



UNITED NATIONS

الاسواق

ESCWA

Arab Horizon 2030

Digital Technologies for Development

Economic and Social Commission for Western Asia

Arab Horizon 2030: Digital Technologies for Development



United Nations
Beirut

© 2019 United Nations
All rights reserved worldwide

Photocopies and reproductions of excerpts are allowed with proper credits.

All queries on rights and licenses, including subsidiary rights, should be addressed to the United Nations Economic and Social Commission for Western Asia (ESCWA),
e-mail: publications-escwa@un.org.

The findings, interpretations and conclusions expressed in this publication are those of the authors and do not necessarily reflect the views of the United Nations or its officials or Member States.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Links contained in this publication are provided for the convenience of the reader and are correct at the time of issue. The United Nations takes no responsibility for the continued accuracy of that information or for the content of any external website.

References have, wherever possible, been verified.

Mention of commercial names and products does not imply the endorsement of the United Nations.

References to dollars (\$) are to United States dollars, unless otherwise stated.

Symbols of United Nations documents are composed of capital letters combined with figures. Mention of such a symbol indicates a reference to a United Nations document.

United Nations publication issued by ESCWA, United Nations House,
Riad El Solh Square, P.O. Box: 11-8575, Beirut, Lebanon.

Website: www.unescwa.org.

Photo credit:
Cover: ©istock.com

Acknowledgements

This study was prepared by the Information and Communications Technologies (ICT) Policies Section in the Technology for Development Division (TDD) at the United Nations Economic and Social Commission for Western Asia (ESCWA). The study working group was led by the Section Chief, Ayman El-Sherbiny, as lead author, and included George Younes, Programme Management Officer, Mirna Barbar, Programme Management Officer, and Zahr Bou-Ghanem, research assistant, ICT Policies Section. The study was based on a report prepared by Souheil Marine, a consultant in digital technologies for development, and under the supervision of the TDD Director, Haidar Fraihat.

The study was discussed internally in ESCWA and received comments from: Khalid Abu-Ismaïl, Chief of Section, Economic Development Poverty Section, EDID; Mohamed Hedi Bchir, Chief of Section, Modelling and Forecasting Section, Economic Development and Integration Division (EDID); Fidele Byiringiro, Economic Affairs Officer, Food and Environment Policies Section (FEPS), Sustainable Development and Productivity Division (SDPD); Ahmed Kamaly, Chief of Section, Economic Governance and Planning Section (EGPS), EDID; Aljaz Kuncic, Economic Affairs Officer, Social Development Division (SDD); Sukaina Al Nasrawi, Social Affairs Officer, Gender Equality Section (GES),

ECW; Oussama Safa, Chief of Section, Social Justice Section (SJS), SDD; Rami Zaatari, Head of Unit for Dissemination and Communication of Statistics, Statistics Division.

The gender dimension was reviewed by Lize Denner, Associate Programme Management Officer in the Innovation Section, TDD. An external peer review was conducted by a panel of experts that included: Christine Arida, Executive Director, Telecom Services and Planning, National Telecom Regulatory Authority, Egypt; Hanane Boujemi, senior technology policy expert; Abdulilah Dewachi, an information and communications technologies consultant; Mansour Farah, a consultant on ICT for development; and Fadi Salem, Director of Research and Policy Advisory, Mohammed Bin Rashid School of Government.

The study was conducted under the ESCWA 2016-2017 biennium work programme and within the Information Society and Digital Economy Hub for the Arab Region (ISDEHAR) framework, endorsed by member countries in the first intergovernmental meeting on technology for development (Dubai, 11-12 February 2017).

ESCWA welcomes any comments from member States, to be sent by electronic mail to the following address: escwa-tdd@un.org.

Executive Summary

Digital technologies have an impact on all socioeconomic endeavours in developed and developing countries, and constitute key elements of the next industrial revolution. This study discusses digital technologies for development in the Arab region in the context of the United Nations Agenda for Sustainable Development and the horizon it sets for the year 2030. Publishing this study is part of efforts to promote radical policy changes in utilizing digital technologies for sustainable development in Arab countries. It sets out proposals and recommendations for harnessing these technologies in social, economic and human development opportunities.

Digital technologies have been important on the international agenda since the World Summit on Information Society (WSIS) of 2003 and 2005, and have a central role in the implementation of the new sustainable development agenda. This document addresses an array of issues related to digital technologies and lying at the intersection of two international agendas, with complementary and consistent challenges; most importantly, how to improve the use of digital technologies for the benefit of sustainable development and fulfilment of the sustainable development goals (SDGs).

Part I sets the scene by providing, in chapter 1, a brief outline of the United Nations 2030 Agenda for Sustainable Development and its accompanying Addis Ababa Action Agenda on financing development, with emphasis on the role they attribute to digital and information and

communication technologies (ICTs). It also discusses the 10-year review of the World Summit on Information Society (WSIS+10), including the new challenges and priorities in the period leading to 2030. Chapter 2 discusses two important dimensions of technology for development and United Nations processes related to digital technologies and the SDGs. It also provides an analytical framework to outline the relationship between the thematic issues addressed in part II and the SDGs. Finally, chapter 3 summarizes the situation of Arab countries for each of the 17 SDGs of the 2030 agenda as reflected in the first *Arab sustainable development report* (as well as other ESCWA publications) and the potential role digital technologies could play in addressing them; this provides the reader with a global overview of the developmental challenges faced by the region and the potential of ICT to help address them.

Part II surveys the situation in Arab countries under thematic policy areas of relevance to digital technologies and their impact on development goals, including: digital strategies; the ICT sector; ICT infrastructure; cybersecurity; digital divide; e-applications; and e-government. Although no formal grouping is suggested for the policy areas, governance, as it relates to digital strategies, is dealt with in chapter 4, addressing the general question of how public policy could enhance digital technologies for development. Chapters 5 and 6 address the ICT sector, focusing on industrial aspects of digital technologies and their impact on the economy,

growth and jobs, and ICT infrastructure. Chapter 7 addresses cybersecurity. Chapters 8 to 10 focus on the use and impact of digital technologies through Internet access in various socioeconomic endeavours. First, the digital divide chapter addresses how many people use the Internet and for what purpose. Next, the e-applications chapter analyses the use of digital technologies in commerce, health and education, and finally the e-government chapter addresses the use of digital technologies by governments to improve the delivery of public services.

Each chapter of part II is organized under four sections corresponding to a common approach adopted for each thematic policy area. First, a contextualization of the thematic issue with respect to its impact on the SDGs is carried out by identifying the relationship with the WSIS action line(s) as well as other considerations and related impact on SDGs, as identified during the WSIS+10 process and discussed in chapter 2. Second, prevailing policies are discussed, including current gaps and future implications, to provide a snapshot of the situation in Arab countries and to measure the gap with more advanced countries. Third, the Horizon 2030 vision is outlined followed by policy change recommendations aimed at fulfilling the prescribed vision for the impacted SDGs. The Horizon 2030 vision offers a view on what could be appropriate for the Arab region given its resources, human capabilities and development expectations. Finally, a business-as-usual trajectory and one which takes into consideration the prescribed Horizon 2030 are compared.

In discussing the above issues, the scarcity of statistical data on digital technologies and the digital economy at large for Arab countries, was a key issue. Often, international assessments

and surveys, whose data timeliness and accuracy could sometimes be questioned, were relied on to substantiate analysis. However, further research that relies on regional studies may be conducted in follow-up studies for further substantiation. In addition, the advent of the Internet has raised governance issues related to this infrastructure, which is of concern for Arab countries and has led to important regional forums and road maps central to our subject. Finally, digital technologies for development require regional cooperation among Arab countries, and ESCWA plays a central role in facilitating and coordinating those efforts.

Part III provides a summary of the 2030 vision and its associated policy change recommendations for each of the seven areas addressed in part II. The key recommended changes include the following:

- Enhance the framework for the development of human capabilities and skills for the digital age and the adoption and use of digital technologies for sustainable development;
- Develop governance mechanisms and reform the regulatory systems that affect the digital economy holistically;
- Formulate good economic policies and incentives for investments in the digital economy business models;
- Facilitate a culture of open dialogue and collaboration that promotes the use of digital technologies for the benefit of sustainable development and attaining the SDGs;
- Develop national digital strategies that are in line with the 2030 development vision, involve all stakeholders, are managed at the highest political level and implemented through a whole-of-government approach;

- Develop national cybersecurity strategies centred on national computer emergency response teams (CERTs), with a mission that goes beyond avoiding cyberthreats to enhancing coordination among all stakeholders, supporting the drafting of better laws to deal with cybercrime and providing national awareness and capacity-building activities;
- Develop the Arab ICT sector to be less reliant on ICT imports and to better integrate Arab countries in global value chains, and to enhance the sector's contribution to economic growth and job creation;
- Develop a good quality ICT infrastructure at affordable prices and promote its use and the use of e-services and related applications for development;
- Develop national and regional e-commerce platforms, together with mobile payment solutions, which could allow e-commerce to be a tool for economic transformation involving all stakeholders;
- Improve national e-health strategies, with the involvement of all stakeholders, for better health outcomes, using ICT technologies and smart tele-health applications for remote health services;
- Develop ICT in education, including the advance of the massive open online course (MOOC) platforms, in association with a reform of education methods to increase access and connectivity; such actions enhance education outcomes through better monitoring and the participation of students in assessment programmes; improve the provision of e-government services that seek to meet local needs and priorities, and enhance the provision of open government data. Such action should engage citizens in public policymaking and decision-making and improve the effectiveness and accountability of the public service;
- Adopt an inclusive approach to implementing policies that involves all stakeholders and takes into consideration the needs of women and men, and engage youth in all parts of policy development;
- This study is foundational, furnishing the ground for a regional process of tracking and monitoring national efforts to link ICTS or digital technologies with sustainable development. ESCWA, based on this study and further consultations with stakeholders during the World Government Summit in Dubai in February 2018 and during the World Summit on Information Society Forum in Geneva in March 2018, has devised and launched the first Arab Digital Development Report (ADDR), with the aim to define a baseline by 2019 on the status of the Arab countries on WSIS Action lines, in light of the theme of the high-level political forum of the United Nations Economic and Social Council in 2019. Several efforts are needed to close the gaps defined in this Horizon 2030 report to achieve the desired status by 2030.

Contents

	<i>Page</i>
Acknowledgements	iii
Executive Summary	v
Acronyms	xii
Part I. Setting the Scene	1
1. The Latest United Nations Processes Pertaining to Sustainable Developments and Digital Technologies	3
A. The new United Nations development agenda (2015)	5
B. The WSIS+10 review (2015)	7
2. The Technology for Development and Linkages	9
A. Digital technologies contribution to SDGs	11
B. The Intersection between United Nations processes related to digital technologies and those related to SDGs	13
3. Arab Status in SDGs and Potential Contribution of Digital Technologies	17
Part II. Digital Technologies Thematic Policy Areas: Future Implications of Prevailing Policies Versus Aspired Horizon 2030	27
4. Policy Area 1: Digital Strategies	31
A. Context in SDGs	33
B. Prevailing policies: current situation and future implications	33
C. Horizon 2030: aspirations and policy recommendations	35
D. Conclusion: business-as-usual trajectories versus Horizon 2030	37
5. Policy Area 2: ICT Sector	39
A. Context in SDGs	41
B. Prevailing policies: current situation and future implications	41
C. Horizon 2030: aspirations and policy recommendations	51
D. Conclusion: business-as-usual trajectories versus Horizon 2030	53
6. Policy Area 3: ICT Infrastructure	55
A. Context in SDGs	57
B. Prevailing policies: current situation and future implications	57
C. Horizon 2030: aspirations and policy recommendation	61
D. Conclusion: business-as-usual trajectories versus Horizon 2030	62

7. Policy Area 4: Cybersecurity	65
A. Context in SDGs	67
B. Prevailing policies: current situation and future implications	67
C. Horizon 2030: aspirations and policy recommendations	69
D. Conclusion: business-as-usual trajectories versus Horizon 2030	71
8. Policy Area 5: Digital Divide	73
A. Context in SDGs	75
B. Prevailing policies: current situation and future implications	75
C. Horizon 2030: aspirations and policy recommendations	81
D. Conclusion: business-as-usual trajectories versus Horizon 2030	83
9. Policy Area 6: E-applications	85
A. Context in SDGs	87
B. Prevailing policies: current situation and future implications	88
C. Horizon 2030: aspirations and policy recommendations	94
D. Conclusion: business-as-usual trajectories versus Horizon 2030	97
10. Policy Area 7: E-government	99
A. Context in SDGs	101
B. Prevailing policies: current situation and future implications	101
C. Horizon 2030: aspirations and policy recommendations	104
D. Conclusion: business-as-usual trajectories versus Horizon 2030	105
Part III. Shaping the Future	107
11. Vision 2030 Blueprint	109
12. Concluding Remarks	119
Annex 1. A Policy Framework for the Supply of Internet Services	127
Annex 2. The Partnership Core List of Indicators (March 2016)	129
Annex 3. Digital Technology Indicators for SDGs	131
Annex 4. The WSIS-SDG Matrix	135
References	137
Endnotes	141
List of Tables	
Table 1. Emerging digital technologies for the SDGs; opportunities and potential threats	11
Table 2. Digital technologies: major benefits and risks along three development dimensions	12
Table 3. Thematic digital technologies issues, WSIS action lines and SDGs	13
Table 4. SDGs situation in the Arab region and the contribution of digital technologies	19
Table 5. NRI and GII ranking evolution, Arab countries	35
Table 6. Doing business, ease of getting credit, FDI inflows and stocks, venture capital	42
Table 7. ICT goods and services exports, Arab countries, 2015	45
Table 8. Global Innovation Index: global rank and pillars, Arab countries, 2017	47

Table 9.	Online creativity indicators, Arab countries, 2016	49
Table 10.	Key ICT infrastructure indicators, Arab countries, indicated year	58
Table 11.	Percentage of population using the Internet, Arab countries, 2016	76
Table 12.	Internet activities in developed and developing countries	78
Table 13.	ICT prices, Arab countries	80
Table 14.	B2C e-commerce index, Arab countries 2016 and percentage Internet shoppers	89
Table 15.	PISA mean scores in science, reading and mathematics, OECD average and Arab countries, 2015	94
Table 16.	EGDI and selected e-government-related indicators from the NRI, Arab countries, 2016	102
Table 17.	Open Data Barometer, Arab countries, 2016	103
Table 18.	Priorities for improving government services in different contexts	104
Table 19.	Summary of Horizon 2030 vision and policy recommendations	112

List of Figures

Figure 1.	GDP growth, Arab world, world, MENA outside high-income, 2003-2016	46
Figure 2.	Significant FTTH/B deployments, Arab countries, 2016	60
Figure 3.	Internet usage gender gap evolution, 2013-2016	77

List of Boxes

Box 1.	ICTs and the 2030 agenda	5
Box 2.	Addis Ababa Action Agenda and role of digital technologies	6
Box 3.	Arab countries in the third global survey on e-health	91
Box 4.	ICT use in education: selected comparisons between Arab countries and the European Union	92

Acronyms

3G	third generation mobile network
4G	fourth generation mobile network
5G	fifth generation mobile network
B2B	business to business (e-commerce)
B2C	business to consumer (e-commerce)
CAI	computer assisted instruction
CERT	computer emergency response team
CIR	critical Internet resources
DE	digital economy
DBI	Doing Business Index
EGDI	E-Government Development Index
EHRs	electronic health records
EU	European Union
FDI	foreign direct investment
FTTB	fibre to the building
FTTH	fibre to the home
GCC	Gulf Cooperation Council
GNI	gross national income
GII	Global Innovation Index
IAI	Internet assisted instruction
ICANN	Internet Corporation for Assigned Numbers and Names
ICT	information and communication technology
ICT4SD	information and communication technology for sustainable development
IGF	Internet Governance Forum
IoT	Internet of things

IPv6	Internet protocol version 6
ITU	International Telecommunication Union
IXP	Internet exchange point
LAN	local area network
LAS	League of Arab States
LTE	long-term evolution (associated with 4G)
MDG	Millennium Development Goals
MLM	multi-lateral model
MSM	multi-stakeholder model
NGA	next generation access
NGN	next generation network
NGO	non-governmental organization
NIS	national innovation system
NRA	national regulatory authority
NRI	Networked Readiness Index
NSO	national statistics office
OECD	Organisation for Economic Co-operation and Development
PISA	Program for International Student Assessment
SDGs	Sustainable Development Goals
SME	small and medium-sized enterprises
STI	science technology and innovation
ccTLD	country-code top-level domain
gTLD	global top-level domain
UHC	universal health coverage
UIS	UNESCO Institute for Statistics
UPU	Universal Postal Union
VC	venture capital
VLE	virtual learning environment
WHO	World Health Organization
WSIS	World Summit on Information Society

Part I

Setting the Scene



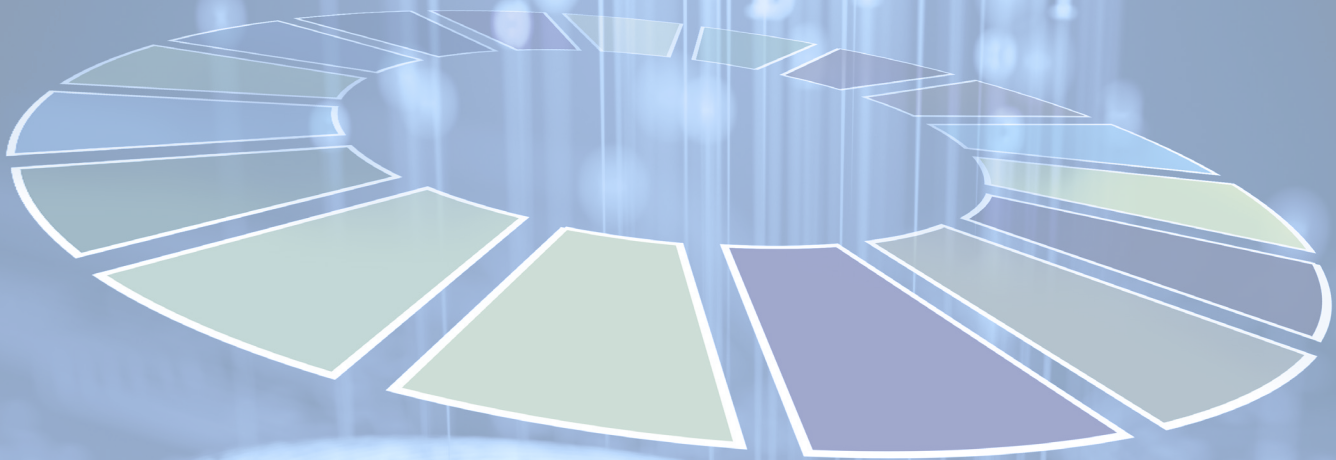
This part provides background on key international development agendas and the World Summit on Information Society (WSIS) process, as well as the impact of digital technologies on development in Arab countries. This background is useful for a better understanding of thematic issues discussed in part two.

Chapter 1 discusses two closely related international development agendas introduced in 2015: the 2030 Agenda for Sustainable Development and the Addis Ababa Action Agenda on international financing for development, the so-called Addis Agenda. The 2030 agenda introduces 17 sustainable development goals (SDGs) for the international community; these set the time frame for our analysis and a starting point for how digital technologies can help fulfil them. The Addis Agenda emphasizes that financing development should become essentially an endogenous process in developing countries, whereby sustained economic growth should generate the needed resources for development. In the brief presentation of these two agendas, the focus is on how they each envision the role of digital technologies. Chapter 1 also discusses the updated and renewed WSIS agenda, which is now linked with the 2030 agenda. The WSIS agenda, through its 11 action lines, was devised in the early years of this century. Upon its renewal, a thorough analysis of these action lines was carried out and it was shown that they could contribute to the 17 SDGs (and their related targets) of the 2030 agenda. This provides a useful reference when discussing the impact of digital technologies on development in the next chapter.

Chapter 2 discusses the rapid evolution of digital technologies for development and the benefits and risks they pose to economic growth and opportunities, and to effective service delivery. The first aspect highlights the limitations of long-term forecasts for digital technologies, due to their rapidly changing nature and unforeseen disruptive effects. The second aspect highlights the broader development impact, or dividends, of digital technologies that cannot be addressed by strictly following the WSIS action line framework, even if the latter is part of them. For this reason, seven thematic issues are introduced in the second part of this chapter to structure the next part of this document around their relationship with WSIS action lines and their related impact on the SDGs, leveraging the above-mentioned action lines/SDG mapping. This contextualization of the chosen thematic issues with the SDGs is further detailed in the general introduction of part two below and its relevant chapters.

Finally, chapter 3 summarizes the challenges faced by Arab countries in seeking to achieve the 17 goals of the 2030 agenda as described in the 2015 *Arab sustainable development report*. The role digital technologies can play in meeting those challenges is briefly summarized.

1. The Latest United Nations Processes Pertaining to Sustainable Developments and Digital Technologies



1. The Latest United Nations Processes Pertaining to Sustainable Developments and Digital Technologies

A. The new United Nations development agenda (2015)

A major milestone in international development occurred in 2015 when the United Nations General Assembly adopted resolution 70/1 on the 2030 Agenda for Sustainable Development.¹

The 2030 agenda was adopted as two other United Nations processes converged, namely the end of the Millennium Development Goals (MDGs) in 2015, and Agenda 21, also known as the Rio Agenda, originally adopted in 1992 and renewed twice, in 2002 and 2012.²

The 2030 agenda introduces 17 interrelated development goals, also known as the Sustainable Development Goals, or SDGs, which build on the MDGs and respond to new challenges. Human development and eradicating poverty remain at the core of the proposed SDGs, with the added recognition that a healthy and resilient environment underpins sustainable social and economic progress.

The SDGs are designed to be action-oriented and global in nature. Proper implementation and global cooperation will be crucial to their success as specifically stated in SDG 17.

The role of information and communications technology (ICT) in achieving the SDGs is

recognized in the text of the 2030 agenda (box 1).

Box 1. ICTs and the 2030 agenda

Paragraph 15 of the 2030 agenda acknowledges that “the spread of information and communications technology and global connectivity has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies, as does scientific and technological innovation across areas as diverse as medicine and energy”.

The three targets below, which are related to gender equality (SDG 5), resilient infrastructure (SDG 9), and means of implementation (SDG 17) explicitly mention ICT:

- Target 5.b seeks to enhance the use of enabling technology, particularly information and communications technology, to promote the empowerment of women;
- Target 9.c aims to significantly increase access to ICT and strive for universal and affordable access to the Internet in least-developed countries by 2020;
- Target 17.8 aims to fully operationalize the technology bank and science, and technology and innovation capacity-building mechanism for least-developed countries by 2017, and enhance the use of enabling technology, particularly ICT.

Source: United Nations, 2015b.

In addition, digital technologies play a key role in ensuring the effective financing of sustainable development, as outlined in the outcome of the

third conference on financing development and its Addis Ababa Action Agenda (Addis Agenda)³ adopted in July 2015 (box 2).

Box 2. Addis Ababa Action Agenda and role of digital technologies

The Addis Agenda states its objective is to underpin the 2030 agenda by an equally ambitious and credible means of implementation and further strengthen the framework to finance sustainable development and the means of implementation for the universal post-2015 development agenda. In view of this, the suggested action agenda is holistic and introduces wide, albeit complementary, financing resources. The last item of the Addis Agenda specifically deals with the role of science, technology and innovation, including ICT.

Domestic public resources are first and foremost generated by economic growth, supported by an enabling environment at all levels. The signatories commit to enhancing revenue administration through modernized, progressive tax systems, improved tax policy and more efficient tax collection and combating tax evasion and corruption. Efficient e-government services, for instance, could play a key role in realizing such objectives. Of particular interest to many Arab countries is the commitment to rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions. This includes restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts. Addressing this issue would likely involve rationalization of energy consumption with digital technologies, such as smart grids and smart meters, in association with the development of renewable energy sources.

For domestic and international private business and finance, signatories acknowledge the importance of robust risk-based regulatory frameworks for all financial intermediation, from microfinance to international banking and commit to work towards full and equal access to formal financial services for all and encourage the use of innovative tools, including mobile banking, payment platforms and digitalized payments. The signatories also recognize the important contribution that direct investment, including foreign direct investment, can make to sustainable development, particularly when projects are aligned with national and regional sustainable development strategies. Government policies can strengthen positive spillovers from foreign direct investment, such as know-how and technology, including through establishing linkages with domestic suppliers, as well as encouraging the integration of local enterprises – in particular, micro, small and medium-sized enterprises in developing countries – into regional and global value chains.

In addressing systemic issues, the signatories committed to “effectively strengthen national institutions to combat money-laundering, corruption and the financing of terrorism, which have serious implications for economic development and social cohesion”. The latter two are topical issues for the Arab region and e-finance could contribute to improved transparency and control of fraudulent activities.

Science, technology and innovation and capacity building are important action areas in which signatories “note with concern the persistent digital divide and the uneven innovative capacity, connectivity and access to technology, including information and communications technology, within and between countries”. The signatories have also committed to promote the development and use of ICT infrastructure and capacity-building, including “rapid universal and affordable access to the Internet” and decided to “establish a technology facilitation mechanism” based on collaboration among all stakeholders. The mechanism is an important target of the SDGs (Goal 17) and is meant to play a key role in technology-related transfer towards developing countries.

Source: United Nations, 2015a.

B. The WSIS+10 review (2015)

The adoption of the 2030 agenda coincided with the 10-year review of the World Summit on Information Society (WSIS). A resolution adopted by the same session of the United Nations General Assembly reflects on the “outcome document of the high-level meeting of the General Assembly on the overall review of the implementation of the outcomes of the WSIS” (WSIS outcome resolution).⁴

The WSIS outcome resolution builds on the “high-level event for the review of the World Summit, [...], and its outcomes, the statement of the 10-year review of the World Summit on the implementation of World Summit outcomes, and the vision of the 10-year review of the World Summit beyond 2015”.⁵ The resolution includes a “call for close alignment between the World Summit on the Information Society process and the 2030 Agenda for Sustainable Development, highlighting the cross-cutting contribution of information and communications technology to the Sustainable Development Goals and poverty eradication”.

It is important to examine the issues highlighted in the WSIS outcome resolution. Some of these were faced during the implementation of the WSIS agendas. Many are still applicable – sometimes in a new form – in the post-2015 period. They include:

Bridging digital divides. The resolution states that, “Despite the previous decade’s achievements in information and communications technology connectivity, we express concern that many forms of digital divides remain, both between and within countries and between women and men”. It noted that the “divides are often closely linked to education levels and existing inequalities”

and recognized that future divides can also slow sustainable development. In other words, the digital divide is still high on the agenda and might well hamper the realization of the SDGs. The text of the resolution further highlights the new dimensions of the digital divide, related mainly to affordability, education and relevant content. The resolution acknowledges a gender digital divide that hampers the participation of women in the information society. This divide is visible in women’s access to and use of information and communications technologies, and extends to education, employment and other areas of economic and social development. The signatories further recommended that “immediate measures to achieve gender equality in Internet users by 2020” should be taken “especially by significantly enhancing women’s and girls’ education and participation in information and communications technologies, as users, content creators, employees, entrepreneurs, innovators and leaders” and that the participation of women in decision-making processes related to information and communications technologies should be ensured.

