative of the demographic breakdown of Internet users in the region. Around 25% were unemployed, including retired, homemakers and those looking for employment. Around 17% worked in the public sector, 37% in the private sector 8% were students, 7% self-employed and 6% percent work in the non-government non-profit sectors. In terms of age, 46% of respondents were under 30 years old and 33% and 79% under 40 years old. In terms of gender breakdown, around 25% of respondents were female and 75% were male, corresponding with estimated imbalanced breakdown of the gender of internet users in the region.

For analysis, in some cases, respondents were divided into country income brackets, as per the World Bank's classifications. These corresponded to:

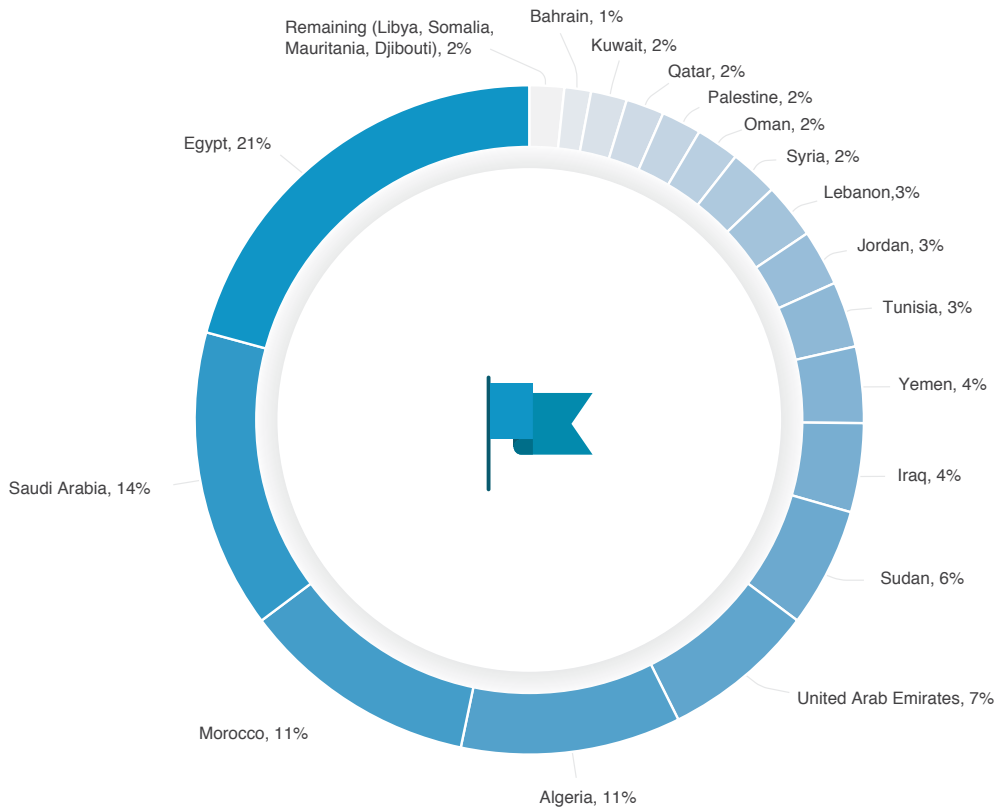
- High Income: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE
- Upper Middle Income: Algeria, Iraq, Jordan Lebanon, Libya, and Tunisia
- Lower Middle Income: Egypt, Mauritania, Morocco, Palestine, Sudan, Syria and Yemen
- Low income countries: Comoro, Djibouti, and Somalia.

Finally, the methodology followed in this report has been fine-tuned over four years to overcome issues continuously emerging from technological changes and new statistical revisions made by governments, international organizations and private sector technology providers. While all possible measures have been taken to minimize errors, these experimental methods may be subject to unintended sources of error, such as measurement, technological and coverage errors. In certain cases, limited data availability, coupled with abrupt geopolitical events in the region related to internet governance, access and usage behaviors may play a role in infusing some measurement errors. To ensure validity, when possible, the data gathered has been validated against numerous alternative sources, including official and third party sources when possible.