Financial mechanisms. The resolution recognizes that “harnessing information and communications technology for development and bridging digital divides will require greater and sustainable investment in infrastructure and services, capacity-building, promotion of joint research and development and transfer of technology on mutually agreed terms”. This is a clear indication of the financial challenges confronting broadband deployment in many countries.

Human rights in the information society. After recalling that “human rights have been central to the vision of the WSIS” the resolution states “that there are serious threats to freedom

of expression and plurality of information, and [...] call for the protection of journalists, media workers and civil society space". It further recalls "that no person shall be subjected to arbitrary or unlawful interference with his or her privacy, family, home or correspondence, consistent with countries' obligations under international human rights law" and accordingly "call upon all States to review their procedures, practices and legislation regarding the surveillance of communications, as well as their interception and collection of personal data, including mass surveillance". The above indicates that mass surveillance of online activities by States and threats to online activists might hinder the adoption of online services.

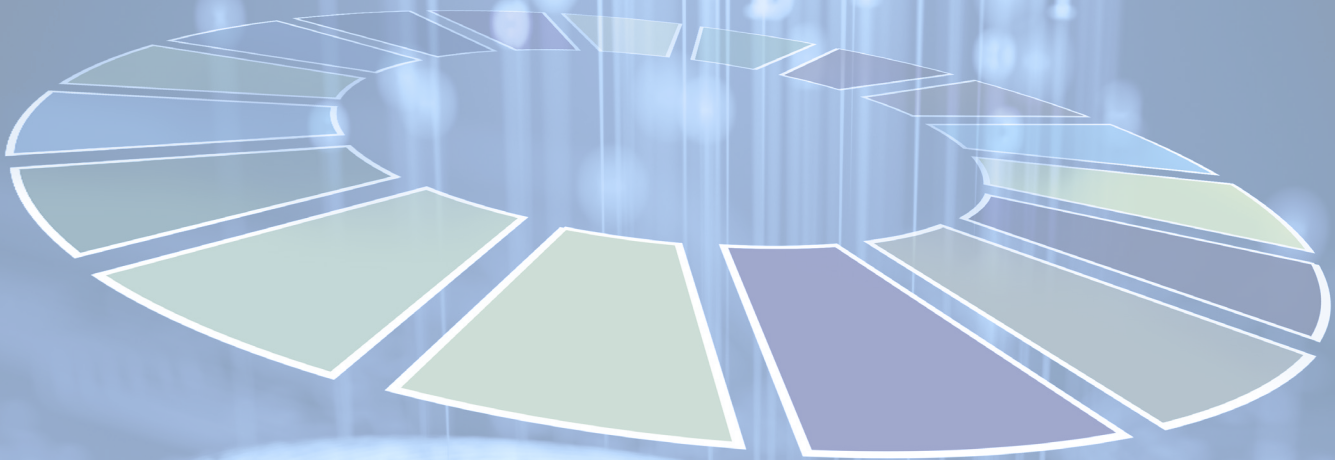
Building confidence and security in the use of ICT. The text observes the "growing uses of information and communications technologies that threaten security and development benefits, including the use of such technologies for terrorist purposes and cybercrime" and expresses "concerns that attacks against States, institutions, companies, other entities and individuals are now being undertaken through digital means". The text invites "Member States to intensify efforts to build robust domestic security in information and communications technologies" and "to cooperate on transnational issues of

information and communications technologies and the use thereof, including capacity-building and cooperation in combating the criminal misuse of the technologies and preventing the use of technology, communications and resources for criminal or terrorist purposes".

Internet governance. The text acknowledges "the role of the Internet Governance Forum (IGF) as a multi-stakeholder platform for discussion of Internet governance issues". It also extends "for another 10 years the existing mandate of the IGF as set out in paragraphs 72 to 78 of the Tunis Agenda". In a veiled criticism that IGF working methods might possibly be improved with greater participation from developing countries, the text stresses that the "Forum should continue to show progress on working modalities and the participation of relevant stakeholders from developing countries".

Follow-up and review. The resolution recognizes "the importance of data and statistics to support information and communications technology for development, and call for further quantitative data to support evidence-based decision-making" and that the "activities of the Partnership on Measuring ICT for Development have made a valuable contribution to data gathering and dissemination and should be continued".

2. The Technology for Development and Linkages



2. The Technology for Development and Linkages

A. Digital technologies contribution to SDGs

Technology is a major contributor to the fulfilment of the SDGs. An analysis carried out in the 2016 edition of the United Nations *Global sustainable development report*⁶ identifies 48 SDGs targets, out of a total of 169, that explicitly refer to technology. These are mostly related to overall technological improvement, universal access to sustainable technology, or a globally effective innovation system for sustainable development.⁷

A panel of international scientists was asked which technologies and what level of their performance and deployment will be most crucial until 2030? Technologies identified fall into the bio-tech, digital-tech, nano-tech, neuro-tech and green-tech clusters. Table 1 summarizes the identified components of the digital cluster.

There was consensus among surveyed scientists that digital technologies provide new information and analytics that can help with make smarter decisions and provide more effective services and innovation in every SDG area. However, they expressed development concerns and the biggest challenges will likely be in sectors such as manufacturing, construction, and transport, where innovations are needed to expand rather than reduce employment opportunities and ensure that more people move out of poverty in all countries.⁸ The technological dimension

facilitates concrete analysis, though there is the risk of obsolescence.

Table 1. Emerging digital technologies for the SDGs; opportunities and potential threats

Crucial emerging digital technologies for the SDGs until 2030
Big data technologies; Internet of things; 5G mobile phones; 3-D printing and manufacturing; Cloud computing platforms; open data technology; free and open source; artificial intelligence and machine learning; 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 systems of electricity use and automatic meter reading; digital monitoring technologies; digital security technology; and blockchain, bitcoin and other emerging technologies that will significantly impact on development in the horizon 2030.
Opportunities
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.
Potential threats
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, cyberattacks.

Source: United Nations, 2016b.

The yearly edition of the World Bank's *Development report* in 2016 was devoted to digital dividends.⁹ A key question posed was whether ICT has led to development benefits, also known as digital dividends,¹⁰ and what factors are key to improving them. The report draws on the World Bank's long experience in financing ICT infrastructure and services projects and providing advisory assistance to many developing countries.

The report states from the outset that, despite the rapid spread of digital technologies in much of the world, digital dividends have lagged. Although it acknowledges that in many instances "digital technologies have boosted growth, expanded opportunities, and improved service delivery yet their aggregate impact has fallen short and is unevenly distributed".

The report adopts a unifying approach, which considers that ultimately "digital technologies greatly lower the cost of economic and social transactions for firms, individuals, and the public sector". Consequently, "they promote innovation when transaction costs fall to essentially zero. They boost efficiency as existing activities and services become cheaper,

quicker, or more convenient. And they increase inclusion as people get access to services that previously were out of reach". It is along these three generic categories of benefits that economic growth, growing opportunities for people, and government and service delivery are analysed (table 2) in two steps: first, to highlight reasons why dividends have not been fully realized; and second, to issue policy recommendations that aim to improve "analog complements" to materialize those dividends.

It is important to note the risks incurred by the widespread use of digital technologies, particularly when analog complements – essentially the responsibility of policymakers – are not up to the task. "Vested business interests, regulatory uncertainty, and limited contestation across digital platforms could lead to harmful concentration in many sectors. Quickly expanding automation, even of mid-level office jobs, could contribute to a hollowing out of labour markets and to rising inequality. And the poor record of many e-government initiatives points to the high failure of ICT projects and the risk that states and corporations could use digital technologies to control citizens, not to empower them".¹¹

Table 2. Digital technologies: major benefits and risks along three development dimensions

Dimension	Inclusion – overcome information barriers	Efficiency – augment existing factors	Innovation – generate economies of scale	Risks
Economic growth	International trade	Capital utilization	Competition	Divergence and monopoly power
Economic opportunities	Job creation	Labour productivity	Consumer surplus	Inequality
Government and service delivery	Participation	State capability	Voice	Elite control and fiscal waste

Source: World Bank, 2016.

B. The Intersection between United Nations processes related to digital technologies and those related to SDGs

United Nations agencies in charge of facilitating the implementation of WSIS Action Lines (AL), gathered at the WSIS Forum in May 2015, elaborated a matrix document showing linkages (when applicable) between each WSIS action line and the SDGs.¹² The matrix is complex (annex 4) and rationale behind each action line/SDG linkage is sometimes convoluted and unfocused. Some action lines impact on many SDGs, with only two having a one-to-one link with an SDG. There are, in fact, 123 SDG/action line crossovers and it is neither manageable nor feasible to address all of them separately.

It is more relevant to address those directly related to current thematic issues aimed at facilitating the advent of an information society and digital economy. These map (though not fully, as the situation has evolved since the time of the WSIS) on to WSIS action lines and the latter's role in fulfilling SDGs as indicated in the above-mentioned matrix. Table 3 summarizes those issues that will be detailed in part II of this document, with their mapping into the relevant WSIS action lines and, in turn, impacted SDG. Those issues will be addressed in the following chapters in the context of the SDGs to help identify how realizing the Horizon 2030 vision for each public policy action domain will contribute to fulfilling the SDGs and the broader 2030 agenda.

Table 3. Thematic digital technologies issues, WSIS action lines and SDGs

Public policy action domains	Relevant WSIS action lines	Sustainable Development Goals
Strategies	C1: Role of governments and all stakeholders in the promotion of ICTs for development	SDG 1: End poverty SDG 3: Ensure healthy lives SDG 5: Achieve gender equality SDG 10: Reduce inequality SDG 16: Peaceful and inclusive societies SDG 17: Implementation mechanisms
ICT sector	See discussion in 0	SDG 5: Achieve gender equality SDG 8: Promote economic growth SDG 9: Build resilient infrastructure SDG 12: Ensure sustainable consumption SDG 16: Peaceful and inclusive societies SDG 17: Implementation mechanisms
Infrastructure	C2: ICT infrastructure	SDG1: End poverty SDG8: Promote economic growth SDG9: Build resilient infrastructure SDG11: Inclusive cities

Public policy action domains	Relevant WSIS action lines	Sustainable Development Goals
Cybersecurity	C5: Building confidence and security in the use of ICT	SDG1: End poverty SDG4: Inclusive and quality education SDG5: Achieve gender equality SDG7: Modern and affordable energy SDG8: Promote economic growth SDG9: Build resilient infrastructure SDG11: Inclusive cities SDG16: Peaceful and inclusive societies SDG17: Implementation mechanisms
Digital divide	C3: Access to information and knowledge See also discussion in 0	All SDGs
E-applications	C7: ICT applications: e-learning C4 (partially) – see also discussion in 0	SDG4: Inclusive and quality education SDG5: Achieve gender equality
	C7: ICT applications: e-health	SDG1: End poverty SDG2: End hunger SDG3: Ensure healthy lives SDG5: Achieve gender equality SDG17: Implementation mechanisms
	C7: ICT applications: e-business	SDG1: End poverty SDG2: End hunger SDG5: Achieve gender equality SDG8: Promote economic growth SDG9: Build resilient infrastructure SDG17: Implementation mechanisms
E-government	C7: ICT applications: e-government	SDG5: Achieve gender equality SDG9: Build resilient infrastructure SDG16: Inclusive and peaceful societies SDG17: Implementation mechanisms

Source: Author and WSIS Forum, 2015, for WSIS action line-SDG mapping.

Linkages, as highlighted in table 3, between the WSIS and 2030 agenda processes indicate a potential that could only be materialized

following appropriate action. It is too early to draw definite conclusions on how actions carried out under the WSIS agenda have led to

meaningful impact on SDGs. A progress report¹³ on WSIS activities carried out in 2016 by United Nations agencies and other international organizations concludes “that ICTs are becoming ever more central to the development of economies and societies, and will play a cross-cutting role in achieving the goals of the 2030 Agenda” and identifies three main challenges:

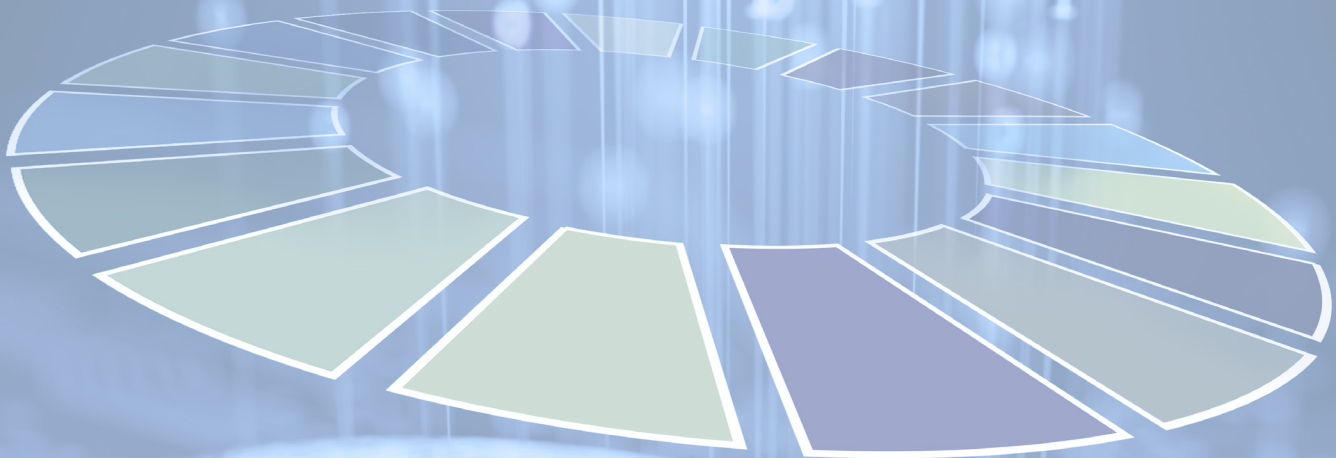
- The continued digital divide between the regions, countries and people with more resources and those with less;

The need to build a more comprehensive evidence base for the development of the information society and its impact on sustainable development;

- The rapid pace of change in ICTs and the impact this will have on global economic and social development.

The first and third challenges will guide the analysis and policy recommendations of the following chapters. Building an evidence base will be addressed in chapter 10.

3. Arab Status in SDGs and Potential Contribution of Digital Technologies



3. Arab Status in SDGs and Potential Contribution of Digital Technologies

Prior to discussing the status of digital technology contributions to the SDGs in Arab countries, it is useful to provide a broad overview of their situation with regards to the SDGs. Table 4 summarizes the situation of the Arab region for each of the 17 SDGs and its

evolution over the past two decades as identified by the first edition of the *Arab sustainable development report*,¹⁴ with specific complements related to ICT infrastructure (Goal 9) and science, technology and innovation (Goal 17) borrowed from other sources.¹⁵

Table 4. SDGs situation in the Arab region and the contribution of digital technologies

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
Goal 1. End poverty in all its forms everywhere	Percentage of population living with less than \$1.25/day stands at 7.4 per cent below global average of 14.5 per cent. Over the period, however, it increased by 34.5 per cent due to, among other things, recent conflict and political instability in many countries.	By making communications more affordable, digital technologies help multiply development opportunities for the poor and empower women and marginalized communities. The deployment of broadband can have an appreciable effect on GDP growth, thereby creating new markets, encouraging innovation and supporting conditions of economies of scale, and by extension, contributing to job creation and poverty eradication.
Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	Arable and permanent crop land area and food production per capita (resp., 4.1 per cent and \$191.4) are well below the world average (resp., 10.9 per cent and \$311). The region has a high dependency rate of cereal imports (56.2 per cent versus a global average of 50.2 per cent) significantly increasing by 33.2 per cent during the period. Agriculture accounts	Low agricultural productivity can be improved by using green ICT and biotechnology to rationalize water consumption, make irrigation more efficient and produce safe, effective fertilizers. ICT can help increase food security by giving farmers direct access to market information and weather forecasts,

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
	for 84 per cent of water use versus a global average of 70 per cent.	as well as planting, harvesting and targeted irrigation advice, logistics and storage, thereby helping to increase yield, restore soil, reduce waste and improve both productivity and effectiveness.
Goal 3. Ensure healthy lives and promote well-being for all at all ages	Global health indicators (life expectancy at birth, under 5 mortality rate) improved in the region over the period but non-communicable diseases now represent the major health challenge for the region as well as the impact of conflict and instability on health.	Digital technologies enable health workers to be connected to information and diagnostic services, while analytics can help make projections about disease outbreaks, health service usage, patient knowledge, attitudes, personal continuous management of diseases and health practices.
Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	<p>Although the Arab region generally performs well in terms of quantity of education, there are major concerns about quality. Arab countries fall far below international averages and benchmarks. Poor quality education means that many young Arabs are unprepared for work. Teaching methods and textbooks in the region often fail to foster critical thinking and rely heavily on “highly didactic, teacher-directed” learning at all levels of education.</p> <p>Governments in the region have made some strides in providing frameworks for education. The proportion of persons in the Arab region who are illiterate is substantially higher for those with disabilities than for the total population. Although in theory all people have the right to education, in practice many people with disabilities cannot exercise this right.</p>	<p>ICT opens the way to distance education and to the dissemination of Arabic content to tens of millions of people who are literate only in Arabic, especially in overcrowded national schools and universities, and creates opportunities for continuing and adult education. The provision of high-quality digital content can lead to better educational performance.</p> <p>E-learning platforms and other technologies offer new ways to learn and reform schools, tertiary institutions and other teaching facilities, making education more accessible to all people, including people with disabilities and children in vulnerable situations.</p>

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
<p>Goal 5. Achieve gender equality and empower all women and girls</p>	<p>Despite improvements in female enrolment in education over the period, particularly at tertiary level where they now surpass males, the female employment-to-population rate of 19 per cent is way below the global average of 47 per cent. Despite some discrepancies among Arab countries, the female share of gross national income (GNI) per capita in the region stands at 30 per cent, much below the world average of 49 per cent.</p> <p>Childbirth complications are the second most common cause of death among adolescent girls (15-19).^a Violence against women, such as intimate partner violence and public harassment, is prevalent across the region, with low levels of legal protection for victims, as well as few programmes and services.^b</p>	<p>Access to ICT can enhance gender equality and women's empowerment, allowing women and girls to access information and technologies of importance to their economic productivity, reproductive health and rights, social well-being and decision-making, as well as involving women in urban planning. Women's sustainable livelihoods can be enhanced through expanded access to markets, education, training and employment.</p>
<p>Goal 6. Ensure availability and sustainable management of water and sanitation for all</p>	<p>Most Arab States suffer from extreme fresh water scarcity, which is exacerbated by population growth and urbanization. Between 1990 and 2014, the percentage of the population with access to safe water has risen from 82 per cent to 84 per cent, still below the global average of 91 per cent (as of 2015). Renewable (ground and surface) water is being withdrawn at an alarming rate, averaging well over available water, and increasing by nearly 13 per cent in the 2000s compared to the 1990s.</p>	<p>Digital technologies will be crucial in ensuring the availability and sustainable management of water and sanitation for all.</p> <p>This is particularly important for smart water management, infrastructure location, better and lower-cost maintenance, optimized operations and improved quality of service to customers.</p>
<p>Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all</p>	<p>Despite good access to electricity in the region (except in least developed countries), intermittent access is a major issue in many countries. The amount of energy the Arab countries use to generate \$1,000 of GDP (in constant 2005 US\$) increased by 23 per cent from 0.34 to</p>	<p>Digital solutions such as smart grids, smart buildings and homes and smart logistics allow other sectors of the economy to improve their energy efficiency and lower energy consumption.</p>

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
	<p>0.42 tons of oil equivalent between 1990 and 2011, in contrast to all other regions, where energy intensity is decreasing (0.29 to 0.24). Despite the region's rich endowment in renewable energy resources, the share in electricity generation remains limited. Renewable energy other than hydroelectric power contributes less than 1 per cent of electricity generation.</p>	<p>The harnessing of renewable energy sources depends on the use of new technologies and innovation, establishing facilities where resources are located and monitoring energy efficiency in its various uses.</p>
<p>Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</p>	<p>Oil, gas, and mining – a dominant sector in oil-rich countries, representing 41 per cent of their GDP in 2012 – accounts for little employment and jobs.</p> <p>The service sector in the region is dominated by low-skills, low-pay jobs.</p> <p>Productivity – key for growth and job creation – is low in the region; its growth rate in the period 1991-2010, at only 0.9 per cent, was the lowest among the world's regions.</p> <p>Employment is one area where the gap between men and women is most visible. Countries have begun to put measures in place to increase the employment of women, as well as award them certain rights, but employment rates among women in the region remain very low.</p> <p>People with disabilities also struggle to access job opportunities, even though countries have put measures in place, such as quotas, to provide better access. In many Arab countries, only a small percentage of people with disabilities are employed, with men being more likely to be employed than women.</p>	<p>Digital technologies can aid educated young people in identifying economic opportunities, given that technological innovation, combined with a sense of initiative, enables bright local people to engage in teleworking and contributes to the global value chain.</p> <p>Technology and ICT offers great opportunities for entrepreneurship and the creation of start-ups, and helps to attract investment, especially in areas of ICT innovation linked to other SDGs.</p> <p>Technologies and ICT offer new ways of work, enhancing employment opportunities for all people.</p>

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	<p>Manufacturing remains a small part of most Arab economies, and is predominantly lower technology manufacturing. Innovation is poor in the region and disconnected from its socioeconomic priorities. Access to ICT infrastructure and Internet use ranges from excellent (in GCC) to at least decent in most Arab countries (even in LDCs), largely thanks to mobile infrastructure. However, fixed broadband access penetration is still low in the region (less than 5 per cent in 2016). It is, in fact, among the lowest in the world, superior only to sub-Saharan Africa and much less than the world's average of 12 per cent.</p>	<p>ICT will continue to play an essential role in building and maintaining resilient infrastructure, in promoting inclusive and sustainable industrialization, and in fostering innovation in the emerging information and knowledge societies, which depend on open access to academic research, transparency to make informed decisions and the power of online collaboration to support cross-sector and in-house co-creation, learning and work.</p>
Goal 10. Reduce inequality within and among countries	<p>Inequality is relatively moderate in the Arab region and has changed little over the past two decades. Gini Index estimates in the 2000s for the Arab region (about 34.3) compare favourably with other regions. Another recent study suggests, however, that in the period up to 2030, economic growth paths are likely to be associated with higher inequality and a shrinking middle class in Arab countries.</p>	<p>Digital technologies can help reduce inequality within and between countries, especially when used to help deliver information and knowledge, and therefore, social and economic progress to disadvantaged segments of society, including those living with disabilities, as well as women and girls.</p>
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	<p>Urban population as a percentage of the total in the Arab region stood at 57 per cent, increasing by 14.3 per cent. Rural-to-urban migration and population growth have led to most Arab cities becoming overcrowded, with growing slums and low-quality informal settlements. Congested traffic and poor quality public infrastructure and services are characteristics of many Arab cities.</p>	<p>Smart cities will make it possible to harness various digital technologies for the collection and analysis of data and assessment of priorities, the identification of potential challenges and adoption of the necessary measures to overcome them.</p>

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
Goal 12. Ensure sustainable consumption and production patterns	<p>Sustainable consumption of energy and water resources are discussed above. A comprehensive analysis of sustainable consumption and production cannot be conducted due to significant gaps in data on waste recycling, treatment and disposal (including hazardous waste). In most countries, the number of cars per 1,000 population is much higher than the global average of 32 as of 2009; this is associated with increased fuel consumption, greenhouse gases emissions and traffic congestion.</p>	<p>Digital technologies can foster sustainable consumption and production through product-specific improvements, increased dematerialization and virtualization, and the implementation of smart technologies in sectors such as agriculture, transport, energy, supply chain management, and smart buildings.</p>
Goal 13. Take urgent action to combat climate change and its impacts	<p>Greenhouse gas emissions per capita in the Arab region (5.3 metric tons) are higher than the world average (4.9 metric tons). The regional trend is clearly unfavourable, with an increase of 54.5 per cent between 1990 and 2011 even on a per capita basis (and 140 per cent in absolute terms). Electricity and transport alone accounted for 60 per cent of the region's carbon emissions in 2010. All in all, the carbon intensity of the region is worsening; in all subregions, except the Maghreb, increases can be observed between the 1990s and 2011.</p>	<p>Smart applications, particularly in energy, transport and buildings, manufacturing, smart services and agriculture and urbanization in general, can help tackle climate change and mitigate its impacts.</p> <p>ICT can optimize value chains and reduce resource usage and waste. It plays a crucial role in sharing climate and real-time weather information, forecasting and early warning systems, and supporting resilience and climate adaptation.</p>
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	<p>The Arab region includes five main regional bodies of water. All face challenges regarding misuse and/or degradation of marine resources. In 2000, only 9 per cent of the Arab population resided in coastal areas below five metres above sea level, a slight decrease since 1990. Although the proportion of the population has remained stable, the total population in such areas has increased, placing greater stress on sensitive coastal environments.</p>	<p>Digital technologies can assist in oceanic conservation and sustainability. Satellite monitoring delivers timely and accurate global data, improving accountability, while big data can be used to analyse biodiversity, pollution, weather patterns and ecosystem evolution, and to help plan mitigation and adaptation strategies.</p>

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
	Average annual fish catch rates for Arab countries increased by more than 180 per cent in 2013 compared with 1990, putting stress on fish stocks in marine bodies in the region.	
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	The average vegetation cover as a percentage of land area in the Arab region declined from 3.68 per cent in 1990 to 2.84 per cent in 2013 (way below the world average of 30.8 per cent). Rangelands have been affected by overexploitation, with a major change in species composition over the past few decades. Overgrazing remains the major factor in rangelands degradation. Protected areas in the Arab region (9.3 per cent of total area) represent less than the world average (14 per cent). However, the Arab region witnessed a clearly favourable trend, with an increase of 189.2 per cent.	Digital technologies can play a significant role in the conservation and sustainable use of terrestrial ecosystems and preventing biodiversity loss through improved monitoring and reporting, which leads to increased accountability, as well as through use of big data to analyse short- and long-term trends and plan mitigation activities. Digital technologies also improve efficiencies in land restoration via sensors, data collection and analysis.
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	Refugees from the Arab region stood at 11.3 million, representing 58.1 per cent of the world total of refugees (19.5 million). This equates to 3 per cent of the Arab population being part of a refugee population, compared with 0.27 per cent for the world. The Arab region exhibits a clearly unfavourable trend in political stability and the absence of violence/terrorism, with the index value decreasing by 66.1 per cent.	Within crisis management, humanitarian aid and peacebuilding, digital technologies have proved a powerful tool in areas such as electoral monitoring, through the use of crowdsourcing. Government use of open data increases transparency, empowers citizens and helps to drive economic growth. Specific ICT applications could help provide social and governmental services to refugees and displaced populations.