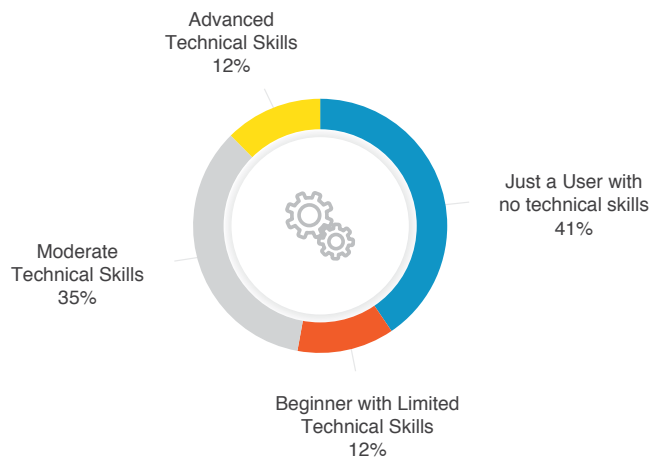
The following charts provide additional information on the demographics of the survey respondents:



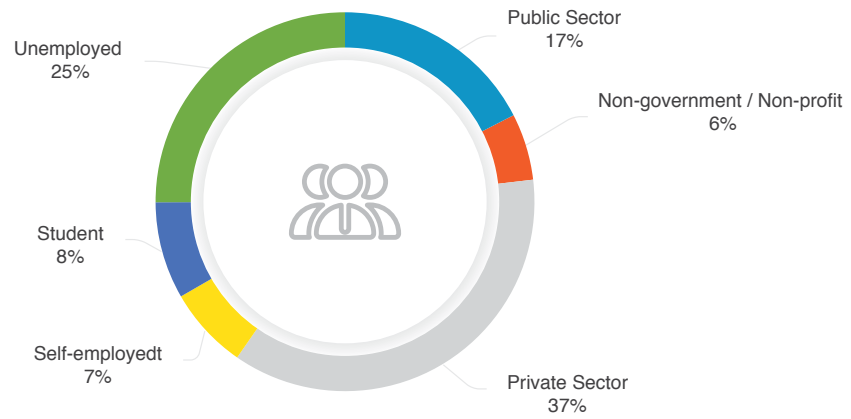
Respondents Country of Residence



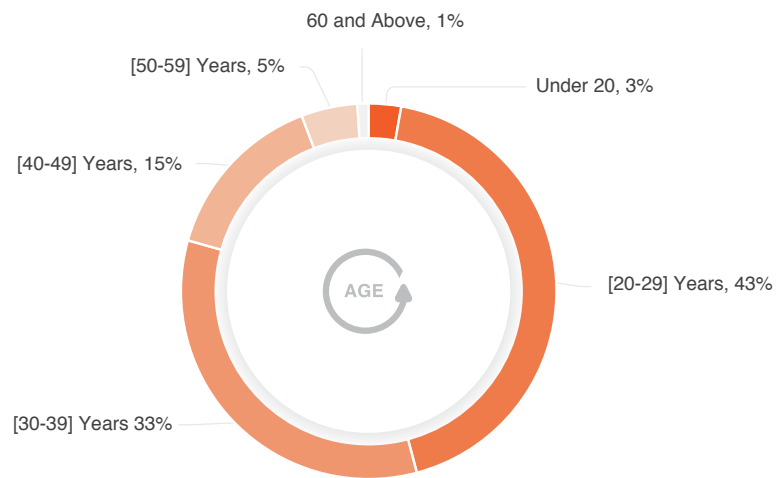
Technical Skills

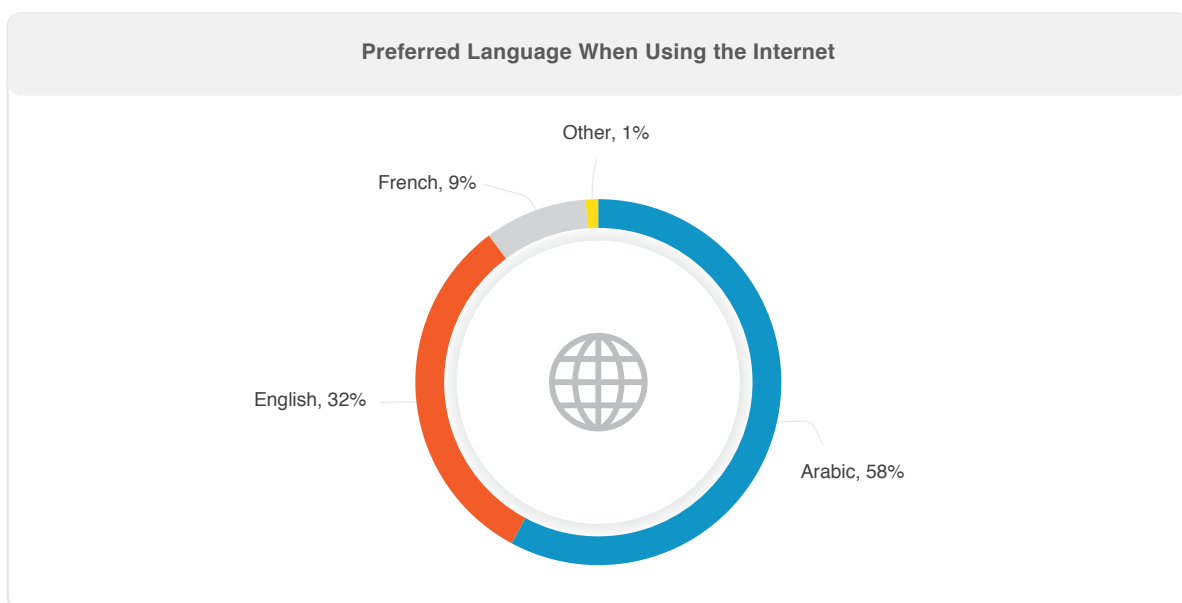
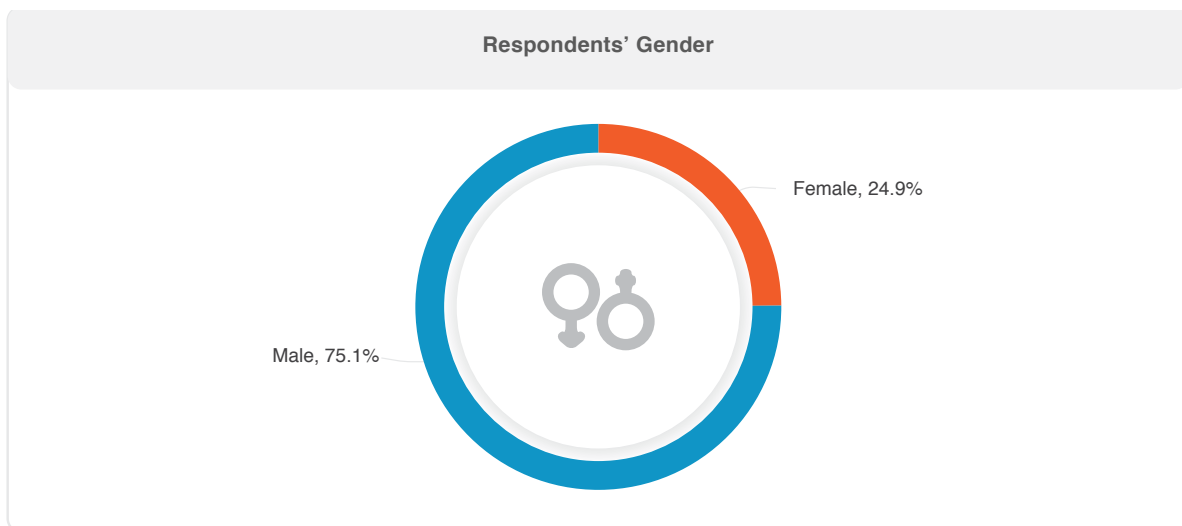


Employment



Age of Respondents





Annex 2: Definitions

The definitions used in this report, such as “Internet of Things” (IoT), “Big data”, “social media” and others, are created and adapted from dominant definitions used by established scholarly and policy literature. There are numerous definitions of each of these terms in policy, technical and academic sources. Primarily, the following definitions informed the conceptualization of each of these terms used in this report:

Active Internet Users

- Internet users refer to individuals who used the Internet from any location in the last three months.
– The International Telecommunication Union (2016)

Active Mobile Subscriptions

- Mobile subscribers (per 100 inhabitants) are the number of subscriptions to mobile service in the last three months.
– The International Telecommunication Union (2016)

Artificial intelligence

- “Artificial intelligence is that activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment.”
- The OECD (2017) based on Nilsson (2010)

Big Data:

1. “Big data are data sources with a high volume, velocity and variety of data, which require new tools and methods to capture, curate, manage, and process them in an efficient way”
– The UN DESA Working Group on Big data 2014
2. “Big data means large data sets that have different properties from small data sets and requires special data science methods to differentiate signal from noise to extract meaning and requires special compute systems and power”
– The Data Science Association 2016
3. “Big Data is a paradigm for enabling the collection, storage, management, analysis and visualization, potentially under real-time constraints, of extensive datasets with heterogeneous characteristics.”
– The International Telecommunication Union 2016

Bots

- “Chatbots”, “bots” or “social bots” in this report refer to automated computer programs that apply machine learning and artificial intelligence technologies to imitate humans and engage in online conversations with other users.
– The Arab World Online 2017

Competitiveness in the Digital Age:

- The set of institutions, policies and factors that determine the level of productivity within an ecosystem which is highly reliant on the adoption of advanced digital technologies.
– The Arab World Online 2017, adapted from The World Economic Forum 2017

Digital Disruption

- Digital disruptions are defined as digital innovations that create new value networks that eventually disrupts and displaces existing markets and networks
- Christensen (1995)

E-Participation

- “The process of engaging citizens through ICTs in policy, decision-making, and service design and delivery in order to make it participatory, inclusive, and deliberative”
- UNDESA (2016)

Fixed-broadband

- Fixed (wired)-broadband subscriptions refers to the number of subscriptions for high-speed access to the public Internet (a TCP/IP connection). Highspeed access is defined as downstream speeds equal to, or greater than, 256 kbit/s. Subscriptions with access to data communications (including the Internet) via mobile-cellular networks are excluded.
– The International Telecommunication Union 2017

Fourth Industrial Revolution (4IR)

- The 4th industrial revolution (4IR) is described by an ecosystem of technological advancements and information systems that are fusing physical, digital and biological beings. It is not necessarily defined by a specific set of advanced technologies themselves, but rather by the transition and transformation that accompanies the adoption of these technologies and the new systems, production, consumption, behaviours, interactions and information flows emerging from the digital foundation of the past decades. Yet, there are numerous technologies associated with what has been defined as a critical juncture in the development path in the digital age. These technologies include artificial intelligence, robotics, internet of things implementations, 3D printing, autonomous and unmanned aerial vehicles, in addition to industrial-scale emerging technologies such as nanotechnology and quantum computing applications.
- Adapted from World Economic Forum 2016
– The International Telecommunication Union 2017

Internet of Things (IoT):

1. All devices and objects whose state can be read or altered via the Internet, with or without the active involvement of individuals.
– The OECD 2015
2. The network of physical objects or ‘things’ embedded with electronics, software, sensors and network connectivity, which enables these objects to collect and exchange data
– The UN / ITU 2016

Smart City

- “A smart city is defined here as an innovative city that uses information and communication technologies.. to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects”
– The International Telecommunication Union (2014)

Social Media:

- Social media are Internet-based applications that facilitate 1) the creation of structured networks of connected individuals, entities or virtual objects based on social attributes, and 2) facilitate multiple interactions between the nodes of these social networks, including the creation and sharing of content by users.
– The Arab Social Media Report 2017, MBRSG

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- **Policy and Scholarly Research:** Conducting research focusing on government policies and societal transformation through technological innovation in the Arab region.
- **Policy Advisory:** The ultimate objective of the Program is to inform present and future Arab policy makers in assessing the impact of the ongoing transformations in their societies and governments; and to help develop locally fitting policies for future governance initiatives.
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