Global goals	Arab region major issues with respect to the concerned goal and evolution between the 1990-1995 and 2010-2015 periods	Potential contributions of digital technologies and ICTs to fulfilling the targets of this goal
Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development	<p>This is a complex goal encompassing diverse targets related to financing, trade, technology, capacity building and international cooperation. Of particular interest for ICTs are the technology domain and impact of investments (particularly FDI) on technology transfer.</p> <p>Science, technology and innovation (STI) in all domains, including ICTs, are weak in the region, both quantitatively (human and financial resources) and qualitatively (outputs). STI linkages with socioeconomic concerns are equally weak. Productive investments in the region are weak, particularly in the industrial sector, and FDI volumes to the region – despite a notable increase during the 2000s – represented only 2.23 per cent of the world’s global FDI volumes in 2015. FDI flows to the region are predominantly in the real-estate and mining sectors, without having led to any significant technology transfer.</p>	<p>The private sector, working with and under the guidance of the public sector, can enlarge ICT markets, especially in broadband and mobile communications, thereby making the most of this technology for development.</p> <p>Implementation should be directed at real challenges on the ground through partnerships between all sectors. Arab countries can make the most of local culture and its values to conclude social contracts at the local and regional levels and to strengthen their position globally. Technology can play an enabling role in support of implementation of all the SDGs.</p>

Source: Authors’ compilation from ESCWA and UNEP, 2015; ESCWA and LAS, 2014; ESCWA, 2015; ESCWA, 2017f; ESCWA, 2017g; ESCWA, 2017h; and Earth Institute and Ericson, 2016.

Note: ^a ESCWA, 2017f.

^b ESCWA, 2017g, ESCWA, 2017h.

Part II

Digital Technologies Thematic Policy Areas: Future Implications of Prevailing Policies Versus Aspired Horizon 2030



The situation with digital technologies has evolved since the adoption of the WSIS agenda in the early years of this century. The nature of the digital divide has changed and is now characterized by users' capabilities and used applications and services, rather than primarily access (although its quality, capabilities and affordability are still issues in most developing and Arab countries). Digital technologies now play an important role in the economy, either directly, as an industrial sector providing goods and services (particularly in the context of Arab countries, which are still heavily reliant on imports of ICT goods and services), and the impact of digital innovation¹⁶ on the economy with the introduction of new products, new business models, new ways of doing commerce (e-commerce) and new employment patterns in all economic endeavour. The role of government through so-called digital strategies extends from mainly ensuring universal access to ICT infrastructure to enhancing the impact of digital technologies on economic growth and opportunities, and public service delivery. Cyberrisks have acquired heightened importance due to the increased reliance on digital technologies in all endeavours involving online exchange of critical personal and business data that should be protected from theft and malevolent use.

Seven thematic issues will be discussed to reflect the present situation and the priorities of digital technologies for development, as indicated above. Digital strategies (chapter 4) and cybersecurity (chapter 7) mainly address the role of government – along with other stakeholders – in ensuring that digital technologies are properly leveraged for economic growth and social development, and that associated risks are properly addressed. Developing an ICT sector (chapter 5) is central to our discussion as is the associated ICT infrastructure (chapter 6), without which any talk of economic and social impact of digital technologies is meaningless. Finally, three thematic issues address how many people have access to the Internet and for what purposes in the digital divide (chapter 8), selected e-applications in health, education and commerce (chapter 9), and the role of e-government applications for better public services delivery (chapter 10).

All chapters follow a common structure and are organized under four identical sections.

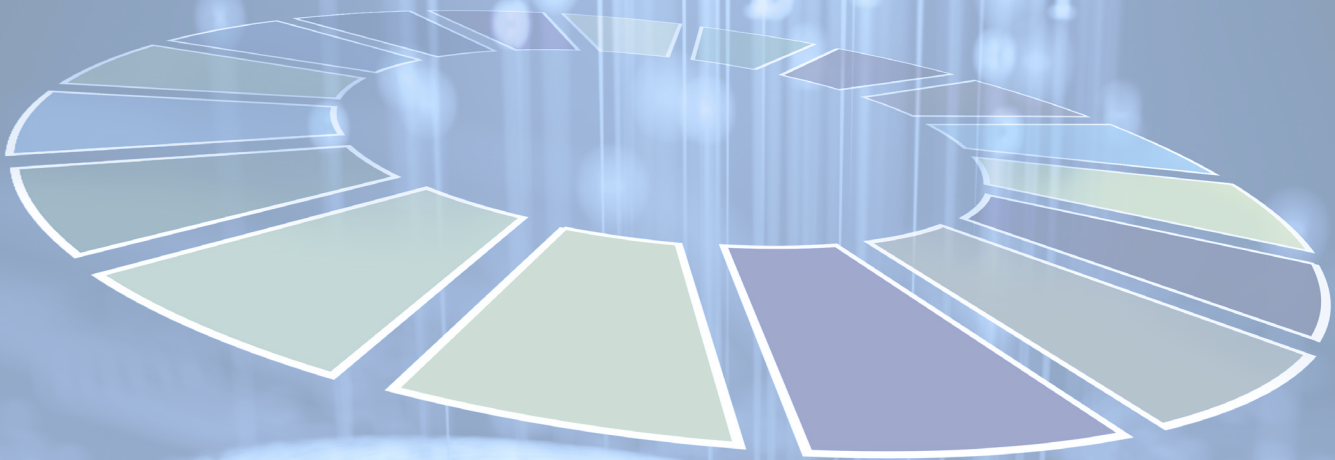
In the first section we place the issue at hand within the context of the SDGs and analyse how it maps into the relevant WSIS action line(s) (as shown in table 3) and impacts on goals and targets as discussed in the WSIS-SDG matrix document.¹⁷ In the specific case of the ICT sector, which addresses industry and jobs issues not covered by WSIS action lines, other goals of relevance are identified. This contextualization helps understand the impact on development goals, particularly if the suggested Horizon 2030 vision (see below) for this issue is realized.

The second step is central, as it consists of a situation and gap analysis of Arab countries with respect to best practices. Limited or outdated data for Arab countries presented problems. Except for ICT infrastructure and service price, for which some reliable data do exist, many issues related to the ICT sector and ICT use and applications have incomplete, outdated or missing data. Also, the first two chapters (digital strategies and cybersecurity) address issues of a qualitative nature, for which, aside from published strategies, enacted laws and created institutions, little is known about real implementation and activities. Consequently, a rigorous gap analysis cannot always be undertaken in quantitative terms and will necessarily be mostly qualitative. This will have impact on the suggested Horizon 2030 visions and related policy recommendations as discussed below.

Next we outline the Horizon 2030 vision, with associated policy change recommendations. A long-term vision corresponding to the horizon of the 2030 agenda, it primarily considers the Arab region's unmet potential and what other similar regions or countries have achieved. It aims to reduce the gap in best practices, highlighting the consequences for development outcomes (see last section below) if this gap is not addressed. Many targets associated with the visions rely on better statistical data collection; their value is not properly measured or, at best, can only be guessed from estimates (for instance, the ICT sector value-added share in GDP or in jobs, and the percentage of government online services users). This is compounded by the rapidly changing nature of digital technologies, making the setting of specific targets for a point in time more than a decade away a difficult exercise even in countries enjoying best practices. However, in many policy areas, the gap in best practices is so wide in Arab countries that policy change recommendations (often suggesting qualitatively improved approaches) can be issued with a certain degree of confidence, even if the associated targets might prove – with better statistical data – either overly ambitious or too modest. This is an area for possible improvement in further research.

The last section compares Horizon 2030 with “business-as-usual” trajectories, focusing on expected consequences for development if policy recommendations are not implemented. The term trajectory is used rather than scenario because there has not been any quantitative comparison between the two situations, either over the course of the period leading to 2030 or at its final date; this is for the same reasons outlined above and related to data availability and the nature of discussed technologies. The consequences of business-as-usual trajectories have such clear negative developmental outcomes, however, that they act as an incentive for policy change, not only via the recommendations here but by considering complementary cross-cutting accelerators and actions.

4. Policy Area 1: Digital Strategies



4. Policy Area 1: Digital Strategies

A. Context in SDGs

Although broader in scope, digital strategies include WSIS action line C1 and, as such, have an impact on SDGs 1, 3, 5, 10, 16 and 17 as indicated in table 3. The impact on SDG1 and SDG5 is not related to any specific target; it is expected that ICTs “allow the private sector to create jobs that contribute to poverty reduction” and a variety of programmes that enhance women’s empowerment. With regards to SDG3, the focus is on target 3.8 for universal health coverage through “various data banks on diseases” and target 3.d related to global health risks by acting to “monitor the spread of a disease”. SDG target 10.c on inequality concerns the cost of migrant remittances, and ICT is expected to “give people access to formal banking” thanks to e-banking and m-banking rather than incur the higher costs of “informal remittances flows”. On SDG16 related to peaceful societies, the focus is on targets 16.5, aimed at reducing corruption, 16.6 on accountable institutions, and 16.10 on fundamental freedom thanks to better access and availability of information. Finally, target 17.18, aimed at enhancing the capability of developing countries to “increase significantly the availability of high-quality, timely and reliable data” can be achieved thanks to “digital transformation of public services to electronic services”.¹⁸

B. Prevailing policies: current situation and future implications

Digital strategies are a key element of government policy aimed at developing not only the ICT sector, but equally, leveraging digital technologies and applications for socioeconomic development.

1. Current situation

All Arab countries have a national digital strategy, though progress in implementation varies, particularly outside the GCC countries. Some countries have revised/updated their digital strategy several times over the period 2000-2015.

Progress in the implementation of national digital strategies was considered in 2015 as part of the information society profiling exercise. Progress was deemed excellent in Bahrain, Qatar and the United Arab Emirates, and good in the remaining GCC countries, Jordan and Morocco. Other Arab countries have had experienced less progress in implementation, namely Algeria, Egypt, the State of Palestine, Sudan, Tunisia, the Syrian Arab Republic and Yemen.¹⁹

One key characteristic of digital strategies in the Arab region is the lack of a participatory and

holistic implementation approach. While it is easy to justify that technical telecom ministries or ICT sector regulatory authorities take charge of elaborating strategies, the implementation should involve all government administrations. The United Arab Emirates, and to a certain extent, Bahrain and Qatar, come close to a holistic approach, particularly regarding services offered to citizens (chapter 10). Nonetheless, despite some high-profile realizations, digital strategies have not had a significant impact on the development of the ICT sector (chapter 5) while adoption of e-applications in key sectors such as business and commerce, education and health remains limited even in high-income GCCs (chapter 0).

Key gaps lie in limited budgets – excluding, that is, high-income GCC countries – for overly ambitious strategies. Other gaps covering culture, awareness, experience and skills, mindset and attitudes are as important. Implementation, as already noted, is often the weakest link where the technical ministry or regulator in charge lacks legitimacy and authority over other government departments and ministries, particularly when the issues address the rather complex demand side of the strategy. The gap in best practices between Arab countries and developed countries lies in insufficient means, weak linkages with other national development priorities and weak implementation.

2. Future implications

For the reasons stated above, it is not easy to project where these gaps might stand in 2030.

However, the track record of existing Arab digital strategies and the continuation of a business-as-usual approach would not lead to meaningful results, even in the more affluent GCC countries.

While it is undeniable that GCC countries have achieved results with their existing strategies, these strategies remain fragile and unsustainable because of rapid technology obsolescence in the ICT sector, lack of endogenous human resources and innovations in this sector and beyond, and insufficient use among the public and in the economy generally.

Two international indices – the Networked Readiness Index (NRI) and the Global Innovation Index (GII), which, respectively, address the digital economy and innovation (in which digital technologies represent a major component; see 4) – have established that most Arab countries have stagnated or lowered over the period from 2010-2011 to 2016-2017, even among many of the affluent GCC countries (table 5).

Arab countries facing acute development challenges and cohorts of unemployed youth will hopefully end up getting their digital strategies right. Policy change recommendations as suggested below might assist them in this process.

In a business-as-usual trajectory, whereby current policies and practices continue, it is expected that the downward/stagnation trend will continue in most Arab countries despite meaningful financial efforts spent on digital technologies by many affluent GCC countries.

Table 5. NRI and GII ranking evolution, Arab countries

Country	NRI 2010-2011	NRI 2016	GII 2011	GII 2017
United Arab Emirates	24	26 ↓	34	36 ↓
Qatar	25	27 ↓	26	49 ↓
Bahrain	30	28	46	66 ↓
Saudi Arabia	33	33 ↓	54	55 ↓
Tunisia	35	81 ↓	66	74 ↓
Oman	41	52 ↓	57	77 ↓
Jordan	50	60 ↓	41	83 ↓
Egypt	74	96 ↓	87	105 ↓
Kuwait	75	61	52	56 ↓
Morocco	83	78	94	72
Lebanon	95	88	49	81 ↓
Algeria	117	117	125	108
Mauritania	130	138 ↓	NA	NA
Yemen	NA	NA	123	127 ↓

Source: WEF, 2011; WEF, 2016; INSEAD, 2011, INSEAD, 2017.

Note: Values for the more recent year with ↓ downward arrows indicate a stagnant or downward trend.

C. Horizon 2030: aspirations and policy recommendations

Horizon 2030 envisages an Arab region where all countries have adopted holistic digital strategies supporting a national long-term development vision and have made progress in implementation. It is forecast that these strategies will have contributed to economic growth and well-being through a well-developed ICT sector and infrastructure, a reduced digital divide and pervasive e-applications, with concrete impact in reducing poverty and inequalities, empowering women and making societies more inclusive.

The envisaged situation in Arab countries would vary according to national institutional capabilities, income level and human resources. While it is expected that high-income GCC countries will reach levels comparable with developed countries in integrating digital technologies into all socioeconomic endeavour, lower-income countries' success will depend on better international and mostly regional cooperation and investment flows to further develop their digital infrastructure, industry and related services for better impact. Least-developed countries will most likely have leveraged digital technologies to enhance their public services and ignite needed reconstruction

on a sound and sustainable basis. As for countries in conflict, it is difficult to predict their future situation due to political uncertainty and their volatile security; however, when conflicts subside, the adoption of digital technologies and strategies would catalyse the reconstruction and state-rebuilding efforts.

To realize the above aspirations, the following policy recommendations might be considered by Arab countries.

A national digital strategy must contain an overarching national vision and associated policies, objectives and targets that aim to leverage digital technologies for development. It must provide an overall framework that encompasses complementary sectoral strategies addressing cybersecurity, e-government and e-applications such as e-health and e-education. A general misconception associates a digital strategy with the ICT sector, and confers its management to a technical authority – a ministry or a regulator – in charge of this sector. Although the ICT sector and related infrastructure are central to a digital strategy, the latter cannot be limited by the confines of the former.

Taking into consideration current digital strategies in many Arab countries, some policy recommendations should be reserved to elaborate and manage future versions of said strategies. The recommendations below remain general in nature and do not address issues specific to any one country. Priorities must be decided according to each country's situation, constraints, and human and financial capabilities.

- A dedicated digital strategy must be primarily articulated with a long-term development vision that is supported at the

highest political level.²⁰ Digital strategies must, therefore, be articulated and made consistent with an overall national vision;^{21,22}

- An implementation and follow-up plan for the digital strategy, that relies on a whole-of-government approach, is needed to ensure success and to effectively address the enabling environment and human capacities;
- Authority to arbitrate on potential conflicts among various administrations should be the remit of a high-level steering committee that coordinates and mediates between the various entities, and acts above any technical ministry or regulator;
- Wide consultations involving all stakeholders are essential and should replace top-down strategies, even those with the best intentions. In this respect, target 17.16 of the SDGs calls for “multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries”.²³ Digital strategies are part of this picture and should follow this principle in all their phases, including design, implementation and monitoring and evaluation;
- Connecting technology showcases with major national developments, particularly when they are financially sustainable, would bring high credit to digital strategies. Including sustainability concerns and effective business models from the outset in all projects, particularly when they address the demand side among disadvantaged populations, is essential. Equally, leveraging private sector contributions in mutually beneficial public-private partnerships is crucial for upscaling and sustainability;

- ICT is rapidly evolving, with new innovations, such as the Internet of things and big data analytics, that could lead to large benefits, but which also have disruptive effects on employment, power concentration, social control and inequalities. Digital strategies should first and foremost accompany efforts, through the necessary analog complements as discussed in section 2.1, to adapt society to these rapidly changing technologies. A multi-stakeholder approach would facilitate this task.

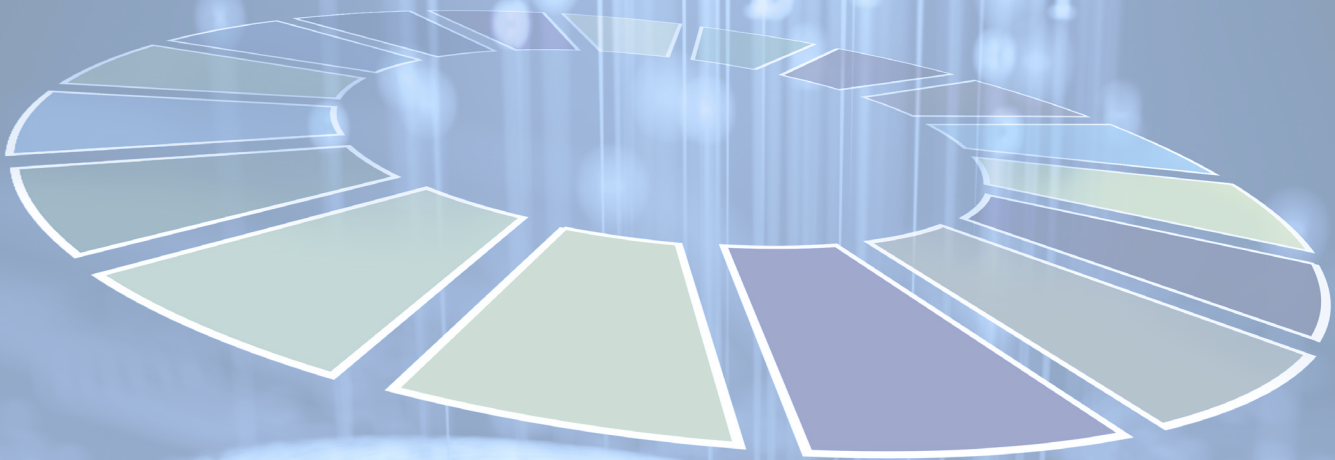
D. Conclusion: business-as-usual trajectories versus Horizon 2030

In a business-as-usual trajectory where current policies and practices are maintained, it is expected that the downward/stagnation trend will continue in most Arab countries despite meaningful financial efforts spent on digital technologies by many affluent GCC countries.

By pursuing Horizon 2030 aspirations, however, Arab countries that implement the above recommendations, associated with broader socioeconomic and enhanced regional integration would enhance their development outcomes and ranking in international indices measuring digital readiness and digital innovation. The downward trend of Arab countries could be reversed significantly and tangible socioeconomic development achieved.

A proper articulation of digital technologies with socioeconomic outcomes requires more than just buying the best technologies and deploying infrastructure. A change in mentality as well as analog complements are often more necessary than merely adopting new technologies. Arab countries need to become active in developing and producing new digital technologies in addition to their general use. This is needed not only to ensure technological independence, but because many of these technologies are imbued with a vision that needs to be adapted to specific cultural contexts.

5. Policy Area 2: ICT Sector



5. Policy Area 2: ICT Sector

A. Context in SDGs

The ICT sector includes the production of ICT goods and services in the broader sense and is a key enabler of the digital economy. It encompasses ICT infrastructure that provides essential telecom and Internet access services (chapter 6) as well as technical aspects of cybersecurity (chapter 7) and digital content and the media industry.

This chapter focuses on enabling factors for the development of the ICT sector, its impact on trade, growth and jobs, and its contribution to innovation as one major component of value added in the economy, in addition to a specific focus on digital content and the media industry.

The ICT sector has a direct impact on SDG 8 related to economic growth and SDG 9 related to industrialization and innovation, and contributes to SDG 17 as it relates to the use of technologies that are essential to achieving the SDGs. As such, and except for action line C9 on media, the WSIS process does not address the development of ICT as an industrial sector, focusing more on ICT infrastructure and its use than on the development of its technological components. Action line C9 contributes to women's empowerment (target 5.b), universal access to ICT (target 9.c), universal access to "relevant information and awareness for sustainable development and lifestyles in harmony with nature" (target 12.8), and to "ensure public access to information and protect fundamental freedoms" (target 16.10).²⁴

B. Prevailing policies: current situation and future implications

Apart from the telecom component, data on the ICT sector's weight in the economy are generally unavailable in the Arab region; this is because development of this sector in the region relies essentially on telecom services and, more specifically, on its mobile component. In one Arab country, for which data are available, namely Saudi Arabia, information technology (IT) services represented only 24 per cent of the total ICT sector, while telecom services represented the remaining 76 per cent.²⁵ In comparison, data from developed countries indicate that IT services, represented nearly 70 per cent of their ICT sector while telecom services represented no more than 30 per cent.²⁶ Strengthening the IT services component in the ICT sector and improving the contribution of Arab countries to the global digital economy are two of the main focus areas of this section.

1. Enabling factors: doing business, getting credit, FDI and venture capital

Like any other industrial sector, the ICT sector is affected by the general economic environment specific to each country. Other factors such as skills, geography and political stability play equally important roles. The business environment and ease of getting credit in Arab countries, as gauged by the Doing Business Index (DBI), flows and stocks of inward foreign direct investments (FDI) and venture capital (VC) deals, are summarized in table 6.

Table 6. Doing business, ease of getting credit, FDI inflows and stocks, venture capital

Country	Doing business report (overall distance to frontier 0-100, rank) 2017	Ease of getting credit (distance to frontier 0-100, rank) 2017	FDI inward flows (millions of US\$) 2016	FDI inward stock (millions of US\$) 2016	Venture capital (number of deals per PPP\$ of GDP) 2016
United Arab Emirates	76.89 (26)	45 (101)	8 986	117 944	0.05 (28)
Bahrain	68.44 (63)	45 (101)	282	28 606	0.02 (57)
Oman	67.73 (66)	35 (133)	142	18 548	NA
Morocco	67.50 (68)	45 (101)	2 322	54 784	0.02 (50)
Tunisia	64.89 (77)	45 (101)	958	29 305	0.05 (32)
Qatar	63.66 (83)	30 (139)	774	33 943	NA
Saudi Arabia	61.11 (94)	50 (82)	7 453	231 502	0.01 (84)
Kuwait	59.55 (102)	40 (118)	275	14 260	0.00 (87)
Jordan	57.30 (118)	0 (185)	1 539	32 148	0.01 (65)
Egypt	56.64 (122)	50 (82)	8 107	102 324	0.01 (72)
Lebanon	55.90 (126)	40 (118)	2 564	61 019	0.08 (22)
State of Palestine	53.21 (140)	40 (118)	NA	NA	NA
Algeria	47.76 (156)	10 (175)	1 546	27 778	0.01 (81)
Mauritania	47.21 (160)	25 (157)	272	6 750	NA
Iraq	45.61 (165)	5 (181)	-5 911	9 498	NA
Sudan	44.76 (168)	15 (170)	1 064	25 467	NA
Syrian Arab Republic	41.43 (173)	15 (170)	NA	10 743	NA
Yemen	39.57 (179)	0 (185)	-561	2 865	NA
Libya	33.19 (188)	0 (185)	493	19 730	NA
Total FDI			30 302	827 215	
Percentage Arab FDI to developing countries			4.67 per cent	9.11 per cent	
Percentage Arab FDI to world			1.73 per cent	3.09 per cent	

Sources: World Bank, 2017, for doing business and getting credit; INSEAD, 2017, for venture capital, and <http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx> for foreign direct investment.

Despite notable efforts by Bahrain and the United Arab Emirates, most Arab countries are in the lower half of the DBI table; among the 190 surveyed economies, only the United Arab Emirates is in the first quintile. A bigger concern is the overall downward trend recorded in many Arab countries between 2011 and 2017. Over the period, only the United Arab Emirates and Morocco significantly improved their “overall distance to frontier” score, while Bahrain slightly improved it.

The getting credit component of the DBI is particularly important for young, innovative firms and is essential for a thriving digital economy. Access to credit is one of the weakest components in all Arab countries.

The experience of emerging countries successfully becoming high-technology producers shows that FDI plays a key role in technology transfer, particularly when these flows are properly channelled towards high added-value sectors.²⁷ The FDI inflows and stocks in Arab countries (table 6) show a large concentration in Saudi Arabia, the United Arab Emirates and Egypt, while two other countries, Lebanon and Morocco, have significant volumes. These five countries alone account for two-thirds of the \$827 billion of FDI inward stocks (that is, cumulated investments) in Arab countries.

After having reached a peak of 6.46 per cent of the world’s total inward FDI in 2009, with an average of 5.21 per cent in the 2005-2010 period, Arab countries’ inward FDI fell to 3 per cent in the 2011-2015 period. This is due to continuing disinvestments in conflict countries such as Iraq, the Syrian Arab Republic and Yemen.²⁸ Even in absolute terms and relative to GDP, FDI inflows have fallen significantly: after reaching \$88.8 billion, representing 4.27 per cent of Arab

countries’ total GDP in 2008, they fell to \$36.9 billion and 1.47 per cent of GDP in 2016.²⁹ It is also to be noted that between 2003 and 2012, the natural resource and non-tradable sectors (mainly real estate and construction) received nearly 50 per cent more greenfield FDI flows [in the region] than tradable non-resource manufacturing and commercial services. Since 2010 high-quality FDI that creates employment and promotes transfers of technology and managerial know-how to host economies in non-oil tradable manufacturing and services – and which can facilitate a transition to higher value-added production and export, economic diversification and increased competitiveness – has decreased substantially, making MENA one of the least integrated developing regions in global value chains.³⁰

The digital economy relies heavily on intangible assets, mainly consisting of know-how, expertise, designs, patents and new organization methods. These offer the advantage of lower entry barriers for skilled individuals and entrepreneurs but may also be harmful. Often, the potential of early-stage ICT projects is difficult to assess and evaluating the above assets, as collateral for traditional loans, is problematic. This is one reason why specific, early-stage financing emerged in the form of venture capital in the last decades of the last century in high-technology clusters (epitomized by Silicon Valley in the United States) for high-risk/high-reward technology projects.

Venture capital is closely associated with either informal or formal technology clusters characterized by an ecosystem that enables entrepreneurs to find and sell their projects to venture capitalists and other so-called business angels. These may be institutional investors (or specific branches of them) or even individuals (generally previous entrepreneurs who had

financial success and wish to invest part of their fortune in new ventures). Governments may support venture capital, though often indirectly, through incentives and tax cuts.

Venture capital is still nascent in most Arab countries,³¹ where there is a notable lack of sizeable innovation ecosystems. Relative to GDP, Lebanon and, to a lesser extent, the United Arab Emirates and Tunisia are the three regional leaders in venture capital. These relative success stories reflect nascent ecosystems created out of local dynamism and some clever public policy intervention encouraging investments in innovative start-ups. Such measures will be discussed below in the policy recommendation chapter.

In conclusion, whether for the general business climate, access to credit, foreign direct investment or venture capital, most Arab countries have major investment gaps, even in some relatively successful emerging countries.³² Financial flows, whether in their traditional form (bank loans, equity, guarantees, for example), or emanating from foreign direct investment or risk-prone capital (venture capital), are still insufficiently channelled to support entrepreneurship in the ICT sector. The business climate in most Arab countries is deteriorating and their rankings in the DBI have lowered in recent years, even in some GCC countries, with access to the credit component particularly weak. Arab countries foreign direct investment inflows have fallen to less than half the values reached in 2008-2009 – as a percentage and in absolute terms as indicated above – and decreased from nearly 6 per cent to barely 2 per cent of global foreign direct investment flows if one considers divestments (table 6).

2. ICT sector share in goods and services exports

The ICT sector share in the goods and services exports in Arab countries (table 7) highlights sizeable values in goods in some countries while services have a much higher share. In GCC countries and other Arab countries with high exports of oil, gas and other natural resources, trade in goods is of much higher value than services. Lebanon is a notable exception, while Egypt, Jordan and Morocco have a near balance between goods and services.

Exports in ICT goods for countries acting as regional distribution hubs – the United Arab Emirates, for example – should account for the value of re-exports. For instance, United Arab Emirates data for 2014 indicate that re-exports represented nearly double the amount of its non-oil exports.³³ It is notable that this country alone accounts for 60 per cent of the total value of gross ICT exports in goods of Arab countries.

The data shown in table 7 indicate ICT exports in Arab countries are approximately \$12 billion for goods and \$15.5 billion for services. Taking into consideration global ICT exports totalling \$1.6 trillion for goods and \$400 billion for services,³⁴ and without discounting re-exports, Arab exports represent less than 1 per cent of global trade in ICT goods and a relatively bigger 4 per cent of ICT services. The total exports of ICT goods and services of Arab countries represented approximately 1 per cent of their total GDP while that of an emerging country like China, which stood in 2016 at near \$500 billion, represented 4.5 per cent of its GDP, and that of Korea for the same year, 8.6 per cent.³⁵

Other data sources on trade³⁶ shed light on the components of ICT service exports. They show that in many Arab countries, these are focused on telecommunication services. At 80 per cent, computer services are predominant in the United Arab Emirates,³⁷ have a sizeable 33 per cent share in Morocco, and a lower but not insignificant share in Algeria, Iraq, Lebanon and Tunisia.

In conclusion, most Arab countries have a small share of the global trade in ICT goods and services. The data for the United Arab Emirates needs to be analysed further to assess the re-export component both in its ICT goods and service exports. Anecdotal evidence

indicates that, in addition to the United Arab Emirates, Egypt, Jordan, Lebanon, Morocco and Tunisia have established a local ICT industry focused mainly on services but which has limited reach.³⁸

3. ICT sector impact on economic growth and jobs

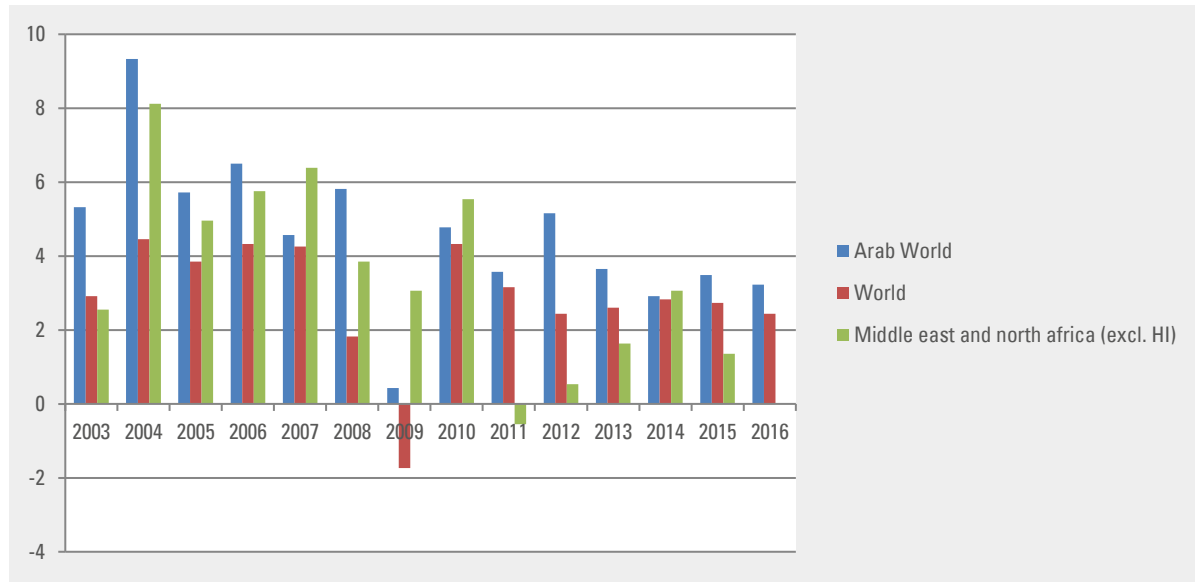
After experiencing relatively strong growth during the first decade of this century, the GDP growth of the Arab region (particularly among countries outside high-income GCC countries) has fallen steeply following the financial crisis of 2008 and, in particular, the Arab uprisings of 2011 (figure 1).

Table 7. ICT goods and services exports, Arab countries, 2015

Country	ICT goods exports (percentage total goods exports) 2015	Total goods exports value (millions of US\$) 2015	ICT services exports (percentage total services exports) 2015	Total services exports (million US\$) 2015
Algeria	2.0	34 313	50.7	3 455
Bahrain	4.0	20 581	21.6	3 302
Egypt	3.7	19 031	6.9	18 538
Jordan	1.8	7 829	5.6	6 308
Kuwait	0.16	55 335	45.0	6 056
Lebanon	1.0 (2014)	4 100 (2014)	23.2	15 815
Mauritania	–	1 389	56.9	246
Morocco	2.2	18 619	19.2	14 673
Oman	0.16	35 682	18.5	3 483
Qatar	0.08	77 294	3.6	14 997
Saudi Arabia	0.16	203 537	1.9	14 474
Sudan	0.00	3 169	5.7	1 767
Tunisia	5.41	14 159	12.2	3 294
United Arab Emirates	2.26	333 370	–	58 924
Yemen	0.075	1 439	17.7	728

Source: World Bank, 2017b for services exports and <http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>.

Figure 1. GDP growth, Arab world, world, MENA outside high-income, 2003-2016



Source: World Bank. Available at <http://data.worldbank.org> (accessed on November 2017).

The digital economy accounts for 4.1 per cent in selected Arab countries' GDP, as measured by digital share in private consumption, private investment, government expenditure and imports and exports, and is 50 per cent that of the United States.³⁹ The average conceals a great deal of variation among countries of the region. Some GCC countries have generally more digitized economies than other countries in the region; the digital economy accounts for 8 per cent in Bahrain and 5.1 per cent in Kuwait, but less than 1 per cent in both Oman and Qatar. Bahrain's high score is mainly driven by that country's high digital exports to neighbours in the region.⁴⁰

Analysis and estimates show that the Arab region's economy has realized only 8.4 per cent of its digital potential. By comparison, western Europe has achieved an estimated 15 per cent of its digital potential, and the US economy 18 per cent.⁴¹

Among the top 1,000 ICT companies in the world by annual revenue, only 1 per cent are in the Arab region. Digital unicorns are start-up digital companies that have a market capitalization of more than \$1 billion. Unicorns are underrepresented in the region. Currently, only Souq.com in the United Arab Emirates qualifies as a unicorn; one company that almost qualifies is Fumia, in Egypt.⁴²

Unemployment rates across regions of the world for different years extending from 1992 to 2013 illustrate that both the Asian and African sides of the Arab region (at respectively, 11.1 and 12.3 per cent in 2013) have the highest percentages compared with other regions.⁴³ Arab states have also the widest gaps among world regions for youth and female unemployment rates with respect to total population, reaching as high as 24 per cent higher for youth and 13 per cent for women.⁴⁴

The unemployed are further categorized in the Arab region according to skills in both oil-producing and non-oil-producing countries.

Projections for a business-as-usual scenario for both skilled and unskilled employment, in both oil- and non- oil-producing countries are quite close and set to grow over the period leading to 2030, reaching highs of 22 per cent among the non-skilled in non-oil-producing countries.⁴⁵

A comparison of the percentages of digital talent in the total workforce shows that the selected Arab countries have a percentage of 1.7 compared with 3.7 and 3.8 for Europe and the United States respectively.⁴⁶ Among the Arab countries measured, it is perhaps surprising to note that Saudi Arabia had the lowest percentage

in digital talents. Equally surprising, Kuwait had the highest percentage in digital talents.

4. Innovation and the ICT sector

A properly functioning national innovation system is essential for the development of an ICT industry and digital economy at large. Effective use of digital technologies is equally at the heart of modern innovation, not only in products but also in processes, marketing and the organizational models of all industries.

The process of measuring innovation is complex since it includes many factors. Table 8 shows the ranking of Arab countries in a major international framework measuring innovation, namely the Global Innovation Index (GII).

Table 8. Global Innovation Index: global rank and pillars, Arab countries, 2017

Country (global rank)	Institutions	Human capital and research	Infrastructure	Market sophistication	Business sophistication	Knowledge and technology outputs	Creative outputs
United Arab Emirates (35)	25	22	29	33	25	71	47
Qatar (49)	37	58	26	85	84	55	54
Saudi Arabia (55)	88	31	40	51	54	62	74
Kuwait (56)	76	68	49	58	127	41	55
Bahrain (66)	51	73	38	84	93	73	71
Morocco (72)	70	63	51	89	122	77	68
Tunisia (74)	77	44	70	98	112	69	76
Oman (77)	39	51	56	72	126	100	91
Lebanon (81)	100	78	88	96	61	82	81
Jordan (83)	64	83	87	116	104	79	72
Egypt (105)	121	82	93	107	120	93	97
Algeria (108)	103	86	79	122	109	107	116
Yemen (127)	126	120	126	117	123	126	124

Source: INSEAD, 2017; data compiled by author.

The GII includes 81 indicators grouped under seven pillars. The first five pillars address innovation inputs while the last two address innovation outputs. The ranking of Arab countries for each pillar is coloured in red when the country's value under the given pillar shows a weakness relative to its global rank; that is, its rank for this pillar is significantly lower than its global one.

Arab countries rank relatively well in the innovation pillars related to human capital and infrastructure but show marked weaknesses in the market sophistication and business sophistication pillars. The two pillars addressing innovation outputs highlight globally weak innovation outcomes in the Arab region, with no Arab country enjoying a high ranking.

It is beyond the scope of this document to discuss in details of table 8 (a thorough discussion is available in other documents)⁴⁷. This document focuses on the key aspects of the NIS that are influenced by the ICT sector and infrastructure and vice-versa, while highlighting their interconnection and mutual influence.

The infrastructure pillar of GII reflects the good showing in ICT infrastructure discussed in the previous section in GCC countries but equally in other countries. The market sophistication pillar measures credit, investment, trade and competition and the weaknesses of Arab countries in credit and investment. The business sophistication pillar measures issues as diverse as knowledge workers, innovation linkages and knowledge absorption, and addresses research and development efforts, foreign direct investment inflows and the sophistication of clusters and university-industry research collaborations. Equally low levels of research and development spending – measured below

1 per cent of GDP in most Arab countries, compared with 2-3 per cent for developed countries⁴⁸ – in its concentration in universities and public research centres and not in businesses, the scarcity of successful Arab technology clusters, and weak university-industry collaboration negatively affect this pillar.⁴⁹

The knowledge and technology outputs pillar focuses on tangible innovation related to knowledge creation, impact and diffusion. It addresses patenting, scientific output, high-tech exports including ICT services exports, high- and medium-tech exports, and manufacturing. Apart from relatively significant patenting activities in Egypt and Saudi Arabia, volume remains weak. High-tech exports are weak in all Arab countries except Kuwait, which has a good showing in ICT services exports. High- and medium-tech manufacturing shows decent values in some Arab countries, but one should note that this value is a ratio of the total manufacturing base and not an absolute measure. This provides an advantage to countries with weak legacy manufacturing.

The creative outputs pillar highlights intangible assets, creative goods and services, and online creativity. This pillar is central to the ICT sector.

Two survey indicators, borrowed from the World Economic Forum's Networked Readiness Index, deal with the role of ICT in the creating new businesses and organizational models. The scores of Arab countries highlight the optimism of their business communities about the creation of new businesses, but the level of optimism is lower with regards to the more complex matter of organizational change. Overall, these two indicators illustrate that digital technologies have not yet significantly affected the creation of new businesses and/or organizational models.

Creative goods and services encompass media, entertainment and publishing activities, with two Arab countries Lebanon (ranked 32) and the United Arab Emirates (34) scoring highly and others in the middle of the table illustrating a certain dynamism of this sector in the region (next section).

Online creativity is gauged through four indicators lying at the heart of the digital economy that measure domain name registration activities under national and global top-level domains, Wikipedia edits and YouTube uploads (table 9).

Despite recent efforts in the Arabization of domain names and national country-code top-level domains, table 9 reveals weak levels of domain name registrations, whether under global or country-level top-level domains, highlighting important gaps in the Arab Internet industry. The percentage of Wikipedia Arabic-language articles currently stands at only 1.13 per cent of the total number of articles and active users (that is, those who edit articles).⁵⁰ The frequency of Wikipedia edits and YouTube uploads shown on table 9 shows that YouTube uploads can be relatively significant in many GCC countries, while Wikipedia edits are still weak.

Table 9. Online creativity indicators, Arab countries, 2016

Country	Generic top-level domains	Country-code top-level domains	Wikipedia yearly edits	Number of YouTube video uploads
	Scaled by population aged 15-69; value (rank)			
United Arab Emirates	11.2 (38)	5.63 (47)	44.38 (68) – 2014	39.12 (32)
Kuwait	8.14 (44)	0.40 (93)	49.43 (58) – 2014	45.82 (20)
Lebanon	6.87 (48)	0.27 (99)	41.71 (72) – 2014	16.96 (60)
Jordan	6.63 (49)	0.29 (98)	51.96 (52)	18.83 (58)
Bahrain	5.44 (53)	1.24 (76)	49.05 (61) – 2014	42.89 (27)
Qatar	4.41 (58)	3.45 (56)	43.94 (70) – 2014	37.66 (34)
Saudi Arabia	3.10 (63)	0.62 (87)	44.85 (66)	45.40 (21)
Tunisia	2.71 (69)	0.20 (101)	32.79 (96) – 2014	9.21 (63)
Oman	1.81 (81)	0.13 (105)	38.42 (83) – 2014	12.97 (61)
Morocco	1.60 (85)	0.79 (84)	38.29 (84)	12.55 (62)
Egypt	1.24 (90)	0.04 (120)	34.75 (91)	7.95 (65)
Algeria	0.49 (107)	0.09 (110)	28.87 (99) – 2014	6.49 (66)
Yemen	0.37 (110)	0.02 (122)	24.03 (104) – 2014	0.84 (71)

Source: INSEAD, 2017.

In summary, although the Global Innovation Index addresses innovation at large, it contains many indicators that are central to the development of the ICT sector. The overall picture for Arab countries, as shown in table 8, is one of undeniable potential in human capital and infrastructure, but equally, many structural weaknesses reflected in low research and development spending, weak clusters, and a scientific system disconnected from socioeconomic realities. Resulting innovation outputs are consequently weak. This is an important gap for Arab countries to overcome to develop their ICT industry, which is central for building an effective innovation system.

5. Digital content and media

Arab Internet users numbered 173.5 million in March 2017, representing the fourth largest group (4.6 per cent) globally.⁵¹ Yet, “the most optimistic assessments today still suggest that digital Arabic content on the Internet does not exceed 2-3 per cent of all searchable web pages”.⁵² Although this quote is from a 2015 ESCWA report, there is no evidence that the situation has improved since. More recent data, focusing on the language used by the top 10 million websites, provide an even lower estimate of only 0.7 per cent for Arabic.⁵³

Arab countries differ in their contribution to Arabic web content. Data from 2013 show that Saudi Arabia and the United Arab Emirates accounted for half of Arabic web pages. Arab countries with a significant majority of their web content developed in Arabic include Iraq, the State of Palestine, Sudan and the Syrian Arab Republic.⁵⁴ However, in all Arab countries, the top three websites are, with a few exceptions, the global leaders, namely Google, YouTube and Facebook.⁵⁵ Among the top five national

sites in Arab countries, a significant number are news and media sites, followed by government, international organization, NGO (essentially in conflict-afflicted countries) and community sites. Other categories include air travel, banking and telecommunications.⁵⁶

Despite admirable efforts and undeniable improvements by public and private players, digital Arabic content remains limited. To assess the future of digital Arabic content from an industrial perspective it is important to focus on what Arab Internet users, particularly youth, predominantly access when browsing. Apart from publicly subsidized government, NGO, education or heritage sites, and business sites financed by their owners (banks, airlines, telecom service providers, for example), digital media plays a central role as a digital Arabic content enabler for an industrial sector, whether through direct financing by users (paid services) or indirect financing through advertising.

The Arab media market⁵⁷ was estimated at \$11.3 billion in 2015 and is expected to grow to \$12.4 billion in 2018, with a compound growth rate of 3.1 per cent. Saudi Arabia (the largest market), the United Arab Emirates and Egypt alone account for nearly 70 per cent of this total. Print and television are the two largest sectors, similarly accounting for 70 per cent. The digital media sector, currently at 15 per cent, has a high growth potential, however, and is expected to reach 23 per cent, or \$2.85 billion of this total in 2018.

The digital media ecosystem is such that end users access content using a variety of interfaces (television, personal computer and smartphones, for example). Views of web pages by device evolved in some Arab countries⁵⁸ from 11 per cent on mobile devices and

89 per cent on desktop or laptop computers in 2011 to a near reversal of the situation in 2015, with 67 per cent on mobiles and only 33 per cent on computers. The popularization of smartphones over the same period was a determining factor behind this change. The effective analysis of usage patterns would help the evolution of online Arabic content, which could lead to the optimization of ICT services and better socioeconomic outcomes.

Social media are likely to play an increasing role in advertising digital Arabic content. For an increasing number of people in the region, this is a “first filter” through which they access content. Videos are popular among Arab youth and could be used as a conduit to push any kind of useful infotainment or edutainment content. News represent an important segment of digital media as people in the region now predominantly use online sources to access information rather than more traditional media (print and radio, and to lesser extent television).⁵⁹

C. Horizon 3030: aspirations and policy recommendations

A Horizon 2030 aspiration for the ICT sector includes an overarching goal that is properly measured relative to GDP and that its productive section component (that is, outside telecom services) reaches at least 30 per cent of the sector value added in GCC countries and 20 per cent in others.⁶⁰ It is hoped the total share of the ICT sector value added reaches 4 per cent of GDP⁶¹ in GCC countries and between 2 per cent and 4 per cent in other countries.

With regards to enabling factors, it is hoped Arab countries can significantly improve their

ranking in the Doing Business Index, with all GCC countries in the first quintile and the remaining countries not below the third quintile. Specific attention should be paid to improving the getting credit component in all countries. foreign direct investment (FDI) would be expected to recover at least the 6 per cent of global FDI reached in 2008-2009 or 4 per cent of Arab countries' GDP, with a more equal distribution among countries and venture capital deals to reach a meaningful 0.1 per cent per billion US\$ GDP⁶² in most Arab countries except least developed countries.

With regards to the share in global ICT goods and services trade, it would be desirable that Arab countries' exports reach a more meaningful percentage of their GDP, up from the current 1 per cent to between 3 per cent and 4 per cent, excluding re-exports, to reach a value at least comparable with that of leading emerging countries as discussed above.

In the Horizon 2030 vision, it is important to significantly reduce unemployment, particularly among youth, with digital technology jobs contributing about 30 per cent to this total reduction, and for the digital talent among the total workforce to increase from the current 1.7 per cent to 5 per cent. As for economic growth, the digital economy contribution to the region's economy should aim to grow from the estimated 4.1 per cent to 6 per cent, and the region should enhance its digital potential from the current estimate of 8.4 per cent to 15 per cent. These figures are not based on computable data; they are simply desirable growth figures. As a proxy for ICT industrialization, the present status of the region is one-thirtieth of the ICT patents per million population compared with the United States⁶³ and expected to reach only one-tenth of this value.

The ICT sector contribution to innovation is central and one key proxy is enhanced efforts in research and development reaching 1 per cent of GDP in most Arab countries (at least GCC countries and those with sufficient human capital). Finally, the Arab digital media market, currently highly concentrated in just a few countries, would have a broader distribution among many countries and reach 70 per cent of the Arab media sector, representing much more than the current (by 2015 figures) share of only 0.65 per cent of the global media and entertainment market⁶⁴ to reach levels of 2 per cent to 3 per cent given the size of their populations and the number of Arab language speakers worldwide.

Structural issues within the rentier model,⁶⁵ which is predominant in the Arab region, whether this rent comes from natural resources and/or distributing favours and monopolies to well-connected cronies, lie at the heart of the unfavourable business climate and weak access to credit in most Arab countries. A dynamic venture capital environment for the development of innovative ICT start-ups is still a distant objective. In the recent context of falling values, foreign direct investment inflows to the region are not properly channelled towards productive and high-technology sectors.

Digital strategies are key to addressing the above challenges. A global approach that addresses the above issues and those related to skills, an enabling economic environment and the nurturing of innovation, as suggested in a recent ESCWA publication on innovation policies, is necessary. Arab national digital strategies should take the same approach.⁶⁶ This is important because innovation and the digital economy are closely related. A thriving ICT sector is a key enabler for a properly functioning national innovation system and vice-versa.

Our key recommendation is to develop national innovation and digital strategies in close coordination and with consistent approaches, both under the remit of a high-level authority.

On digital content and media, policymaking should adapt to the strong trends resulting from mobile access generalization, social media and online access to news. Removing online content restrictions and filtering (as already suggested when discussing cybersecurity) and supporting all actors (from institutional media to individual bloggers) to provide factual and verified information are two key recommendations. This could involve reforming the status of the public broadcaster, establishing a media regulatory authority, media sector liberalization and digital policies addressing in a unified manner the telecom and media sectors.⁶⁷ Public policy could also support initiatives – they might be led by education entities, social workers or even private entities – to develop infotainment or edutainment content on media predominantly used by youth with the objective of using such content as a hook to draw them into more serious, useful content.

To create jobs and growth through digital technologies, Arab countries might consider the following recommendations.

- Enhance digital jobs available to youth quantitatively and qualitatively, moving them from the predominant pattern of operating services with relatively limited room for design, development and innovation;
- The region lags in its share of companies dealing with digital technologies and applications. Most of the big players in the region are international companies, with local sleeping partners, or partners involved in public relations or management activities

rather than technical and developmental work. Governments should introduce incentives for small local companies in the digital sector to merge with other companies to form larger enterprises that can compete with companies from outside the region;

- The digital sector will likely become a new source of employment. Arab businesses need to make talent development and future workforce strategy a priority for growth. Organizations can no longer be passive consumers of ready-made human capital. They require a new mindset to meet talent needs and optimize social outcomes. Employers should invest in developing employees' careers by funding their further education and introducing career development programmes and rewards for young employees;
- Countries in the region must transform their employment structure to reflect the growing importance of the digital economy. The ICT job family is anticipated to experience high growth centred on data analysts and software and applications developers, not just within the ICT industry itself, but across a range of industries, including financial services and investors, media, entertainment and information, mobility and professional services. Computing power and big data analytics are significant drivers of employment growth in each of these sectors;
- While jobs shift across domains and public awareness increases on changes with emerging technologies, governments could provide social safety nets, and upskilling and reskilling frameworks, that support people's adaptation to change;
- Governments and major employers should consider the variety of new job families evolving in societies, such as online

freelancing, gig economy⁶⁸ jobs and crowd work, and incorporate them in the vision strategy for 2030. Mapping, revising and enhancing employment policies in the Arab region should be undertaken so they do not conflict with sharing economy opportunities and contribute to reducing unemployment in the region;⁶⁹

- Governments and major employers in the region should pay attention to lifelong learning and training. It should be made attractive and rewarding for workers. Training systems and labour market institutions should be encouraged by governments of the region.

In summary, the aspirations contained in the 2030 vision for a developed ICT sector in the Arab region require a restructuring of digital strategies and innovation policies. The development of the ICT sector depends on advanced technologies, effective ecosystems and human networks that need long-term planning and sufficient financial resources. Furthermore, Arab countries, even with a nascent ICT sector, should reduce their dependence on imported technologies and enhance their capabilities to improve and adapt technologies to their needs.

D. Conclusion: business-as-usual trajectories versus Horizon 2030

In a business-as-usual trajectory, with digital strategies insufficient to develop the ICT sector industry, Arab countries would continue to be mainly consumers of ICT goods and services and marginal actors in their trade and industry. What would be of bigger concern is a heavier reliance on imported ICT goods and services because this will be harmful to the development of the digital economy in

general and the adoption of key emerging technologies, especially with the lack of policy direction for strengthening local technological businesses. It is likely that without the development of the ICT sector and industry, Arab countries' contribution to ICT trade will not develop for goods and services. Small increases in foreign direct investment inflows might result from the cessation of conflict and the start of reconstruction in some countries but it is not foreseen that these will be directed, in priority, towards a productive, high value-added ICT sector. Likewise, available venture capital will likely improve in some affluent GCC countries but essentially remain negligible in most other countries. The global business and credit environment climate depend on macro-economic policies beyond the scope of this document; it is likely, however, that if no dramatic policy change

takes place in this respect, they will have an adverse impact on the development of a thriving ICT industry.

The Horizon 2030 vision, essentially through restructured digital strategies developed in close coordination with innovation strategies, could put Arab countries on the pathway to developing their ICT sector. For developing countries, the ICT sector is quite difficult to develop because it is highly reliant on advanced technologies, effective ecosystems and human networks that cannot be built overnight, even if financial resources were available. At the very least – and even with a nascent ICT industry – Arab countries must endeavour to reduce their dependence on the imported technologies that will likely permeate all economic and social endeavours in the period leading to 2030 and have the expertise to use, improve and adapt them to their needs.

6. Policy Area 3: ICT Infrastructure



6. Policy Area 3: ICT Infrastructure

A. Context in SDGs

Developing an ICT infrastructure, particularly for broadband access, is central to many targets of SDG 9 that aims to “develop quality, reliable, sustainable and resilient infrastructure” (target 9.1), “facilitate sustainable and resilient infrastructure development in developing countries” (target 9.a), and “significantly increase access to information and communications technology” (target 9.c). An ICT infrastructure that allows universal access to communication and Internet services contributes to higher productivity and helps “achieve higher levels of economic productivity through diversification, technological upgrading and innovation” as stated in target 8.2 of SDG 8. In addition, an ICT infrastructure contributes to the poverty reduction goal of SDG 1 by ensuring that the “poor and the vulnerable, have equal rights to economic resources, as well as access to basic services” (target 1.4), with ICT considered as such a basic service. Finally, ICT infrastructure can help achieve specific targets of SDG 11, to “reduce the number of deaths [...] caused by disasters” (target 11.5) and allow cities to implement “integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change [and] resilience to disasters” (target 11.b) thanks to the important role it plays “to ensure communications in cases of disruptive events”.⁷⁰

B. Prevailing policies: current situation and future implications

ICT infrastructure is a key element that allows access to Internet content and services. Fixed and mobile telephony, fixed and mobile broadband Internet access, and available international bandwidth per Internet user in Arab countries is summarized in table 10.

Fixed telephony, although of reduced importance, allows fixed broadband access using digital subscriber line technology. The averages of Arab countries reveal major differences. They are mostly lower than those of developing countries, but GCC countries, Lebanon, Libya and the Syrian Arab Republic have values that are higher than the Arab region’s average. Although some Arab countries have introduced limited competition in fixed telephony, legacy copper largely remains the property of monopoly operators.

One consequence of limited competition in fixed access is that fixed broadband access to the Internet remains weak. With an average of only 4.7 per cent, it is nearly half the value of developing countries and nearly seven times lower compared with developed countries. GCC countries, except Kuwait and Oman, and Lebanon enjoy higher values. Fixed broadband in the Arab region is generally slow, often associated with caps on volumes of allowed traffic, and quite expensive (cost is discussed in more details in section 8.2.4).

Table 10. Key ICT infrastructure indicators, Arab countries, indicated year

Country/ region	Fixed telephony subscriptions (per 100 inhabitants) 2016	Mobile telephony subscriptions (per 100 inhabitants) 2016	International bandwidth (bit/s per Internet user) 2015	Fixed broadband subscriptions (per 100 inhabitants) 2016	Mobile broadband subscriptions (per 100 inhabitants) 2015
Algeria	8.24	117.02	30 119	6.92	40.1
Bahrain	20.8	216.93	47 205	16.82	131.8
Egypt	7.11	113.7	11 318	5.2	50.7
Iraq	5.53	82.16	NA	NA	NA
Jordan	4.55	196.31	27 524	5.84	35.6
Kuwait	10.96	146.55	50 096	2.76	139.3
Lebanon	21.05	96.37	27 275	25.62	53.4
Libya	21.49	119.78	NA	2.64	NA
Mauritania	1.27	86.52	1 451	0.25	89.3
Morocco	6.02	120.72	18 316	3.65	39.3
Oman	9.8	159.22	33 724	6.19	78.3
State of Palestine	9.26	76.81	13 399	6.87	NA
Qatar	19.34	147.1	67 473	10.77	80
Saudi Arabia	11.96	157.6	69 556	10.81	111.7
Sudan	0.34	68.63	2 189	0.06	29.4
Syrian Arab Republic	15.21	54.23	3 146	4.01	10.4
Tunisia	8.59	125.82	33 812	5.65	62.6
United Arab Emirates	23.43	204.02	107 904	13.3	9.2
Yemen	4.65	67.17	2 496	1.65	5.9
Arab countries	7.70	106.40	-	4.70	43.50
Developed countries	38.10	127.30	-	30.30	89.10
Developing countries	8.50	98.70	-	8.70	36.00
World	13.60	103.50	-	12.40	45.10

Source: International Telecommunication Union (ITU).

Note: For year 2016 data, see data files on <http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>; for year 2015 data on bandwidth and mobile broadband subscribers, see ITU, 2016.

Next generation access is characterized by the deployment of new access technologies that facilitates high-speed broadband, including for example, fibre-optics solutions, such as fibre to the home (FTTH) or the building (FTTB).⁷¹ FTTH and FTTB figures for deployments for 2016 are shown in figure 2. Essentially, significant deployments are taking place in GCC countries, less so in other Arab countries. Nevertheless, it is estimated that only 9.2 per cent of fixed broadband subscribers in the MENA region were using FTTH and FTTB technologies in 2016.⁷²

Compared with other countries,⁷³ the United Arab Emirates and Qatar, at respectively 93.7 per cent and 87.9 per cent penetration of households for FTTH and FTTB, occupy the top two positions in the world, above many developed countries and historical leaders, such as South Korea. Another Arab country with significant FTTH and FTTB deployments is Saudi Arabia (17.4 per cent) distantly followed by Kuwait (4.7 per cent), Oman (2.7 per cent) and Jordan (1.1 per cent). It is worth noting the relative low values of many developed countries, particularly in western Europe (the European Union average is at 9.34 per cent) and even the United States (13.1 per cent). This is because the business case for FTTH and FTTB deployments depends highly on public initiatives (government or local authorities) and on the perceived benefits by end users from high-quality legacy fixed broadband; digital subscriber lines in western Europe and cable television in the United States. Given that many Arab countries have no such legacy,⁷⁴ there is a need for innovative policy approaches for next generation access deployments as will be discussed in the policy recommendations.

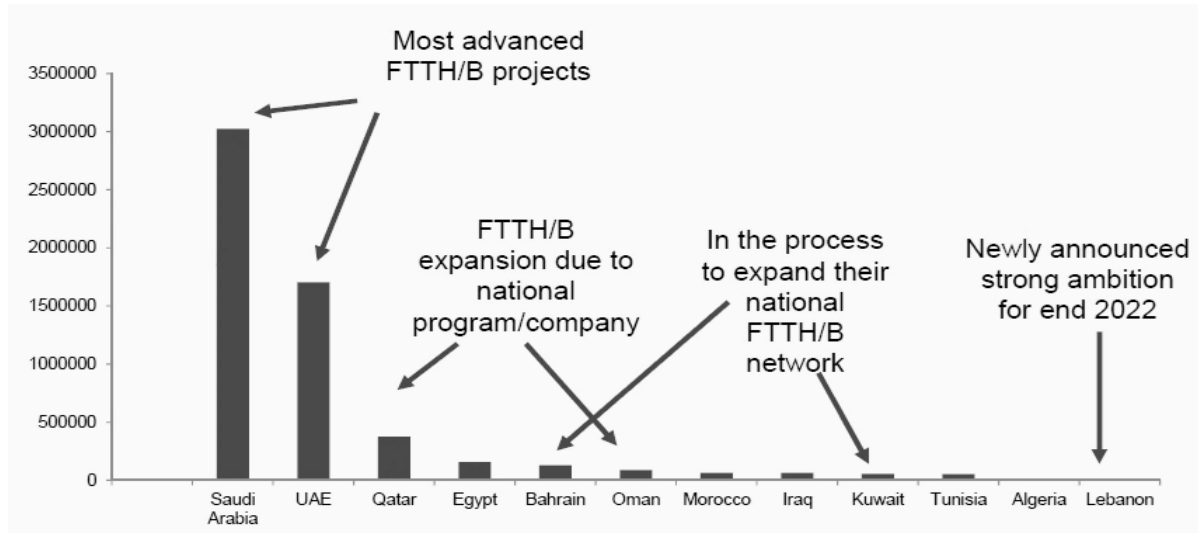
Mobile telephony on the other hand reflects important – and largely private-led –

investments in this infrastructure over the past two decades in all Arab countries, irrespective of their income level.⁷⁵ Most Arab countries have a minimum mobile penetration of 80 per cent, with a total average for Arab countries being above 100 per cent. The mobile telephony sector in the Arab region is generally competitive, which has a positive impact on prices for consumers, although some countries maintain a duopoly, with practically a rent-split between the two so-called competitors and relatively high service prices.

The development of mobile broadband followed the introduction of third generation (3G) mobile network upgrades in all Arab countries concomitant with rising demand led by the popularization of smartphones and over-the-top communication applications. This resulted in high percentages of mobile broadband in nearly all Arab countries (table 10) though still lower – particularly outside GCC countries – than mobile telephony (generally at half the latter's value in many countries). The Arab average is above that found in developing countries and the gap with developed countries is much less than for fixed broadband. Arab countries remain, however, slightly below the world's average.

Next generation 4G networks offering higher speeds are now deployed in nearly all Arab countries except in some due to conflict.⁷⁶ Some GCC operators are announcing ambitious plans to roll out future 5G networks. Although it is expected all GCC countries would have moved to 5G by 2021, it is assumed take-up among subscribers will be slower as users are “less likely to migrate to a more expensive 5G service when they are content with the faster 4G and 4G LTE-A Pro speeds which will be widely available by 2021”.⁷⁷

Figure 2. Significant FTTH/B deployments (number of homes passed), Arab countries, 2016



Source: http://ftthcouncilmena.org/documents/Reports/FTTHCouncilMENA_PanoramaSept2016_Idate.pdf.

Broadband traffic backhauling, whether originating from fixed or mobile access, acquires heightened importance as users benefit from higher-speed access and consume more data concomitant with the expected inflation of “connected objects” thanks to the development of the Internet of things. Backhauling affects quality of service and cost. It involves the following:

- The interconnection between the access network and the so-called core network, leading to the servers hosting a variety of services and content accessed by end users generally, involves an operator-specific backbone. Big operators in developed countries have their own backbones, sometimes spanning different countries, but often in developing countries, building a national backbone whose services are mutualized by all operators is a necessary step;
- As the Internet is global and traffic is often routed to external networks, the amount of international bandwidth offered per end user is very important. This bandwidth is offered through international links leading to global networks or regional backbones interconnecting neighbouring countries, facilitating their internal traffic and leading to major submarine cables for landlocked countries;
- To avoid using costly international bandwidth, local hosting of services and national or regional Internet exchange points contribute towards keeping the traffic as local as possible.

International bandwidth per Internet user, as summarized in table 10, shows that many Arab countries suffer real shortages. Even richer GCC countries have values that are sometimes lower than those found in some developing countries. This is a critical issue, since many services used

by Arab Internet users are not hosted locally⁷⁸ or consume international bandwidth due to the absence of national and/or regional Internet exchange points.⁷⁹ This is closely related to core networks of all giant content players not yet extending their activities to the Arab region, which is also largely affected by a less-developed data centres industry.

The Arab region is geographically privileged, standing on the routes of major international submarine cables, with many Arab countries connected to those cables as well as regional cables to neighbouring countries. However, “to improve Internet access and reduce its costs, Arab countries must first adopt a new Internet structure that connects Arab countries to each other via direct cables so as to ensure appropriate Internet access between them. Once this is achieved, Internet exchange points can then secure access to the global Internet network”.⁸⁰

The major gap in many Arab countries’ ICT infrastructure lies in the low fixed broadband access penetration rate. Of more concern, and closely related to the resulting quality of broadband service, is the low number of national and regional Internet exchange points, limited international Internet bandwidth and weak national Internet backbones in many Arab countries. Despite good mobile broadband Internet penetration rates in most countries, offering inexpensive person-to-person communication to the masses (chapter 8), quality of Internet experience remains limited by the above-mentioned issues, and broadband Internet access – whether in its fixed or mobile variant – can become highly expensive if one moves away from limited-use patterns.

C. Horizon 2030: aspirations and policy recommendation

Horizon 2030 envisages that by 2030 all Arab countries will have filled the gap in fixed broadband access, reaching levels of developed countries in affluent GCC countries and at least ranking in the middle of developed and developing countries for other Arab countries. Next generation access is also expected to reach 100 per cent in GCC countries and at least 50-75 per cent in other countries. Closely associated with the above targets are those related to international connectivity, national backbones, Internet exchange points and local hosting, all contributing to enhanced quality and lower costs for Internet users. Without setting detailed targets for each (which can be specific to each country situation), it is expected that improving these factors will lead to generalized uncapped data volumes for fixed broadband access and throughput for both mobile and fixed broadband at a quality and pricing equivalent to developed countries for GCC countries and no less than 70-80 per cent for other countries.

Many Arab countries have good telecommunications infrastructure, though some challenges remain in balancing the benefits of Internet services with national cybersecurity considerations. While it was not difficult to deploy mobile infrastructure, the status of fixed broadband and the overall quality and affordability of access to the Internet hint at serious underlying issues. This is increasingly important given the expected increases in online services.

It is evident that poor levels of fixed broadband access result in inadequate access. The near absence of full unbundling and of innovative

service offers – bundles, for example – impedes fixed broadband uptake. Even if the quality of the legacy fixed telecom copper is inadequate in many areas, it could still be leveraged to improve fixed broadband uptake, which allows for services other than those available with mobile phones and pave the way for next generation access uptake.

Backbones are needed at the national and regional levels to improve the fluidity of traffic generated by access networks, whether fixed or mobile. Infrastructure-sharing schemes must be applied to enable entry for newcomers on an equal footing. Backbone owners, be they private or public, must allow open and fair access to their infrastructure.

A third priority area concerns national and regional Internet exchange points, related services and data centre hosting. With the emergence of cloud computing services, it is important that servers be located at the nearest Internet routing distance to end users. Such deployments primarily result from private sector investments, but they also require regional intra-Arab cooperation, mainly in harmonizing cross-border regulations and providing incentives to develop Internet exchange points through conducive national policies and regulations. Public sector and ICT regulators could supervise those activities to ensure non-exclusionary practices to guard against monopolies.

A general framework for improving the supply side of ICT infrastructure can be found in annex 1. This framework includes some of the above recommendations. They were selected for their importance and relevance to the Arab region. Arab countries may choose to adopt these to improve the quality and affordability of their ICT infrastructure. The key point is that protecting

vested interests and restricting market entry to well-connected players will not be in the interest of governments or consumers.

Next generation access deployments, be they fixed or mobile variants,⁸¹ and the rise of the apps economy,⁸² are likely to become the next frontier for the evolution of ICT infrastructure in the period leading to 2030. These will result in the emergence of so-called next generation networks, whereby the frontier between data and telecom subscriptions will become blurred.⁸³ For the region to keep pace with these developments, next generation access deployment requires a proper regulatory framework.⁸⁴ Such a framework is fully consistent with the measures outlined above and others shown in annexes.

Improving quality of service will enhance competition and drive down prices for consumers. This next generation access framework is also critical for national policies and regulations that help legacy operators embrace new revenue streams through increased flexibility to provide innovative service packages that extend beyond the telecom sector and across various verticals.

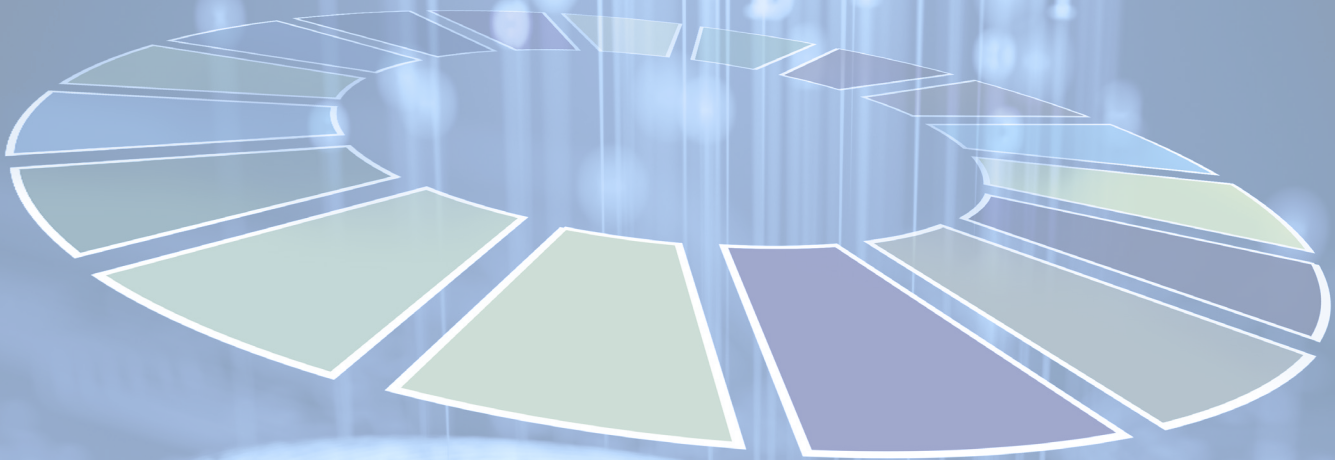
D. Conclusion: business-as-usual trajectories versus Horizon 2030

In a business-as-usual trajectory, GCC countries will likely continue improving their ICT infrastructure, with many having improved fixed broadband and good levels of next generation access deployment. The relative small geographical size of some Arab countries and their high level of resources will likely lead to steady advances even if they may be associated with high prices for next generation access and lower take-up among poorer

members of the population. The same cannot be said for lower-income Arab countries, particularly those with destroyed infrastructure due to conflict. It is quite likely that prices (4) relative to quality will remain high (at best reaching developing countries' average) and next generation access deployments at very low levels (in the orders of 20 per cent of a low general base) and reserved, due to their high cost, to the more affluent, further deepening the digital divide within each country.

In the majority of Arab countries, particularly outside the GCC, the suggested recommendations for a Horizon 2030 trajectory aim to improve penetration rates (primarily for fixed broadband) and the quality of service of broadband access, and to drive down prices. This trajectory would likely pave the way for better, more affordable next generation access deployments in the period leading to 2030 and avoid a deepening of the digital divide, at least from the supply side, in many of the region's countries.

7. Policy Area 4: Cybersecurity



7. Policy Area 4: Cybersecurity

A. Context in SDGs

Cybersecurity is related to many SDGs. It primarily protects against the adverse effects posed by cyberthreats to ICT adoption. It concerns the access of “all men and women, in particular the poor and the vulnerable [...] to appropriate new technology and financial services, including microfinance” (target 1.4), and the potential of ICT use in education to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” (Goal 4), which includes ensuring “equal access for all women and men to affordable and quality technical, vocational and tertiary education” (target 4.3), and eliminating “gender disparities in education” (target 4.5).

Raising public awareness of cybersecurity is essential to enhancing the use of technology, particularly ICT, in development initiatives that seek to empower women and engage youth. Cybersecurity should also be considered in efforts to enhance “inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries” (the so-called smart cities, target 11.3), and “human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disaster” (target 11.b).

Cybersecurity is necessary to ensure reliable and sustainable access to energy, as well as to

affordable, efficient and clean energy (Goal 7), especially since energy is “increasingly relying on ICTs for the management and control of the relevant systems” and “cyber-threats are becoming a valid risk that should be addressed”. Also, addressing the target to “end abuse, exploitation, trafficking and all forms of violence against and torture of children” (target 16.2) requires action to combat online child abuse and the implementation of child online protection policies.

Central to cybersecurity is its contribution to building a reliable infrastructure (target 9.1), universal access to ICT (target 9.c) and economic growth (target 8.1). Cybersecurity is crucial to “enhance the use of enabling technology, in particular information and communications technology” (target 17.8) by “raising awareness on the measures to be undertaken for a secure and fruitful use of ICTs”.⁸⁵

B. Prevailing policies: current situation and future implications

1. Current situation

The majority of Arab countries recognize the importance of cybersecurity and have already established national computer emergency response teams (CERTs), often in association with their national cybersecurity strategies.⁸⁶ Most Arab countries, however, lack a proper privacy and data protection law, though some,

including Morocco, Tunisia and the United Arab Emirates, have enacted such a law and others have established projects but have not yet enacted laws.⁸⁷

Nine Arab countries have enacted laws to define and punish cybercrimes while a few others have projects but are yet to enact laws. Notably, the Arab Convention on Combating Information Technology Offences, adopted by the League of Arab States in 2010, was signed by 18 Arab countries but ratified by only seven.⁸⁸ At the international level, the Budapest Convention on Cybercrime, the unique international instrument to combat cybercrime,⁸⁹ was adopted in 2001 and entered into force in 2004, but is not signed or ratified by any Arab country; the only Arab country admitted for accession to this treaty is Morocco.⁹⁰

With a few notable exceptions, information on Arab computer emergency response team (CERT) activities is missing, not only about their core mission to avert cyberattacks but in spreading awareness and developing capacity within their respective countries.

Round-the-clock information exchange and cooperation among CERTs is essential as cyberattacks, like the Internet, are global in nature. The Forum of Incident Response and Security Teams (FIRST) is now established as the major international forum through which nearly 400 national and private organization CERTs cooperate and exchange information on emerging cyberthreats or ongoing cyberattacks to find solutions and technical fixes.

FIRST includes 11 Arab CERTs: five are from the United Arab Emirates (the national CERT plus those of Etisalat, Du, Abu Dhabi Government and Abu Dhabi Police) and the remaining are the national CERTs of Egypt, Morocco, Oman,

Qatar, Sudan, and Tunisia.⁹¹ On intra-Arab cooperation, the Oman CERT, in cooperation with the International Telecommunication Union, was established in 2013 as a c for Arab countries and whose main activity to date has been to organize an annual regional conference.⁹²

Cybersecurity is often pursued with secrecy, even in open societies, making it difficult to obtain reliable information about the real economic consequences of cyberattacks. It is clear, nonetheless, that Arab countries lag significantly when it comes to institutional, human, and financial means, in laws to ensure privacy and combat cybercrimes, and in public awareness. Some notable exceptions are the United Arab Emirates, other GCC countries (notably Oman and Qatar) and Tunisia, which all have well-established national CERTs.

2. Future implications

Cybersecurity is a key challenge for Arab countries, not only because of the steady growth and sophistication of cybercrime, but also due to the likely increased use of e-services in the period leading to 2030.

The lack of effective means to deal with cyberattacks and cybercrime might jeopardize the benefits brought by access to the Internet, cause material and privacy loss, and moral harm. This may lead users, administrations and companies to shy away from online tools and services, with immense economic and developmental consequences.

Arab countries, despite having made progress in ICT infrastructure (chapter 6), have not yet fully embraced the Internet. Low levels of online services use (in government, commerce and social services) and the resulting low levels of

disclosure of critical personal data (bank accounts details, health information) characterize use patterns in Arab countries. Access to the Internet, predominantly through mobile phones, is essentially centred on person-to-person over-the-top communication applications and social media, even though many Arabs, particularly among youth, increasingly and voluntarily share their privacy on the latter. A clear awareness of cyberrisk and the potential malevolent use of personal data posted online is, however, insufficiently developed in the Arab region.

The gap in cybersecurity between Arab countries and best-in-class countries has, therefore, relatively limited consequences, thanks to low levels of Internet use and, most important, limited disclosure of online critical information. Given the development of online services that is required (partially covered in the e-application chapter below) to achieve the SDGs, this situation must change. Arab countries should significantly reduce this gap, as suggested below, if they are to avoid the consequences outlined above.

In a business-as-usual trajectory, most national Arab CERTs will maintain their mostly silo activities amid a shortage of useful linkages with the private sector and in an environment characterized by a weak cybersecurity culture. Eventually, cyberattacks that cause significant material loss or a massive loss of critical data would likely jeopardize any confidence Arab users might have in the handling of their private data.

Many Arab countries share a conviction that content filtering, beyond its social and political grounds, is a cybersecurity measure, even if it generates a merely “collateral” cybersafety effect. Content filtering would eventually

become more harmful than beneficial, however, convincing many tech-savvy people to start using software, often sourced from cybercriminals, to overcome it.

C. Horizon 2030: aspirations and policy recommendations

In 2030, it is envisaged Arab countries will have well-established and functioning national CERTs along the lines prescribed by the policy recommendations below. This would be allied to a solid culture of cybersecurity involving civil society and the private sector, with the latter establishing their own CERTs supporting and coordinating with the national ones. It is also foreseen that all national CERTs closely coordinate with their Arab peers (through an effective Arab organization that needs to be established) and others (through FIRST or any other relevant forums) to combat cybercrime and exchange information on emerging threats. Effective technical solutions to combat cyberthreats will become pervasive, allowing people to use ICT services in a safe and secure way. Finally, a legal framework, enabling cybercrime to be combated and ensuring data privacy, would be implemented, and all Arab countries would have effectively implemented the Arab convention and most joined international instruments, such as the Budapest convention.

To achieve the above aspirations, the following policy recommendations might be considered by Arab countries:

- Arab countries might wish to update their cybersecurity strategies, where they exist, or elaborate strategies based on a projected increase in the use of e-services and the related impact of cyberattacks.

A cybersecurity strategy should adhere to the following key principles:

- ✓ Multi-stakeholder: government alone cannot possess the expertise needed for handling increasingly sophisticated cyberattacks. The active involvement of businesses and all categories of end users in both the elaboration and implementation of such a strategy are essential for success;
- ✓ Holistic: a cybersecurity strategy should consider needed technical and organizational means (establishing a computer emergency response team, or CERT, for example), legal aspects (completion and consolidation of needed cybercrime and data privacy laws), as well as the development of a national culture of cybersecurity among all stakeholders (businesses, government officials, lawmakers, law-enforcement bodies and citizens at large);
- ✓ Extrovert: cyberthreats are global and, as such, any national cybersecurity strategy should seek cooperation through regional (intra-Arab) and global forums for information exchange and mutual help;
- It is necessary that countries, especially those with limited resources, adapt cybersecurity measures to an optimal level of effectiveness while minimizing the costs. Cybersecurity is never free, as with any security measure; it has a cost which should be commensurate with potential damage. A cost-benefit analysis based on a rational evaluation of the cost of cybersecurity incidents needs to be carried out. A proper analytical framework⁹³ could help evaluate the direct and indirect costs of cybersecurity incidents for all stakeholders and contribute to this cost–benefit analysis with a rational justification of needed investments by public and private stakeholders;
- Countries would need to strengthen their national CERTs to be a public services body that could meet its potential rather than merely serving as an annex to the state security apparatus. The CERT plays a key role in implementing and coordinating a national cybersecurity strategy, serves as a centre of excellence in cybersecurity and advises the government and lawmakers on the need to update of cybersecurity laws. CERTs would also contribute to building a national culture of cybersecurity with advisory services and national awareness campaigns, provide advice to national or foreign companies operating in the country, and support NGOs and civil society at large working on cybersecurity awareness campaigns. Although many core activities of a CERT are confidential by nature, including gathering data on potential cyberthreats and assisting in the forensics of criminal cases involving cybercrimes, other activities could be made public;
- Arab CERTs ought to build an effective regional cooperation network and to improve their participation in global forums and networks such as FIRST;⁹⁴ for both, moving national CERTs out of the influence of state security apparatus (and even formal remit in some cases) and, consequently, away from direct political interference would be a helpful prerequisite, if not an essential one;
- On the legal side, Arab countries must introduce or complement their legal arsenal to combat cybercrime and ratify and make effective use of the Arab convention on cybercrime. Countries should also consider joining the international Budapest convention on cybercrime, pending adoption of any United Nations-sponsored

one, as this gesture will also allow them to adjust their legal arsenal in accordance with that of the most advanced countries;

- It is important to have national ad-hoc initiatives for child online protection, including awareness-raising campaigns. Model guidelines elaborated by the International Telecommunication Union's Child Online Protection Initiative⁹⁵ could, for instance, be adapted to each country's local context. Online addiction among youth and teens is another area of concern, with proven effects on social development and schoolwork, and harassment on social networks. Protecting children from harmful content on the net should be coupled with raising awareness, in coordination with teachers and social workers in daily contact with youth and teens;
- Content filtering is not the appropriate answer, nor is it even effective. Many Arab countries have censorship or use online content filtering,⁹⁶ which apart from being costly, does little more than threaten the usefulness of the Internet as an engine for growth.⁹⁷ The wide use of virtual private networks (VPNs) and other anti-censorship techniques in the Arab region show the ineffectiveness of online censorship. The use of these techniques is widespread on smartphones and computing devices in the Arab region, about 23 per cent on smartphones and 17 per cent for computers, and Internet users tend to opt for anonymous

browsing and applications, and for encryption applications to protect their privacy.⁹⁸

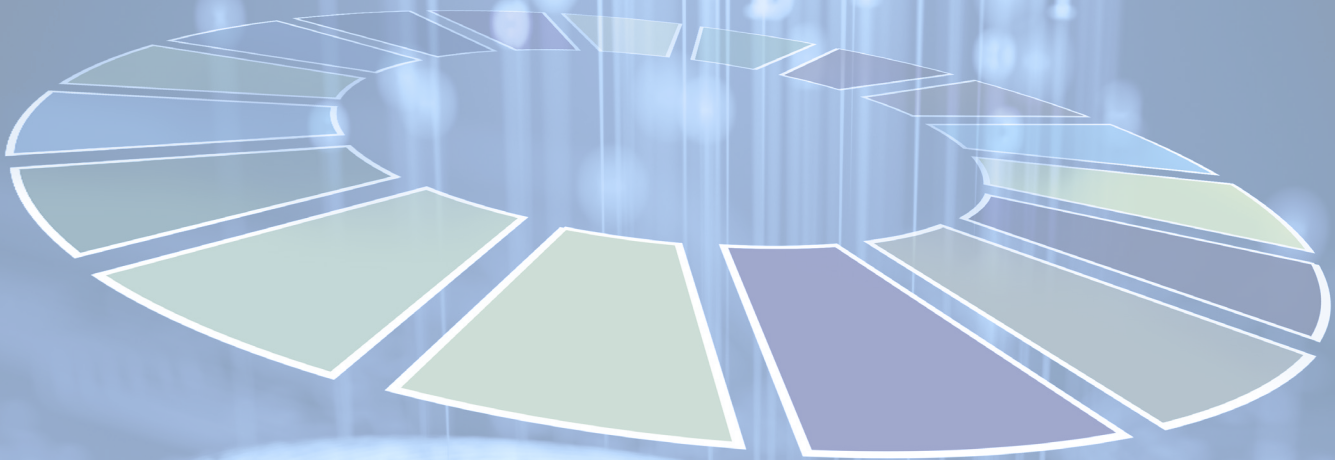
D. Conclusion: business-as-usual trajectories versus Horizon 2030

In a business as usual trajectory in an environment characterized by a weak culture of cybersecurity, cyberattacks causing significant material loss or a massive loss of critical or personal data, would jeopardize confidence among Arab users in the handling of their private data.

Content filtering is essentially more harmful than beneficial and might convince many tech-savvy people to start using software – often sourced from cybercriminals – to overcome it.

The suggested recommendations for a Horizon 2030 cybersecurity agenda aim to build a national culture of cybersecurity that supports all technical and legal measures. These policy recommendations to improve cybersecurity strategies and their executing arm, the national CERTs, have no other overarching objective. Like any security measure, cybersecurity depends on its weakest link. That link is often human. A well-functioning national CERT will help build confidence in digital technologies and their eventual contribution to development.

8. Policy Area 5: Digital Divide



8. Policy Area 5: Digital Divide

A. Context in SDGs

As stated by the WSIS+10 review resolution “the digital divide reflects inequalities in access and barriers to productive use. Many areas simply remain unconnected. Even when a region is connected to the Internet, access is not easy. [...] Illiteracy and lack of skills are important barriers”. Internet access is still not universal, with an estimated 3.6 billion people – that is less than half the world’s population – using the Internet by the end of 2017.⁹⁹ Among the reasons behind this gap “lower internet use among adults than among youth, and the lack of use among the uneducated” are a determining factor but “even among the literate, internet use may be limited by a lack of content in local languages”.¹⁰⁰

Bridging the digital divide has been a global goal of the two WSIS summits and all action lines contribute to achieving it; this, in turn, impacts on all SDGs. Action line C3 on access to information and knowledge impacting all SDGs,¹⁰¹ as discussed in the SDG-WSIS matrix document,¹⁰² sheds light on the supply side through numerous examples of initiatives offering information resources (mainly by international organizations) for each SDG. This highlights how the digital divide, which addresses the demand side, is important to all SDGs; applications, as discussed in the next two chapters, and information resources are virtually meaningless without users.

This chapter provides a global overview of Internet users in Arab countries and discusses specific Internet usage patterns according to age, education, gender equality, and rural/urban populations.

B. Prevailing policies: current situation and future implications

1. Internet users and gender gap

Internet user values (as a percentage of population) in Arab countries are summarized in table 11. In total, 45 per cent of the populations of Arab countries are using the Internet. By definition, this indicator measures the “proportion of people who used the Internet from any location in the past three months”.¹⁰³

Data on Internet users shows discrepancies among Arab countries. While four GCC countries stand at or above the average of developed countries, nine other Arab countries stand at or above the average of developing countries, and six are below it. Globally, the average of Arab countries is only 2.8 per cent higher than that of developing countries due to low adoption rates in some countries with large populations.

Among Arab countries reporting sex-disaggregated data, the gap between males and females is significant in Morocco, the State of Palestine and Saudi Arabia, and lower in Egypt

and Morocco. Bahrain and the United Arab Emirates report near or full equality.¹⁰⁴ International Telecommunication Union estimates of the overall gender gap for Arab

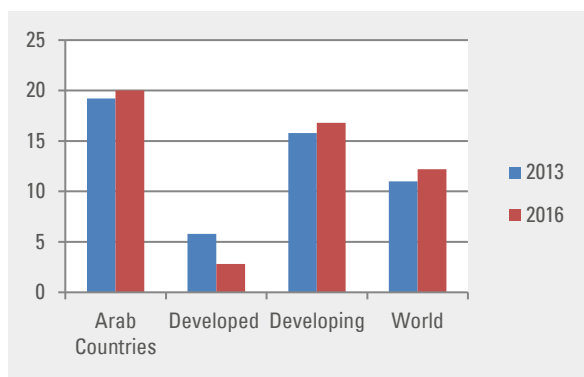
countries (figure 3) puts it among the highest in the world, however, second only to Africa. Of special concern is the slight upward trend of this gap between 2013 and 2016.

Table 11. Percentage of population using the Internet, Arab countries, 2016

Country/region	Percentage of Internet users		
	Population	Males	Females
Algeria	42.95	NA	NA
Bahrain	98.00	97.5	99
Egypt	39.21	40.8 (2015)	34.8 (2015)
Iraq	21.23	NA	NA
Jordan	62.30	NA	NA
Kuwait	78.37	NA	NA
Lebanon	76.11	NA	NA
Libya	20.27	NA	NA
Mauritania	18.00	NA	NA
Morocco	58.27	63.1	53.5
Oman	69.82	72.1	67.3
State of Palestine	61.18	59.6 (2014)	47.5 (2014)
Qatar	94.29	94.1 (2015)	91.7 (2015)
Saudi Arabia	73.75	76.7	69.8
Sudan	28.00	NA	NA
Syrian Arab Republic	31.87	NA	NA
Tunisia	50.88	NA	NA
United Arab Emirates	90.60	90.6	90.6
Yemen	24.58	NA	NA
Arab countries	41.80	--	--
Developed countries	79.60	--	--
Developing countries	39.00	--	--
World	45.90	--	--

Source: ITU. Available at http://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2017/Individuals_Internet_2000-2016.xls and <http://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2017/Individuals%20using%20the%20Internet%20by%20gender.xls>.

Figure 3. Internet usage gender gap evolution, 2013-2016



Source: ITU, 2016, p. 193.

2. Internet usage patterns

Another important indicator is the type of activities carried out online by Internet users,¹⁰⁵ although “reliable and valid data on Internet use are currently not available for many developing countries”,¹⁰⁶ including many Arab countries; scant data is available for some (Bahrain, Egypt, Oman, Qatar, Morocco and State of Palestine) as highlighted in the analysis below.¹⁰⁷

Table 12 summarizes useful and contrasting Internet usage patterns of developed and developing countries. Most Arab countries would fall under the latter group.

Communication applications are predominant in both groups of developed and developing countries. Sending mails is by far the top application in nearly two thirds of developing countries while it is much less so in developed countries, with social media occupying the top spot.

Web radio, web television and entertainment applications occupy to a much lesser extent the top spot in both groups. Notably, entertainment applications are among the top five in 77 per cent of developing countries compared with only 19 per cent in developed countries.

Education and learning activities are more important in developing countries. This is most likely due to frequent access from schools and the scarcity of local material. Reading newspapers or books is far more important in developed countries. Health-related information is not important for both groups. Finally, getting information about goods and services is important to both groups but more so in developing countries. Developing countries fall behind developed countries in the usage of e-commerce, e-banking and e-government.

3. Factors impacting on Internet usage levels and usage patterns

(a) Gender dimension

Downloading software is higher among male Internet users in all countries. Arab countries follow the same pattern but with lower gaps, except for Qatar and Bahrain, which have values that are similar to developed countries. Oman has a higher proportion of women carrying out this activity. The opposite could be said about access to health information, which is predominantly an activity of women in all countries. Arab countries follow the same pattern, with Qatar and Bahrain leading the pack, followed by Egypt, State of Palestine, Morocco and Oman.¹⁰⁸

Table 12. Internet activities in developed and developing countries

Internet activity		Developed countries (percentage)			Developing countries (percentage)		
		Top	Top 3	Top 5	Top	Top 3	Top 5
Communication	Sending or receiving mails	65	84	95	23	67	90
	Social media, blogs and online discussions	5	30	54	37	67	77
	Telephoning over the Internet/VoIP	3	11	14		3	17
Entertainment	Listening to web radio					7	10
	Watching web television					3	7
	Entertainment (music/video/games)	3	14	19	10	40	77
Learning and finding information	Education or other learning activities		16	22	3	30	50
	Reading newspapers, magazines, or books	11	49	78	7	23	50
	Information related to health			22			13
	Getting information about goods and services	5	57	95	20	50	63
E-commerce and e-service	Buying or selling goods and services	3	5	14			3
	E-banking		24	43		3	13
	Interacting with government	5	11	46		3	17

Source: ITU, 2016.

For participation in social media, usage by women is much lower than by men. The gender gap persists in the region, and it applies to Facebook, Twitter, LinkedIn and Instagram. According to the *Arab social media report 2017*, research indicates “women in the Arab region have not gained a representative voice online,

nor managed to increase their share of the digital space in the region”.¹⁰⁹

(b) Education attainment

Engaging with social media, streaming or downloading music, images and videos,

purchasing or ordering goods and services on the Internet, or carrying out e-banking is higher among tertiary-educated users in most Arab countries.¹¹⁰ One might expect Internet usage increases with educational attainment level and this is so in all countries, developed and developing alike.¹¹¹ Internet usage levels are high (90-100 per cent) among this category in the large majority of developed and developing countries. Among Arab countries, only the State of Palestine registers about 80 per cent for this category, while Qatar and Oman are at near 100 per cent and Egypt is close to 90 per cent. The gap with those who have only primary-level education is high in Egypt and State of Palestine, where Internet usage in this category reaches lows of 20 per cent and 10 per cent respectively, while it is less marked in Qatar (75 per cent) and Oman (60 per cent).

(c) Age

Internet usage by age group is highest among youth aged 15-24. Qatar and Bahrain tend to follow the pattern of developed countries, with a zero or low gap between age groups, while Oman has 25 per cent more users among youth, the State of Palestine and Morocco a third more, and Egypt 80 per cent more.¹¹²

On the opposite side, adults aged 74 and above have a much lower Internet usage levels in most countries. In Arab countries, only 2 per cent of Oman's seniors are online, while the State of Palestine and Egypt's seniors fare only a notch better.¹¹³

(d) Rural/urban

Data from a subset of analysed countries¹¹⁴ highlights that the number of Internet users in rural areas is lower than in urban

agglomerations. The gap is generally correlated with differences in socioeconomic development between rural and urban regions and tends to be lower in developed countries. Switzerland, Japan and the United States have very low differences.¹¹⁵ Arab countries data show a relatively low gap in Oman and the State of Palestine of 5 per cent, which is larger in Egypt at 15 per cent and much larger in Morocco at 35 per cent.

4. Affordability of ICT services

Affordability plays a key role in determining the levels of usage of ICT services. Usage prices of mobile cellular, fixed broadband and mobile broadband in Arab countries, expressed as a percentage of gross national income (GNI) in purchasing power parity US dollars per capita, are summarized in table 13.

Using percentages of GNI per capita is prone to distortions due to how GNI is calculated, inequality levels and population size, though it offers the convenience of comparability with other countries. An established rule, drawn from the best practices of developed countries, is that the cost of all ICT services combined should not exceed more than just 2-3 percentage points of GNI per capita.¹¹⁶ This rule, however, should be applied with caution in developing countries due to the importance of their informal economy but, more importantly, because of the higher cost of communication services relative to income. The high mobile penetration rates even in the poorest countries are a case in point.

Mobile cellular sub-basket¹¹⁷ prices are affordable in most Arab countries.¹¹⁸ The United Arab Emirates leads the pack in the affordability of mobile cellular prices. GCC countries have by

far the most affordable prices in the region but many other Arab countries hover around the margin of 1 per cent, putting them at levels comparable with those of many developed countries. Arab countries with the least affordable prices are Yemen and Mauritania, which are least developed countries with the lowest GNI per capita levels in the region. State of Palestine, and to a lesser extent Morocco, also have high prices despite having higher GNI per capita than the previous two countries.

For the fixed broadband sub-basket¹¹⁹ GCC countries again lead the pack and surpass developed countries. Kuwait, at only 0.26 per cent GNI per capita, is not only the regional but global leader. Notably, many Arab countries from outside the GCC have significantly higher averages than some developed countries. On the other hand, the prices of high-end fibre services introduced in some GCC countries are much higher than in other developed regions, with retail prices as high as \$600 per month.¹²⁰

Table 13. ICT prices, Arab countries

Country	Mobile cellular sub-basket	Fixed broadband sub-basket	Mobile broadband prepaid, handset-based, 500 MB
United Arab Emirates	0.18 (5)	1.09 (41)	0.44 (28)
Qatar	0.24 (9)	0.83 (23)	0.29 (18)
Kuwait	0.35 (19)	0.26 (1)	0.40 (25)
Oman	0.62 (32)	1.30 (52)	0.93 (64)
Bahrain	0.63 (34)	0.76 (20)	0.46 (30)
Saudi Arabia	0.68 (39)	1.90 (68)	0.89 (63)
Tunisia	0.95 (58)	1.19 (48)	1.30 (81)
Libya	0.98 (59)	3.34 (90)	5.56 (137)
Jordan	1.15 (68)	7.04 (123)	1.15 (71)
Iraq	1.86 (88)	5.22 (111)	1.90 (96)
Lebanon	1.88 (89)	2.10 (73)	1.32 (83)
Egypt	1.90 (90)	2.56 (82)	1.18 (73)
Algeria	2.24 (104)	3.38 (91)	1.30 (82)
Sudan	2.25 (105)	2.85 (86)	2.30 (107)
Morocco	4.00 (126)	3.96 (99)	2.00 (98)
State of Palestine	5.69 (138)	6.93 (119)	5.73 (138)
Yemen	7.76 (143)	6.77 (120)	12.47 (161)
Mauritania	14.21 (168)	10.17 (134)	29.73 (177)

Source: ITU, 2016, pp. 107, 120, 136-137.

Finally, mobile broadband pre-paid plans offering 500 Mbytes of data per month reveal price levels comparable with the mobile cellular sub-basket and even lower (Libya is a notable exception). GCC countries, such as Qatar, Kuwait and the United Arab Emirates, have the most affordable mobile broadband prices in the region. Compared with the average of developed countries, Arab countries outside the GCC have more expensive mobile broadband prices.

In summary, prevailing policies would lead to a deeper digital divide between countries in the region as well as between regions in the same country. This digital divide would also be more significant between Arab countries and developed countries. The real use of Internet and its impact on socioeconomic endeavours and behaviour would likely be limited to the high-income GCC countries and other Arab countries with better socioeconomic situations. In such a trajectory, the number of Internet users of e-applications with direct socioeconomic impact would maintain a level of 50 per cent as average in GCC countries and a mere 20-30 per cent in others. Also, affordability of Internet access (including new generation access in its fixed variant) would be no less than 5 per cent of GNI per capita in GCC countries and between 5-10 per cent in other countries.

C. Horizon 2030: aspirations and policy recommendations

As in many developing countries, Arab countries benefited from the emergence of mobile telephony and access to the Internet through mobile phones. Unlike developed countries, which experienced an early take-up of access to the Internet thanks to legacy fixed

infrastructure, developing and many Arab countries (though some had a decent fixed infrastructure at the time by developing countries standards) had to wait for mobile telephony to significantly improve their Internet access.

Internet usage in the large majority of Arab countries is essentially through mobile, with particular emphasis on over-the-top, person-to-person applications and social media. This dominant pattern, despite its undeniable benefits in offering better communication among people, has not yet permitted the advantages of digital technologies – better inclusion, efficiency and innovation – to enhance development in this region.

Horizon 2030 envisages that Arab countries should reach universal access to the Internet, driven particularly by improvements in some largely populated countries and reducing the large gender gap¹²¹ all over the region. With regards to activities on Internet, better statistical data will become available from all Arab countries, showing evidence that e-applications, with direct socioeconomic impact and engagement online with government and other public services, reaches levels no lower than 20 per cent of developed countries in GCC countries and 40 per cent in others. The cost of a full basket of telecom and Internet access services (including new generation access) should reach 1 per cent of GNI per capita in GCC countries and stay at no higher than 3 per cent in others.

Improving the use of digital technologies has been the focus of policies to reduce the digital divide since the early years of this century. Such policies generally address the demand side, bringing solutions to the main problem of lack

of Internet use. The nature of the digital divide has changed, however, particularly due to the development of smartphones and enhanced coverage of populations by a 3G signal in most countries. The main agenda of digital divide policies has now shifted towards capabilities, cost and quality of access.

The old digital divide remains in many areas of the world but the new version concerns more what people do on the Internet and the benefits this might bring to a specific endeavour for which they are using it, particularly in comparison with more advanced countries.

Policy recommendations to address the digital divide in Arab countries will deal first with the general framework for the required infrastructure, quality of access, affordability and capabilities, irrespective of any specific e-application. Recommendations for e-applications discussed in the previous chapter will complement these recommendations.

As discussed in the ICT infrastructure section, Arab countries could leverage their fixed telephony infrastructure to improve the Internet experience thanks to fixed broadband. Despite the lack of improvement in fixed infrastructure in most Arab countries, where it has not kept pace with demographic growth – some countries have even had decreases in fixed subscriptions¹²² – many Arab countries still enjoy a significant double-digit penetration rate of their fixed telephony infrastructure. When associated with higher speeds and uncapped data volumes, this opens new avenues for Internet use that are qualitatively different. Examples include content-rich multimedia applications, enhanced use for professional and educational purposes, and remote support services (for example, telehealth).

Driving down Internet access costs requires infrastructure bottlenecks to be removed, as discussed in the ICT infrastructure section. It needs public policy intervention that deals with market failure characterized by insufficient investments and resulting in high prices and low-quality service. Public authorities should, where possible, develop public-private partnerships and open-access schemes in areas judged as unprofitable by private investors. Government or local authorities could, for instance, lay out an infrastructure such as “dark fibre” in new or existing neighbourhoods and lease it to operators on a non-discriminatory basis.

Developing user capabilities is also important. An Internet access culture is not limited to technical capabilities. For instance, being able to discern useful information from “noise” and assess the reliability of online information sources is a capability few Internet users have. Equally, proper online behaviour, or “netiquette”, is largely unknown by most Internet users.¹²³ The education system has a big responsibility to nurture such a culture among youth, but public policy should develop and support initiatives aimed at educating the population at large, particularly women and girls and disadvantaged groups, and measuring resulting capabilities through national tests and reliable statistics.¹²⁴

While national ICT strategies are often developed and implemented by telecommunications ministries, a participatory approach is needed to allow a whole-of-government engagement in these efforts.

Although bridging the digital divide would be a continuous endeavour, recommendations and measures suggested for a Horizon 2030 trajectory would at least contribute to a better

qualitative use of the Internet and an enhanced impact on socioeconomic development. The digital divide is expected to be more qualitative and require governments and societies in the Arab region to catch up with best practices and ensure an inclusive process that engages all the population, particularly the disadvantaged and marginalized. Additionally, emerging digital technologies, such as the Internet of Things or artificial intelligence, have many social and economic implications even in advanced countries.¹²⁵ Therefore, Arab countries ought to bridge the internal and external digital divide, and adapt these technologies to what best fits their development priorities.

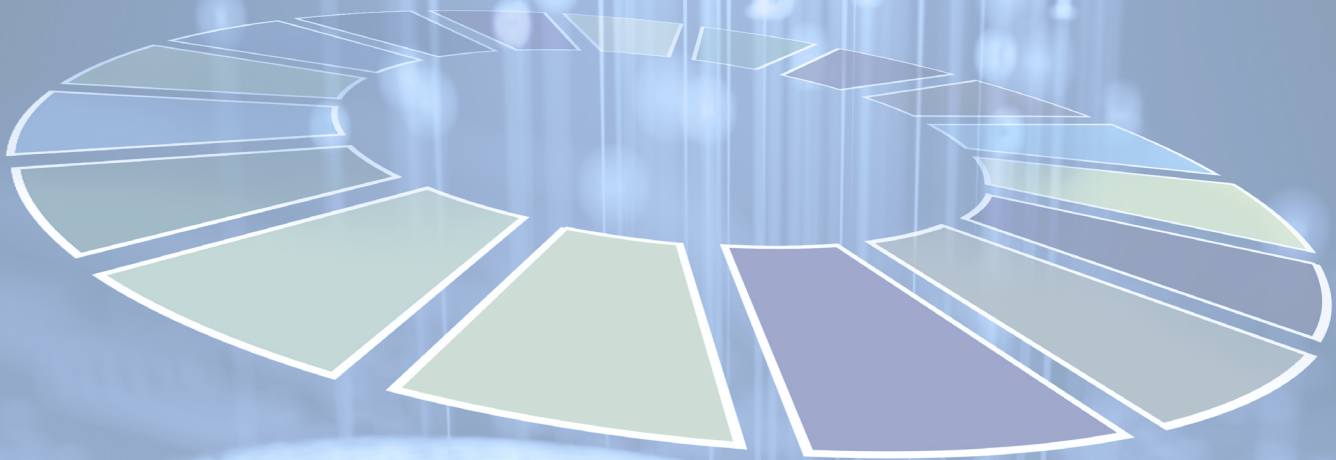
D. Conclusion: business-as-usual trajectories versus Horizon 2030

In a business as usual trajectory, the likelihood of a deepening digital divide will be high, not only between many Arab countries and developed countries but, more importantly, within each country. It is possible that the number of Internet users might reach nearly 100 per cent by 2030, but with many still using it for basic communications.¹²⁶ The real use of the Internet, however, with real change on socioeconomic endeavours and behaviour will likely be limited to the high-income GCC countries and the socioeconomic elite of other Arab countries, with limited impact on key

development issues and SDG targets. In such a trajectory, the number of Internet users of e-applications with direct socioeconomic impact will stay, if data are available, at 50 per cent of the developed countries average in the GCC countries and a mere 20 per cent to 30 per cent in others. Affordability of Internet access, particularly when it includes new generation access in its fixed variant, would be at no less than 5 per cent of GNI per capita in GCC countries and between 5 per cent and 10 per cent in other countries.

Although the generic issues of capabilities, cost and quality of experience will likely remain valid, specific measures should be adapted to eventually change the nature of the divide over the period leading to 2030. It is not unrealistic to forecast that the digital divide will become increasingly qualitative, putting an onus on governments and society at large in Arab countries to catch up with best practices elsewhere. Even more importantly, they must strive to include all their populations, particularly the disadvantaged and currently excluded, in this process. With Internet users in the region having concerns about artificial intelligence and their related applications,¹²⁷ Arab countries should, in their endeavours to bridge their internal and external digital divide, also seek to adapt these technologies to what best fits their societies and development priorities.

9. Policy Area 6: E-applications



9. Policy Area 6: E-applications

A. Context in SDGs

While the previous chapter discussed Internet use from an end user perspective, this chapter looks at the supply side, focusing on select e-applications that have a direct impact on specific SDGs (table 3). These are e-commerce, e-health and e-education, which will also address ICT capacity building by highlighting the skills necessary for a digital economy.

E-business contributes to poverty reduction by allowing the poor and vulnerable equal rights to economic resources (target 1.4) through selling local goods online, improving agricultural productivity and the income of small-scale producers (target 2.3). This is thanks to local and international market places selling and distributing food, and empowering women's entrepreneurship through ICTs (target 5.b). E-business is central to the SDG 8 targets of decent job creation (target 8.3) allowing for entrepreneurship, creativity and innovation, and the formalization and growth of micro, small and medium-sized enterprises, the promotion of sustainable tourism (target 8.9) and expanded access to banking, insurance and financial services for all (target 8.10) through m-banking. Finally, e-business contributes to increasing the access of small-scale industrial and other enterprises to financial services (target 9.3) and the exports of developing countries (target 17.11) by strengthening the ability and readiness of firms to engage in business to consumer (B2C) and business to business (B2B) e-commerce.¹²⁸

E-health is central to all targets of SDG 3, particularly to ending epidemics (target 3.3) and achieving universal health coverage (target 3.8), where ICT enables the efficient and accountable delivery of essential supplies such as drugs, vaccines, diagnostics and equipment. E-health enables the poor and vulnerable to have equal access to social protection (target 1.3) and health as a basic service (target 1.4). It also contributes to ensuring access to safe, nutritious and sufficient food (target 2.1) and ending all forms of malnutrition (target 2.2) thanks to the monitoring of the health and nutritional status of populations, including vulnerable groups, and for assuring their access to food. Universal access to sexual and reproductive health for women (target 5.6) benefits from the extension of health services and health information systems to remote and underserved areas, while access to ICT (target 5.c) empowers women with the knowledge and communications capability they need to make a difference to the health of their families and communities. E-health contributes to the science, technology and innovation capacity building mechanism (target 17.8) as access to innovation and e-health applications supports health institutions as well as measuring progress on sustainable development (target 17.18). Data on ICT uptake in the sector provide evidence for the uptake and trends in e-health and its impact on health and other related socioeconomic outcomes.¹²⁹

E-learning and its related WSIS action impacts on all targets of SDG 4, considering that

“enhanced use of e-learning for education will be an important means to support the achievement of this goal, by offering affordable and flexible means to access education, and supporting more effective pedagogical innovations to improve the quality of education offered”.¹³⁰ Building skills for the digital economy is part of WSIS action line C4 on capacity building that impacts on several SDGs. Of particular importance is how it increases the number of youth and adults with relevant skills for employment, decent jobs and entrepreneurship (target 4.4), and ensures all learners acquire the knowledge and skills needed to promote sustainable development (4.7), thanks to programmes eradicating illiteracy using ICT, thus facilitating employment and entrepreneurship in the sector.¹³¹

B. Prevailing policies: current situation and future implications

1. E-commerce

An e-commerce transaction is defined as: “... the sale or purchase of goods or services, conducted over computer networks by methods specifically designed for the purpose of receiving or placing of orders. The goods or services are ordered by those methods, but the payment and the ultimate delivery of the goods or services do not have to be conducted online. An e-commerce transaction can be between enterprises, households, individuals, governments, and other public or private organisations”.¹³²

E-commerce transforms the enterprises that use it and the economy at large. It introduces new consumption patterns and allows new players, such as micro or small enterprises, to carry out transactions with customers irrespective of their

geographical location. For developing economies with large informal sectors, e-commerce has an important economic and developmental impact.

Although the precise volume of e-commerce and its impact on retail sales is known in developed countries, in Arab countries it is not properly measured. Many market estimates establish that, Europe and North America apart, only the Asia and Pacific region has a sizeable share in the global e-commerce landscape. The combined share for the Arab region,¹³³ together with Latin America and Eastern Europe, is no more than 10 per cent of the global figure.

A market study of business to consumer e-commerce within the Gulf Cooperation Council¹³⁴ estimated its value at \$5.3 billion for 2015 and forecast it to reach \$19.5 billion, a 30 per cent growth, in 2020. Business to consumer contributes 0.4 per cent of the GDP in GCC countries, while it reaches 3.5 per cent in the United Kingdom, and 1.9 per cent in the United States. Despite an impressive forecast, business to consumer e-commerce figures within the GCC pale in comparison with the global figure of \$1.915 trillion in 2016,¹³⁵ which is expected to reach the \$4 trillion mark in 2020.¹³⁶

An essential measurement is the percentage of the population carrying out e-commerce activities. Recent data from the European Union indicated that 66 per cent of its population aged 16-74 shopped on the Internet.¹³⁷ Data for most Arab countries are scarce, but when available shows low values (table 14) and usage limited to the more affluent.

A no less important issue relates to the supply side of e-commerce and enterprises carrying it out. Data from developed countries and the European Union highlight that even in advanced

countries it is not widespread among small and medium-sized enterprises (SMEs). In 2016, for example, only 17 per cent of SMEs in the European Union were selling online, with e-commerce representing 9.4 per cent of their turnover. Only 7.5 per cent of SMEs carried out cross-border e-commerce.¹³⁸ Similar data for Arab countries are missing.¹³⁹

The United Nations Conference on Trade and Development (UNCTAD) established an

international index to gauge the e-commerce readiness of countries. The data for Arab countries are summarized in table 14, which shows how low credit card use has a key role in driving down the potential of business to consumer e-commerce. It is worth noting that other e-payment methods might be used for e-commerce. Some countries, essentially those in the GCC, introduced national e-payment systems, although they have a good percentage of credit-card users.

Table 14. B2C e-commerce index, Arab countries 2016 and percentage Internet shoppers (indicated year)

Country	B2C e-commerce index value (rank)	Share of individuals using Internet	Share of individuals (15+) using credit cards	Secure Internet servers per million population, normalized	UPU postal reliability index	Percentage Internet shoppers value (year)
United Arab Emirates	73.4 (25)	90	37	80	86	14 (2012)
Qatar	72.4 (26)	91	32	78	88	15 (2013)
Bahrain	66.5 (32)	91	28	75	72	-
Kuwait	61.9 (40)	79	26	76	67	-
Lebanon	57.4 (48)	75	11	65	79	-
Saudi Arabia	52.2 (56)	64	12	64	69	23 (2014)
Oman	48.8 (65)	70	27	68	30	8 (2013)
Tunisia	44.5 (73)	46	7	56	69	-
Morocco	41.5 (79)	57	4	45	60	4 (2014)
Jordan	41.3 (80)	44	2	60	59	12 (2014)
Egypt	32.9 (82)	32	2	45	81	1 (2014)
Algeria	32.3 (95)	18	6	37	68	-
Iraq	14.3 (127)	11	2	28	16	-
Sudan	12.4 (132)	25	0	0	25	-

Source: UNCTAD, 2016.

Note: UPU is Universal Postal Union.

2. E-health

Highlighting the broad impact of digital technologies on the health-care system, e-health is defined as the cost-effective and secure use of ICT in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research.¹⁴⁰

Beyond personnel competencies, quality and breadth of infrastructure, optimal and timely information exchange ensures effectiveness and reduces costs. Case studies reflecting on the experience of developed countries have proved that ICT can make significant improvements in health-care delivery – reducing medical errors, improving clinical care through adherence to evidence-based guidelines, and preventing duplication and inefficiency in its delivery.¹⁴¹

There are several related issues that require public policy intervention. Among those, cost is central and cannot be left to market forces alone since the beneficiaries of an e-health system are not necessarily those who bear the cost. The second issue relates to the privacy and liability of patient data. The third is logistical, and related to the exchange of medical information between providers.

E-health essentially involves an overhaul, and a change in habits and culture within the health system. This cannot be conducted without a national strategy designed with the participation and consent of all stakeholders. WHO and the International Telecommunication Union (ITU) have developed kits and guidelines based on the experiences of early adopters to help

developing countries elaborate their national e-health strategies.¹⁴²

It is difficult to benchmark the e-health performance of countries. A 2015 guide by the Organisation for Economic Co-operation and Development (OECD) for measuring ICT usage in the health sector is still in its pilot phase.¹⁴³ A third survey by the Global Observatory for eHealth with WHO in 2015 focused on the role e-health plays in achieving universal health coverage (UHC). It concluded that it has become clear that UHC cannot be achieved without the support of e-health, and that UHC is part of the post-2015 agenda, “Goal 3 is to ‘Ensure healthy lives and promote well-being for all at all ages’ and its target 8 is to ‘Achieve universal health coverage’, so that all people receive the high-quality health services they need without suffering financial hardship”.¹⁴⁴

The survey touched on developments that “can be expected to have significant impact in the next 5-10 years, such as social media and big data”, but also on some that may also prove notable over the next 10 years, “such as low-cost smartphones to enable virtually everyone everywhere to have access to audio-visual examples of best (global and local) practices for improving health behaviours and supporting UHC could represent a paradigm shift in health care”.¹⁴⁵

Of the 125 countries participating in the survey, 12 were Arab countries.¹⁴⁶ Saudi Arabia and the United Arab Emirates were missing, as well as Egypt and Kuwait, who participated in the 2010 survey.¹⁴⁷ The situation of Arab countries is summarized in box 3.

Box 3. Arab countries in the third global survey on e-health

Bahrain, Jordan, Qatar and Sudan^a reported having established an e-health policy/strategy, but Bahrain did not give a date for its adoption. Among the various funding sources for programmes, the majority of responding countries noted public sources or donor/non-public funding (eight of the 12 countries). Only six countries reported public-private partnership schemes, and four private or commercial funding.

With regard to legal frameworks for e-health, among the 13 policy areas suggested by the survey, Arab countries mainly addressed policies and regulations that govern civil registration and vital statistics (nine countries), protection of the privacy whether in paper or digital format (eight countries), and national identification management systems (seven countries). Definition of medical jurisdiction, liability and reimbursement of e-health services was reported only by Bahrain, Qatar and Iraq, while patient safety and quality of care based on data quality, data transmission standards or clinical competency criteria by Bahrain, Iraq and Jordan.

Established telehealth programmes (the delivery of health care from a distance) involving teleradiology, teledermatology, telepathology, telepsychiatry or remote patient monitoring were reported by Jordan (three), Algeria (two), Bahrain (two), and Oman (one,) alongside another informal programme in Jordan, and two pilots and one informal programme in Bahrain. Mauritania (with two), Morocco (one) and Sudan (one) reported having only pilot programmes, and Lebanon reported two informal programmes.^b

Bahrain, Jordan and Oman reported a national electronic health records (EHRs) system but only Jordan and Oman provided a date for its establishment with a specific regulatory framework and programmes leveraging on it.

Countries were asked to report specific mobile health (m-health) programmes from among a total of 14 ranging from toll-free emergency or health call centre information services, to patient health monitoring and surveillance services or access to patient information by professionals at point of care. Oman, with 10 established programmes and two pilots, was the regional leader followed by Jordan with six established and one informal programme and five pilots. Sudan (seven), the Syrian Arab Republic (seven), Algeria (six), Lebanon (five), Morocco (five), Bahrain (four) and Qatar (three) also reported established programmes, alongside other pilot and informal programmes for the latter four. Mauritania reported five pilots and three informal programmes, and Iraq just two pilots.

Only Bahrain and Oman reported having a national policy or strategy on the use of social media by government organizations working in the health sector, while Jordan was the only country reporting a policy/strategy governing the use of big data.

Source: WHO, 2016.

Note: ^a For country profiles, see <http://www.who.int/goe/publications/atlas/2015/en/>.

^b Established, pilot or informal are the three levels used to designate maturity of a programme.

3. E-education and skills for the digital economy

An indicator used in the World Economic Forum's Networked Readiness Index (NRI) seeks the opinions of the business community on Internet

access in their country's schools. At a constant perimeter of the six GCC countries and Algeria, Egypt, Jordan, Lebanon, Morocco and Tunisia, the average of Arab countries for this indicator is close to the global mean value of all countries over the last three surveys, though slightly decreasing.¹⁴⁸

From this narrow perspective, it might be concluded that Arab countries have made progress in at least equipping their schools with computers connected to the Internet. As always, the average conceals differences between countries, with the United Arab Emirates and Qatar occupying high positions, even at global scale, and a significant number of countries, including some GCC ones, at much lower positions.

UNESCO's Institute for Statistics (UIS) collects statistics on ICT use in education. Data are limited to five countries (Egypt, Jordan, Oman,

Qatar and State of Palestine), reflecting their situation in 2010-2011. UIS published a summary report summarizing the data in 2013.¹⁴⁹

Developed regions like the European Union conduct in-depth surveys of ICT use in education in the 27 EU countries. Data from the 2016-2017 survey are not yet published, but analysis of the previous survey in 2011-2012 is available.¹⁵⁰ Despite the different methodologies used, they can be compared because they refer to the same year (box 4), and can help in identifying gaps between the two regions.¹⁵¹

Box 4. ICT use in education: selected comparisons between Arab countries and the European Union

Students-per-computer ratios in the European Union were seven (14 connected to the Internet) in primary, five (14) in lower secondary and four (14) in upper secondary. Among Arab countries, Jordan, Oman and Qatar, though with higher values, remained comparable with the EU, while the State of Palestine had significantly higher values, particularly with regard to Internet connectivity. Egypt had even higher orders, particularly at primary level for computers, and at all levels for computers connected to the Internet; for example, its value for primary was 441 students per computer connected to the Internet compared with 14 in the EU.

While the UIS data address the percentage of schools connected to the Internet and availability of a broadband connection, the EU survey focuses more on the type of broadband connectivity, and its speed. Jordan and Oman both had high percentages of schools at all grades connected to the Internet (80-90 per cent) but significantly lower (50-60 per cent) with broadband. Qatar, followed by Egypt and the State of Palestine, were at lower values, between 70 per cent for the first and 30 per cent for the last, with no data on broadband for the first two. The State of Palestine provided identical data for broadband. In the EU, about 90 per cent of schools at all levels had high-speed broadband with a significant share of fibre, particularly upper secondary.

While UIS data address the percentage of schools with computer labs, the EU survey considers computers in a lab, a classroom, a library or other locations. Computer labs were very high at all education levels in Jordan and Oman (above 90 per cent) but lower in Qatar and the State of Palestine (50 to 80 per cent depending on level), followed by Egypt with 12 per cent in primary and 42 per cent in lower secondary. In the EU, computers were 60 per cent in computer labs at all levels though a significant share (30 per cent) was in classrooms at primary level.

UIS asserts the presence of a local area network (LAN) in schools, while the EU survey focuses beyond the existence of a physical LAN and on the connectedness of a school, and particularly student access to a virtual learning environment (VLE). LAN availability in schools in Arab countries follows the same pattern as computer labs, with 10 to 20 per cent lower values at all levels and for all countries. In the EU, 27 per cent of primary students and 61 per cent of lower and upper secondary students were in schools with a VLE, and remote access to this was available outside school hours in 80 and 90 per cent, respectively.

UIS data measure whether an ICT-assisted instruction (IAI) is supported in schools through radio (RAI), television (TAI), computers (CAI) or Internet (IAI). EU methodology focuses more on the intensity of ICT use in lessons, its availability during lessons, frequency of specific ICT equipment use (whether the school's or student's own) as well as use of interactive whiteboards. CAI was supported in all primary and secondary schools in Oman, 80 to 90 per cent of Egypt and Jordan's schools, and more than half of schools in Qatar and the State of Palestine. There is no data on Egypt for IAI and other countries had a lower percentage, ranging from 20 to 30 per cent, except for Qatar, which had nearly identical values as for CAI. In the EU, 86 per cent of primary-level students were in schools with teachers reporting use of ICT in class, 81 per cent for lower secondary and 86 per cent at upper secondary; 29 per cent of primary students were in schools where teachers use ICT in more than 25 per cent of lessons, climbing to 32 per cent at lower and upper secondary levels.

On ICT and training competencies of teachers, UIS data address the percentage of teachers qualified to teach ICT material and those doing so, those trained to teach subjects using ICT and those doing so, and those trained via ICT distance education programmes. The EU survey focuses on a teacher's experience in using ICT and frequency and nature of activities they carry out using it. In addition, the survey addresses issues related to teacher's professional development in ICT subjects (such as compulsory training, auto training, online communities and subject specific training). A high percentage of teachers trained to teach subjects using ICT was found in Jordan (88 per cent for all levels) and Qatar (100 per cent at upper secondary, but 68 and 43 per cent at lower secondary and primary), and the State of Palestine reported 50 per cent at all levels, while Oman reported only 35 to 40 per cent. Regarding teachers who use ICT in teaching other subjects, the State of Palestine reported high percentages in primary (90 per cent) and lower secondary (80 per cent) and Qatar for upper secondary (100 per cent) but much lower values were reported by Oman (35 to 40 per cent). No data were available for Jordan and Egypt. In the EU, some 80 per cent of teachers at all levels had four or more years of experience in using computers/Internet at schools, up to 98 per cent for those with one-year and more experience.

Source: UIS and EU.

The findings are not meant to offer a comprehensive comparison, nor do they allow for a rigorous gap analysis. A striking difference, however, concerns patterns of ICT use in education. The EU survey highlights issues that have not yet reached the radar of developing and Arab countries. This hints at large-scale ICT use in education not yet happening in Arab countries, that this is where the major, overarching gap resides.

This is of concern if ICT competencies and/or their use in developing other competencies are

assumed to be central to advance the skills needed for the digital economy.

The relationship between ICT use in education and a student's performance is not straightforward. One study relating the experience of developed countries showed a reverse correlation between the intensity of ICT use in schools and a student's performance as measured by the Program for International Student Assessment (PISA), and concluded that "technology can amplify great teaching, but great technology cannot replace poor teaching".¹⁵²

Table 15. PISA mean scores in science, reading and mathematics, OECD average and Arab countries, 2015

Country/region	Science			Reading			Mathematics		
	Both sexes	Boys	Girls	Both sexes	Boys	Girls	Both sexes	Boys	Girls
OECD	493	495	491	493	479	506	490	495	488
United Arab Emirates	437	424	449	434	408	458	427	424	431
Qatar	418	406	429	402	376	429	402	397	408
Jordan	409	389	428	408	372	444	380	373	387
Lebanon	386	388	386	347	339	353	398	408	386
Tunisia	386	388	385	361	348	373	367	370	364
Algeria	376	369	383	350	376	435	360	356	363

Source: OECD, 2016.

Analysis of the PISA scores (table 15) reveals the gap Arab countries face in all disciplines compared with average OECD country scores. Of particular concern is that most have not shown progress against previous PISA rounds, Qatar being the exception. The high percentage of low performers among students (30 to 60 per cent) and the low percentage of best performers (for example, 7 per cent in the United Arab Emirates) is likewise worrying.¹⁵³ On the positive side, girls generally perform better than boys, often in reverse of global OECD trends.¹⁵⁴

C. Horizon 2030: aspirations and policy recommendations

1. E-commerce

A Horizon 2030 vision has business to consumer e-commerce in the region, after statistical measurement in all countries, reaching 2 per cent of global figures (from the current 0.25-0.30 per cent, taking the GCC volume as a

proxy for 80-90 per cent of the total),¹⁵⁵ the share of non-GCC countries of this total reaching at least 50 per cent compared with the current 10-20 per cent. As significant for socioeconomic development is the share of SMEs engaging in e-commerce, which should reach 60 per cent in GCC countries and 30-60 per cent in other countries.¹⁵⁶ Another measure relates to Internet shopping, which is expected to reach 70 per cent of Internet users in GCC countries, and 30-50 per cent in other countries.¹⁵⁷ Finally, the use of electronic, particularly mobile, payment solutions should be universal among mobile users in GCC countries and at least 50 per cent in other countries.¹⁵⁸

A recent e-trade for all initiative launched by UNCTAD with ITU, World Bank, UPU and the World Economic Forum, aims to improve “*the ability of developing countries, and particularly benefit LDCs, to use and benefit from the digital economy*”. The platform¹⁵⁹ provides advice and materials for developing countries and country profiles summarizing all factors affecting

e-commerce,¹⁶⁰ and could be leveraged by Arab countries to address any shortcomings.

A further issue faced by all Arab countries relates to the lack of statistical data on the volume of business to consumer and business to business e-commerce. Arab national statistics offices (NSOs) should start tackling this through regular statistical surveys.

Despite the shortage of official data, when compared with developed countries, e-commerce is nascent in Arab countries. The concern, however, as substantiated by the low number of online shoppers, is not the gap, but its impact on inclusive and sustainable growth. Anecdotal evidence points to business to consumer e-commerce in the region as essentially used by the wealthiest populations in GCC and other Arab countries to buy high-end products and services on the Internet. Policy priority should thus aim to improve growth and jobs through e-commerce and assist in formalizing the large informal private sector, which in most Arab countries is essentially made up of micro and small enterprises.

SMEs face financial and human resource hurdles that hinder them adopting e-commerce even in developed countries. A sound policy would support the development of national or cross-border Arab e-commerce platforms that allow SMEs and even micro enterprises to sell their products online. Alongside this, developing mobile payments to leverage smartphone penetration among Arab populations would also encourage online transactions.

A key role of public policy is to encourage national and secure platforms for both commerce and payment that primarily serve the national economy.¹⁶¹ A lesson for all developing

and Arab countries is the uptake of mobile payment and e-commerce in China – though favoured by market size and public policy – as witnessed by platforms such as Alibaba and its associated payment system Alipay, or the electronic wallet of the messaging platform WeChat. Estimates of total mobile payment volume in China for 2016 put it at \$760 billion, dwarfing that of the United States (\$74 billion) by a factor of 11. China's share in the \$1.915 trillion of global volume of business to consumer e-commerce for 2016 was 42.4 per cent; it was at less than 1 per cent of this volume in 2005.¹⁶²

2. E-health

An Horizon 2030 vision has all Arab countries implementing a national e-health strategy, at an advanced stage for GCC countries, and early to medium stage in others. In the absence of established international benchmarks for e-health, this study suggests electronic health records be adopted by all GCC countries, and at least in 70 per cent of other Arab countries with a similar percentage of telehealth and m-health programmes (as per WHO survey). E-health applications based on big data analytics and other advanced artificial intelligence (AI) technologies for the benefit of better health monitoring and diagnosis will be operational in GCC countries, and in the advanced stage of piloting at least in all other countries.

The experience of developed countries suggests governments could play a crucial role in enhancing the efficiency and benefits of ICT in the health sector by addressing cost and privacy issues and interoperability. A national e-health strategy must be all-inclusive. Without a coherent strategy, e-health will not be effectively integrated in the national system. At best, it would remain a set of disconnected,

smart technological shows with no significant impact, specifically on SDG 3, which strives to ensure healthy lives and promote well-being for all at all ages.

Arab countries that have not yet adopted a national e-health strategy are recommended to urgently elaborate one, or if they have one, update it with guidance from the joint ITU/WHO toolkit and its suggested three-step approach, which consists of responding to health and development goals, setting out an action plan that reflects country priorities and a plan to monitor implementation and manage risks. This national vision should be inclusive and involve key health and non-health stakeholders. Of equal importance are “governance mechanisms to provide improved visibility, coordination and control of e-health activities that are occurring across the country’s health sector”.¹⁶³

Except for GCC countries, Arab countries face issues related to the quality and capacity of their public health sector, particularly for the poor who cannot afford private health sector costs due to non-existent or insufficient cost coverage schemes for health services. Countries facing conflict situations and internal refugees, or those with refugees from neighbouring countries, face specific challenges in providing them with decent health care. This could be improved by smart and targeted e-health applications, such as teleradiology or telediagnosis. Even with targeted projects, however, organization and sustainability issues should be considered upfront and integrated within a national strategy wherever possible.

Similarly, Arab countries with a good health infrastructure should carefully consider e-health projects aimed at the best technologies, even if they can afford them. The experience of

developed countries illustrates that in terms of cost, e-health is challenging and might easily become a sink of public and private money. Cost-benefit analysis – not an easy task in the health sector – should be carried out to evaluate projects. A national e-health strategy could be highly beneficial if only to place such projects within a consistent global picture of a national health system.

3. E-education and skills for the digital economy

Under an Horizon 2030 vision, ICT use will spread through all education levels in Arab countries. Beyond schools connected to the Internet and computer-to-learner ratios, which might become less relevant by 2030, the percentage of learning activities using ICT and the impact of ICT-supported learning methods on student competencies, as reflected in international tests, must acquire higher relevance. Consequently, this study envisions that ICT use, measured by national surveys, will impact on 50-70 per cent of learning activities in all Arab countries. It is also expected that a large majority (80 per cent-plus) of countries will join international assessment programmes for their pupils – PISA, for example – and improve their results, reaching 80 per cent to parity and above with OECD averages.

Countries face the double challenge of addressing the shortcomings of their education system in terms of quality and making it more inclusive¹⁶⁴ and also enhancing ICT use. This is fundamental to prepare young people for the non-routine skills needed for the digital economy, with a direct impact on SDG 4 and ensuring “inclusive and equitable quality education” and the promotion of lifelong learning opportunities for all.

Lifelong learning is fundamentally a capability developed from early education and is much needed in the context of the rapidly evolving technologies and jobs of the twenty-first century. The Arab education system should evolve to equip students with the capacity to learn – a result of new methods that develop independent and critical thinking leveraging on a smart use of ICT targeted to enhance efficiency of already improved teaching.

Arab countries might draw inspiration from the European Union survey of ICT use in schools, and carry out surveys focusing on ICT equipment and access to the Internet as much as on how ICT is effectively used in the educational process. Countries should participate in the PISA test, using it to assess if ICT use has led to better education outcomes, and why.

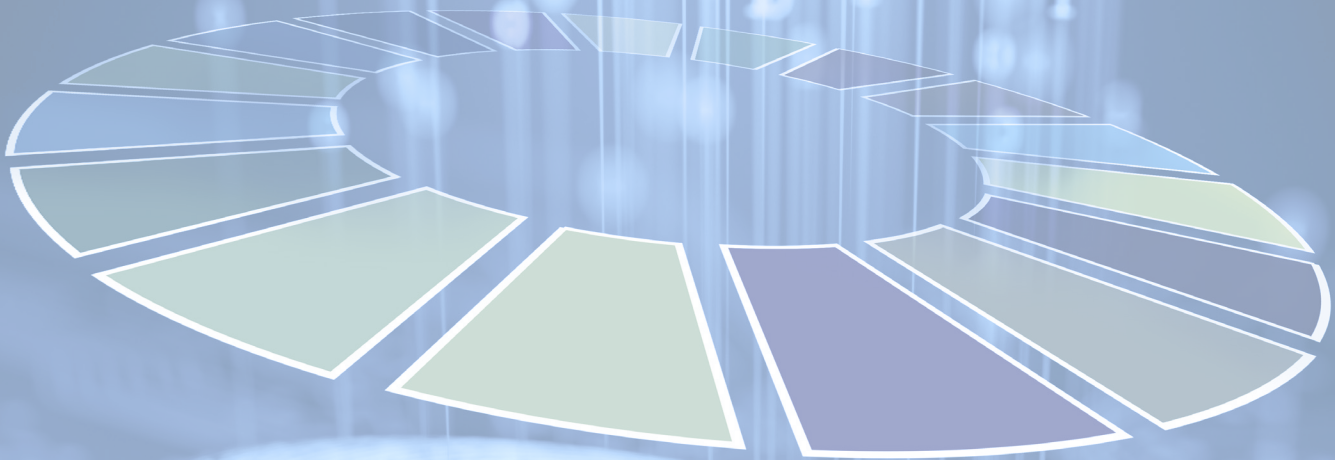
D. Conclusion: business-as-usual trajectories versus Horizon 2030

The targets set in the Horizon 2030 vision for e-commerce, e-health and e-education could be achieved under the prescribed policy recommendations. Fulfilling these targets, however, depends on reform of the given sector, detailed discussion of which is beyond the scope of this document. E-commerce and e-payment are useful tools with high impact on the economy and growth. They are associated with economic reform that encourages initiative and entrepreneurship instead of rent and provides proper financing, particularly to SMEs, helping them escape from informality. Even the best ICT can do nothing to cure a failed education system. Reform that develops quality education systems, from early childhood to university education, is essential, as well as efforts to update curriculum, develop research

and engender critical and independent thinking and capacity for lifelong learning. These are the skills needed for a twenty-first century knowledge economy. Using ICTs in the health sector is equally associated with a properly functioning social security system that ensures quality care for all, and the active involvement of health and social workers in any e-health strategy and resulting technical solutions.

Considering the specific situation of Arab countries, a business-as-usual trajectory is equated with an absence of these reforms. Despite technical improvements and the latest technologies, particularly among affluent GCC countries, any impact will remain limited. The regional share of business to consumer e-commerce is expected to stay below 1 per cent of global volume, mainly concentrated within affluent countries of the GCC. The impact on SMEs will be limited, with only 10 to 20 per cent adopting e-commerce outside the GCC, 40 per cent within it. Internet shoppers might reach volumes close to 80 per cent within the GCC but will remain at a minority (20 to 30 per cent) in other countries. With e-health, many Arab countries still lack a comprehensive strategy, or if a strategy exists it is not properly implemented. Electronic health records, telehealth and m-health applications might experience a quantitative surge in the region, doubling in all countries and particularly within the GCC, but will not be properly integrated within health systems. Use of advanced big data analytics and AI tools will be limited to experimentations and restricted deployments. As regards e-education, its adoption in learning activities will be enhanced but still with limited impact, likely 30-40 per cent in GCC countries, well below that in others. More countries will likely join student assessment programmes such as PISA, but their results will stay well below OECD averages, with little improvement over the period.

10. Policy Area 7: E-government



10. Policy Area 7: E-government

A. Context in SDGs

E-government is central to SDG 16 and its targets to develop effective, accountable and transparent institutions at all levels (target 16.6), make certain responsive, inclusive, participatory and representative decision-making at all levels (16.7), and ensure public access to information and protect fundamental freedoms (16.10). In this latter respect, “ICT is a key driver and enabler of enhanced efficiency, effectiveness and transparency in public service delivery” and “ICT-enabled information sharing, and consultation provide opportunities to expand participation in decision-making”. In the same manner, e-government is critical in developing demand for ICT, and impacting target 9.c to increase access to information and communications technology and target 17.8 on fully operationalizing the technology bank and enhancing the use of ICT.¹⁶⁵

B. Prevailing policies: current situation and future implications

The main challenge to e-government is the lack of comprehensive statistical data, particularly on effective use and impact of e-government services. Since 2003, the biannual United Nations E-Government Survey,¹⁶⁶ with its E-Government Development Index (EGDI)

and companion E-Participation Index, has established itself as a global reference, despite being limited to desk research and lacking country data sheets, and providing only aggregate data. The last edition was in 2016.

Other information on e-government emanates from the World Economic Forum’s global opinion survey of business leaders, which includes e-government indicators as components of its annual Networked Readiness Index (NRI).¹⁶⁷ Last published in 2016, it reveals the views of the business community on the use of ICT by governments.

The evolution of E-Government Development Index values of Arab countries since 2003 and their ratings in the 2016 edition indicates steady progress. Of the 193 countries surveyed, the United Arab Emirates and Bahrain were among the leading group of 29 characterized by a very high value of above 0.75, with eight others (remaining GCC countries, and Lebanon, Jordan, Morocco and Tunisia) among the second group of 65 countries with a high value of above 0.5.¹⁶⁸ This indicates that many Arab countries have successfully implemented e-government services. Other indicators from the Networked Readiness Index¹⁶⁹ support this view for the two regional leaders, plus Saudi Arabia and Qatar (table 16).

Table 16. EGD and selected e-government-related indicators from the NRI, Arab countries, 2016

Country	EGDI value 0-1 (rank)	Importance of ICTs to government vision 1-7 (rank)	Government success in ICT promotion 1-7 (rank)	Impact of ICTs on access to basic services 1-7 (rank)	ICT use and government efficiency 1-7 (rank)
Bahrain	0.7734 (24)	5.2 (9)	5.1 (12)	5.4 (26)	5.4 (10)
United Arab Emirates	0.7515 (29)	6.1 (1)	6.2 (1)	6.1 (4)	6.1 (1)
Kuwait	0.7080 (40)	3.2 (113)	3.3 (116)	4.1 (71)	3.7 (89)
Saudi Arabia	0.6822 (44)	5.3 (7)	5.3 (9)	5.2 (33)	5.5 (8)
Qatar	0.6699 (48)	5.9 (3)	5.8 (4)	6.0 (8)	6.0 (3)
Oman	0.5962 (66)	4.5 (39)	4.4 (44)	4.6 (50)	4.5 (46)
Tunisia	0.5682 (72)	3.6 (90)	3.8 (83)	3.8 (100)	3.6 (92)
Lebanon	0.5646 (73)	2.7 (134)	2.7 (134)	3.4 (117)	3.0 (125)
Morocco	0.5186 (85)	4.3 (50)	4.3 (49)	3.8 (95)	4.0 (65)
Jordan	0.5123 (91)	4.5 (36)	4.4 (40)	4.8 (43)	4.4 (47)
Egypt	0.4594 (108)	3.2 (112)	3.6 (99)	3.5 (108)	3.4 (112)
Libya	0.4322 (118)	-	-	-	-
Syrian Arab Republic	0.3404 (137)	-	-	-	-
Iraq	0.3334 (141)	-	-	-	-
Algeria	0.2999 (150)	3.1 (119)	3.4 (115)	3.2 (124)	3.3 (116)
Sudan	0.2539 (161)	-	-	-	-
Yemen	0.2248 (174)	-	-	-	-
Mauritania	0.1734 (184)	3.1 (124)	3.1 (123)	3.0 (129)	3.0 (123)

Sources: United Nations, 2016a; World Economic Forum, 2016.

Assessing the real impact and effective use of e-government on development requires comprehensive data that are currently lacking. The *World development report 2016* indicates the undeniable effect of e-government information services on development, yet has noted limited impact in the streamlining

of government processes, receiving citizen feedback or improving government workers' efficiency.¹⁷⁰ Although these are global conclusions, anecdotal evidence indicates they apply to many Arab countries. The report further notes that digital technologies "have helped willing and able governments better

serve their citizens, but they have not yet empowered citizens to make unwilling governments more accountable”.¹⁷¹

Leading countries in the United Nations E-Government Survey are exclusively developed countries. Among the top 10 countries in the E-Government Development Index, six are from western and northern Europe (Denmark, Finland, France, Netherlands, Sweden and the United Kingdom), two from Asia (Republic of Korea and Singapore), and the remaining two from Oceania (Australia and New Zealand). This points to other factors – analog complements key among them – that play an important role and explain the gap between these countries and others, including the two Arab leaders. The analysis of Arab countries points to four categories of challenges that governments must address, namely management and administrative, demographic and social, economic, and infrastructure/connectivity issues.¹⁷² Beyond technical change, a culture change within Arab

administrations and interaction with citizens must take place.

In the absence of detailed statistical data per country, it is difficult to quantify the gap between Arab countries and best global practices. Arab countries, however, are not at the same level. The United Arab Emirates and Bahrain enjoy good quality technical e-government implementation and sound political vision.¹⁷³ The regional leaders are followed by a cohort of countries with decent technical implementation and/or clear political vision, then a large cohort of countries lacking human/financial resources, with political instability and/or conflict, and weak/unclear government vision, or any mixture of the above.

Finally, on the specific issue of open government data, evidence from the Open Data Barometer¹⁷⁴ points to low levels of readiness and implementation, particularly poor impact of open data in all Arab countries (table 17).

Table 17. Open Data Barometer, Arab countries, 2016

Country	Global rank (of 114 countries)	Score (of 100)	Readiness (of 100)	Implementation (of 100)	Impact (of 100)
Tunisia	50	32	45	32	22
United Arab Emirates	59	26	47	23	12
Qatar	74	19	31	18	2
Bahrain	74	19	33	20	7
Saudi Arabia	74	19	37	15	12
Morocco	79	17	25	18	13
Egypt	85	14	27	14	6
Jordan	87	13	28	11	6
State of Palestine	100	8	23	7	2
Lebanon	104	6	17	7	0
Yemen	114	0	0	6	0

Source: opendatabarometer.org.

C. Horizon 2030: aspirations and policy recommendations

In Arab countries, e-government services are at different stages of development and sophistication, as reflected in the United Nations E-Government Survey. Countries share many common challenges, including the cultural transformation of their public services, promoting citizen participation and e-government services, and improving the quality and quantity of public data.

A Horizon 2030 vision sees efforts to develop e-government translated into higher quality public services and enhanced citizen participation and satisfaction. The latter can be measured through systematic population surveys; the former is more amenable to statistical measurement of percentages of automated government services and their use relative to any analog version. If such indicators are available (annex 3), it is possible to envisage most government services having an online version by 2030,

with an adoption rate among Internet users in GCC countries averaging 80 per cent.¹⁷⁵ Judging by the efforts of many GCC countries to improve e-government services, this target, provided it is properly measured, is a bare minimum. Targets can be set at 20 to 30 per cent lower for middle-income countries, and 50 per cent in low-income/least developed countries. Population satisfaction should reach highs of 90 per cent within the GCC, and 60-80 per cent in other countries. As regards open data, all Arab countries should have adopted policies and enhanced their global rank in the Open Data Barometer, with no GCC country below the second quintile and no middle-income country below the third.

The *World development report 2016* observes that the quality of government institutions is correlated with their adoption of digital technologies,¹⁷⁶ though these essentially are tools for improvement. Digital transformation priorities depend on a country's institutional maturity level (emerging, transitioning or transforming), as summarized in table 18.

Table 18. Priorities for improving government services in different contexts

Emerging countries: laying the foundations for institutions	Transitioning countries: building capable, accountable institutions	Transforming countries: deepening collaborative institutions
<ul style="list-style-type: none"> • Improve informational services to citizens; • Strengthen provider monitoring and payment; • Establish population registers • Scale up non-state provision of services; • Increase electoral accountability. 	<ul style="list-style-type: none"> • Strengthen government delivery systems; • Strengthen provider management; • Get regular user feedback on service quality; • Increase transparency in priority areas. 	<ul style="list-style-type: none"> • Improve collaboration across government; • Enhance participatory policy-making.

Source: World Bank, 2016.

Each level is associated with a set of digital technologies and analog complements. For example, mobile phone-based information services are most relevant for emerging countries; digital platforms for citizen feedback and participation could be important for transitioning countries; and integrated whole-of-government digital solutions are key for transforming countries. Analog complements, including civil society and community involvement, are important for emerging countries, while public-private partnerships for fee-based services are suitable for transitioning countries and, likewise, for transforming countries, eliminating silos for the whole-of-government transformation.¹⁷⁷

Once priorities are identified, technologies important for the digital transformation of a government must be evaluated in accordance with its needs after considering the impact, effort, link with SDGs and estimated costs within an action priority matrix. This will maximize impact and minimize effort and costs.¹⁷⁸ An action priority matrix may not necessarily include the most sophisticated technologies, but would focus on those likely to lead to the most effective and relevant institutional consolidation. Arab countries would follow such an approach in accordance with their institutional maturity, an example of a developmental complementing a technological approach.

According to the *World development report 2016*, “The Internet largely, but not entirely, reinforces rather than replaces pre-existing relationships of accountability between governments and citizens, and it complements rather than substitutes for existing government capabilities”.¹⁷⁹ As emphasized by successive United Nations e-government surveys, digital

technologies are being adopted by governments worldwide, despite the nature of their political systems or relationship between their public administration and citizens. Cultural differences and resistance to change by a country’s administrators notwithstanding, optimal results are often obtained when services amenable to improvement through digital technologies are prioritized and where citizens have incentive and means to monitor this improvement.¹⁸⁰ Citizen participation is closely associated with better service efficiency resulting from government adoption of digital technologies.

Arab countries, according to their national priorities and contexts, might consider classifying public services and activities by how amenable to improvement they are through digital technology. And they might further focus on those where people have the motivation and means of measuring this.¹⁸¹ Such a pragmatic approach might lead not only to quick wins, but also help overcome resistance to change and ensure better citizen participation.

Finally, Arab countries should increase efforts to quantitatively and qualitatively improve their open government data. They must grasp its importance for better accountability, and also because the data revolution allows government and non-government actors to leverage data to maximise social impact. Data analytics fed by proper data could help address all the SDGs as highlighted; the United Nations Global Pulse initiative, for instance.¹⁸²

D. Conclusion: business-as-usual trajectories versus Horizon 2030

In a business-as-usual trajectory, affluent Arab countries may improve e-government services

and citizen participation.¹⁸³ Less affluent countries will most likely continue to improve, albeit with more difficulty as technologies become more complex and costly, particularly in terms of expertise, while those trailing in the E-Government Development Index might increase the number and quality of some services but will likely trail in others, mainly due to low citizen participation. It is expected that even if percentages of online services approach 100 per cent in GCC countries, participation levels would be higher than 50-60 per cent; Arab middle-income countries and low-income/LDCs would have similar lower percentages than the horizon scenario.

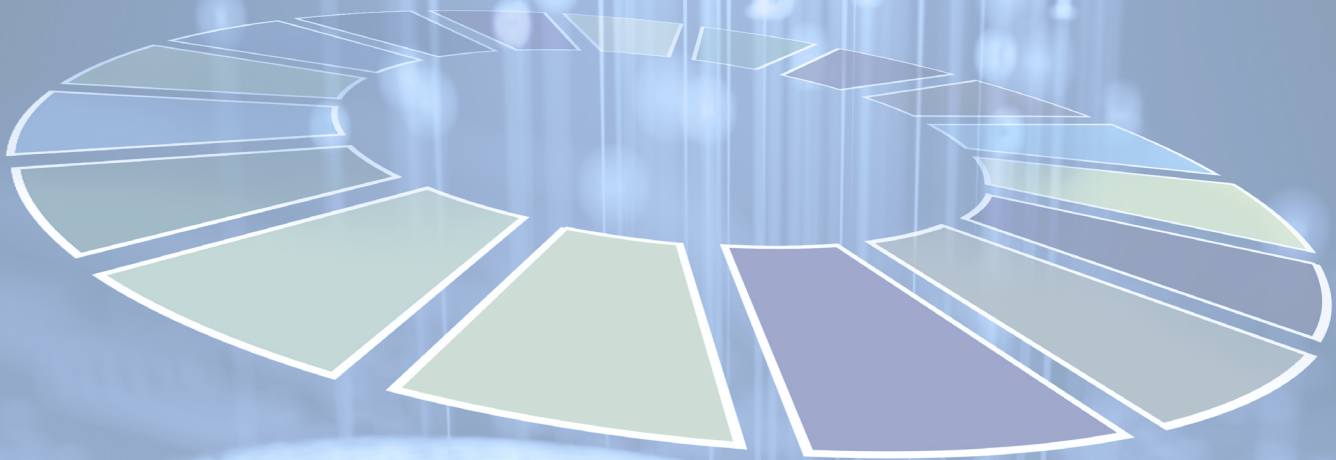
Advances that result from adopting the above recommendations to fulfil Horizon 2030 objectives (beyond those accrued from technical improvement) lie in using the most appropriate technologies at optimized cost and better citizen participation. This approach focuses on development outcomes and better government accountability in addition to improved service delivery. Technology on its own could reinforce and complement but not replace a political reform agenda in the region. Only through such an agenda would a more efficient e-government in the region mean less social control, as some countries might be persuaded to implement a more open, accountable governance approach.

Part III

Shaping the Future



11. Vision 2030 Blueprint



11. Vision 2030 Blueprint

The region is facing tremendous development challenges as highlighted by the first *Arab sustainable development report*. The deteriorating situation over the past 20 years with some development goals is cause for concern. In this context, a new industrial revolution is taking place, as a result of digital technologies and other factors.

Although Arab countries, to varying degrees, have embraced digital technologies, they remain consumers not producers. Equally, despite the development of good to decent ICT infrastructure in many countries, the adoption of social media and online person-to-person communication, and some ICT-sector industrial success stories, digital technologies continue to have restricted impact in the region. On the development dimensions of the economy, service delivery and people empowerment, the digital footprint remains limited.

The reasons for this depend on country situations, but they involve many factors related to the increasing complexity and evolution of digital technologies. Framework conditions indicate that Arab countries need enhanced human capabilities to fully exploit their

potential, appropriate governance and regulation, good underlying economic conditions and investment, and a culture of open dialogue. The weakness of conditions in most Arab countries limits the adoption and use of digital technologies in many sectors.

For each issue, a Horizon 2030 vision is suggested with policy change recommendations that address both technical factors and framework conditions for its implementation, which are interrelated and interdependent. As transpires from the analysis, the use and impact of digital technologies depend on framework conditions, which is true in many applications. Taking education as an example, digital technologies thrive and reinforce good education methods, contributing to better education outcomes, but their use remains limited and will have little impact in a context of inappropriate education methods. The same logic applies to health, government services and many other domains.

Table 19 presents a summary of the Horizon 2030 vision, and a blueprint of policy recommendations for each of the seven policy areas discussed in this study.

Table 19. Summary of Horizon 2030 vision and policy recommendations

Issues	Horizon 2030 vision	Policy recommendations summary
Digital strategies	<p>All Arab countries to adopt holistic digital strategies supporting a national long-term development vision.</p> <p>Strategies contribute to economic growth and well-being through a developed ICT sector and infrastructure, reduced digital divide and pervasive e-applications, with solid impact on poverty reduction, women's empowerment, reduced inequality and more inclusive societies.</p>	<ul style="list-style-type: none"> • Develop digital strategy articulated with a long-term development vision supported at the highest political level; • Implement and follow-up digital strategies through a whole-of-government participatory approach; • Leverage public-private partnerships, with sustainability and effective business models considered in all projects; • Address disruptive effects of digital technologies on employment, power concentration, social control and inequality with proper measures and capacity building; • Consider the gender dimension in all phases of policy-making, strategy planning and implementation, to meet the needs of women and men (and girls and boys) and target equality.
ICT sector	<p>Share of the ICT sector value added expected to reach 4 per cent of GDP in GCC countries, 2-4 per cent in other countries. FDI expected to recover to 6 per cent of global FDI with more equal distribution among countries. Venture capital deals to reach a meaningful 0.1 per cent per billion US\$ GDP in most Arab countries except LDCs. Arab region share in global ICT goods and services trade to reach 10 per cent in services and 2-5 per cent in goods excluding re-exports. Research and development effort to reach 1 per cent of GDP in most Arab countries. Arab digital media market to reach levels 2-3 per cent of global media and entertainment market.</p> <p>Unemployment, particularly among young people, significantly reduced with digital technology jobs</p>	<ul style="list-style-type: none"> • Develop digital strategies that address framework conditions and issues related to employment structures, skills, enabling economic environment and nurturing of innovation to enhance the ICT sector's share in the economy; • Develop national innovation and digital strategies, coordinated and with consistent approaches, under the remit of a high-level authority; • Remove online content restrictions and filtering and support all actors that provide factual and checked information; • Establish a media regulatory authority, media sector liberalization and digital policies addressing in a unified manner the telecom and media sectors; • Support initiatives related to the development of relevant infotainment or edutainment content on media predominantly used by youth;

Issues	Horizon 2030 vision	Policy recommendations summary
	<p>contributing to 30 per cent of this, and digital talent among total workforce increased from 1.7 to 5 per cent. As for economic growth, the digital economy contribution to the region's economy to grow from the present estimated 4.1 to 6 per cent and the region to enhance its digital potential from the estimated 8.4 to 15 per cent. As a proxy for ICT industrialization, the present status of the region is one thirtieth of the ICT patents per million population compared with the United States and expected to reach only one tenth of this value.</p>	<ul style="list-style-type: none"> • Enhance digital job opportunities available for youth both quantitatively and qualitatively; • Governments to introduce incentives for small local companies in the digital sector to merge with other companies and create larger enterprises that can compete with companies from outside the region; • Arab businesses to invest in developing employees' careers by funding further education; and introduce career development programmes and rewards for young employees to meet the needs of digital economy; • Transform employment structure in line with the growing importance of the digital economy; • Governments and major employers to consider the variety of new job families such as the gig economy and crowd work and incorporate them in the strategy vision for 2030; • Governments and major employers in the region to pay attention to lifelong learning and training; • Governments to provide safety nets to support people whose jobs are likely to be affected by emerging technologies, and adapt to the changes of the emerging fourth industrial revolution.
ICT infra-structure	<p>Reach fixed broadband access at developed country averages in GCC countries, and others to be at the midpoint between developed and developing country levels, with next generation access expected to reach 100 per cent in GCC countries, and at least 50-75 per cent in other countries. Generalized uncapped data volumes for fixed broadband access to become the norm, and throughput for both mobile and fixed broadband to reach quality and</p>	<ul style="list-style-type: none"> • Develop full unbundling of legacy copper and innovative bundled service to enhance fixed broadband penetration and pave the way for the next generation access uptake; • Develop backbone at national and regional levels to improve the fluidity of traffic generated by access networks; • Encourage infrastructure-sharing schemes to develop equal-footing entry for newcomers with open and fair access to common infrastructure; • Develop national and regional Internet exchange points and local hosting of

Issues	Horizon 2030 vision	Policy recommendations summary
	pricing equivalent to developed country averages for GCC countries and no less than 70-80 per cent for other countries.	<p>services and data, and ensure non-exclusionary practices that may lead to the emergence of monopolies;</p> <ul style="list-style-type: none"> • Consider the general framework of annex 1 and its recommendations to improve quality and affordability of ICT infrastructure and pave the way for next-generation access deployments and future next generation networks.
Cyber security	All countries to develop well-functioning national computer emergency response teams and establish a solid culture of cybersecurity involving civil society and private sector. National computer emergency response teams to coordinate with Arab peers and others. Effective technical solutions to combat cyberthreats to become pervasive. A legal framework implemented to combat cybercrime and ensure data privacy in all Arab countries.	<ul style="list-style-type: none"> • Develop a cybersecurity strategy that is multi-stakeholder, holistic and extrovert; • Conduct a cost-benefit analysis of cybersecurity incidents with rational justification of needed security investments by public and private stakeholders alike; • Build a national computer emergency response team to become a national centre of excellence in cybersecurity, with advisory role with governments and lawmakers, and support NGOs and civil society working on cybersecurity awareness campaigns; • Arab computer emergency response teams should build an effective regional cooperation network and improve their participation in global forums and networks such as FIRST; • Countries to update their legal arsenal to combat cybercrime, and ratify and make use of the Arab convention on cybercrime and consider joining the international Budapest Convention on Cybercrime; • Develop ad-hoc national initiatives to protect children from harmful content on the net and address youth and teen online addiction and issues related to harassment on social networks; • Remove content filtering and censorship that, beyond being costly, do little more than threaten the usefulness of the Internet as an engine of growth.

Issues	Horizon 2030 vision	Policy recommendations summary
Digital divide	<p>All countries to achieve universal access to the Internet and eradicate the existing gender gap. E-applications with direct socioeconomic impact and online engagement with government and other public services to reach levels not lower than 20 per cent for developed countries in the GCC, 40 per cent in other countries. The cost of a full basket of telecom and Internet access services (including next generation access) to reach 1 per cent of GNI per capita in GCC countries and not higher than 3 per cent in others.</p>	<ul style="list-style-type: none"> • Countries to leverage their fixed telephony infrastructure and improve the Internet access experience via fixed broadband with content-rich multimedia applications, enhanced use for professional and educational purposes, and remote support services (telehealth, for example); • Drive down Internet access costs by addressing infrastructure bottlenecks, as recommended for the ICT infrastructure. Public policy intervention should address market failure situations characterized by insufficient investments resulting in high prices with low quality of service; • Develop public-private partnerships and open access schemes in areas judged unprofitable by private investors. Central and local authorities could lay out passive infrastructure such as dark fibre in new or existing neighbourhoods and lease it to operators on a non-discriminatory basis; • Develop user capabilities and an Internet access culture through the education system and ad-hoc initiatives for the population at large, particularly among women and girls, and disadvantaged groups.
E-applications: E-commerce	<p>Business to consumer e-commerce in the region to reach 2 per cent of global volumes with at least 50 per cent for non-GCC countries in this total. Small and medium-sized enterprises engaging in e-commerce activities are 60 per cent in GCC and 30-60 per cent in other countries. Percentage of Internet shoppers to reach 70 per cent of Internet users in GCC and 30-50 per cent in other countries. E-payment to become universal in GCC countries and to impact at least 50 per cent of the population in other countries.</p>	<ul style="list-style-type: none"> • Leverage UNCTAD's e-trade for all platforms to address shortcomings hindering the development of e-commerce; • National statistics offices to address lack of business to consumer and business to business e-commerce data through their regular statistical surveys; • Develop national or cross-border Arab e-commerce platforms to allow micro, small and medium-sized enterprises to sell products online; • Develop mobile payment leveraging smartphone penetration among Arab populations to encourage online transactions;

Issues	Horizon 2030 vision	Policy recommendations summary
		<ul style="list-style-type: none"> • Encourage the development of national and secure platforms for both commerce and payment at the service of the national economy.
E-applications: E-health	<p>All countries to implement a national e-health strategy at an advanced stage within the GCC and early to medium stage in others. HERs (Electronic Health Records) to be adopted by all GCC and at least by 70 per cent of other Arab countries, with similar percentage of telehealth and m-health programmes established in all countries. E-health applications based on big data analytics and other advanced AI technologies operational in GCC countries and at least in advanced stage of piloting in all other countries.</p>	<ul style="list-style-type: none"> • Develop or update a national e-health strategy involving all health system stakeholders by following the suggested three-step approach of the ITU/WHO toolkit, elaborating a national e-health vision, an action plan and a plan to monitor implementation and manage associated risks; • Develop smart and targeted e-health applications, such as teleradiology or teliagnosis, considering upfront their sustainability and eventual integration within the framework of a national strategy; • Consider with caution e-health projects aimed at showing the best technologies even if affordable, and ensure a cost-benefit analysis is carried out to evaluate any e-health projects.
E-applications: E-education and skills	<p>ICT use to become pervasive at all education levels in all countries. ICT use to impact 50-70 per cent of learning activities in all countries. A large majority (80 per cent-plus) of countries to join international student's assessment programmes for their pupils – such as PISA – and improve results, reaching 80 per cent to parity and above with OECD averages.</p>	<ul style="list-style-type: none"> • Develop school ICT infrastructure and connectivity to the Internet at all stages, particularly for primary and pre-primary levels; • Introduce new teaching methods that develop independent and critical thinking leveraging on smart and effective use of ICT targeted to enhance their efficiency; • Conduct school surveys focusing on ICT equipment and access to the Internet as much as on how ICT is used effectively in the educational process; • Participate to PISA – or any equivalent test – and use results to address issues in the education system and assess if ICT use has led to better education outcomes, and why.

Issues	Horizon 2030 vision	Policy recommendations summary
E-government	All government services to have an online version with averages of 80 per cent adoption in GCC countries by 2030. Targets can be set at 20-30 per cent lower for Arab middle-income countries, 50 per cent in low-income/LDCs. Population satisfaction to reach highs of 90 per cent in GCC and 60-80 per cent in other countries. All countries to adopt open data policies and enhance their global rank in the Open Data Barometer, with no GCC countries below the second quintile, and no middle-income countries below the third quintile.	<ul style="list-style-type: none"> • Countries should evaluate, according to their maturity level, the set of digital technologies and their analog complements to enhance government services and evaluate these technologies in accordance with their needs after consideration of their impact, effort, link with SDGs, and estimated costs within an action priority matrix; • According to their national priorities and contexts, countries might consider classifying their public services and activities by their amenability to improvement through digital technology and focus on those where citizens have both an incentive and means to measure this improvement; • Countries should deploy more efforts aimed at the quantitative and qualitative improvement of their open government data and leverage the data analytics revolution for better social impact; • Countries should ensure that e-government adds a public value and promotes qualitative participation.

With regards to quantitative and statistical linkages between the ICT domain and the SDGs, the 2030 Agenda sets ambitious goals and targets for the 15 years spanning the period 2015-2030, and the United Nations Statistical Commission 244 indicators through a global framework. SDG indicators do not properly reflect the impact of digital technologies. ICT is mentioned explicitly only in three targets, and the Commission defined an ICT-related indicator for each. In addition, three ICT-related indicators were defined for targets with no explicit mention of ICT, two for Goal 4 on education and one for Goal 17. More indicators than these six are required to guide policy-making efforts

aimed at leveraging digital technologies. The best place to define such indicators would be a national digital strategy as well as related complementary sectorial strategies (for e-government, e-health, e-education, and so on) that set target values for each indicator in accordance with a country's specific conditions, priorities and capabilities.

It would be a complex – and ultimately useless – endeavour to elaborate a comprehensive, universally applicable list of indicators for SDGs. Each country should establish indicators, and devote efforts to collect data, based on its own priorities and means.

12. Concluding Remarks



12. Concluding Remarks

All-inclusive recommendations for immediate and essential policy changes pertaining to each area, and the impact on development, can be summarized as follows:

- Develop as soon as possible (and before Horizon 2030) a national digital strategy linked with a long-term development vision. The strategy should be managed at the highest political level and implemented through a whole-of-government approach. It should involve all concerned national stakeholders, leverage public-private partnerships and address the disruptive effects of digital technologies with capacity building and proper regulation that reduce the risk of inequality, power concentration and exclusion. A digital strategy is a prerequisite for creating the proper enabling environment and support for all the issues addressed below;
- Build an ICT sector that includes a significant place for production of ICT goods and services. This will reduce dependency on imports, help integrate Arab countries within global value chains of this key twenty-first century industry, and contribute to economic growth and job creation. Structural factors associated with the global business environment, access to credit and venture capital and proper channelling of FDI to productive sectors should be primarily addressed. Increasing research and development spending and encouraging innovation with digital technologies at its centre is a critical success factor. ICT goods and services exports and leveraging digital media and software industries will increase digital Arabic content and cultural presence and build a national ICT industry;
- Address the central shortcoming of Arab ICT infrastructure, which has one of the lowest rates of fixed broadband access among world regions (higher only than Africa), limited capabilities and high prices. The region should transition from a model based on rapid returns and rent-seeking monopolies (primarily in mobile networks) to one based on long-term investments that build solid networks and develop advanced access infrastructure, such as optical fibre networks. This involves an array of regulatory practices to reduce bottlenecks at all network levels and ensure fair and open competition among service providers. It also involves public investment at national and regional (city or local authorities) levels. Only through this will Arab countries develop a quality infrastructure at affordable prices that allows advanced e-applications for enhanced socioeconomic development;
- Develop a national strategy whose aim is to establish a culture of cybersecurity. National computer emergency response teams are at the centre of this strategy and, beyond their core mission of defending a country against cyberthreats, ensure coordination among national stakeholders, support policy-makers in drafting laws to deal with cybercrime and play a central role in national awareness and capacity building.

Technical and law-enforcement cooperation at Arab regional and international levels are prerequisites for success. Without a proper strategy all potential benefits resulting from digital services and applications in social, commercial and industrial domains can be jeopardized;

- The region accounts for 173 million Internet users (42 per cent of the population), a little above the average of developing countries but still half that of developed countries. Use is dominantly limited to social media and over-the-top communication applications primarily through mobile networks, with little impact on socioeconomic services. The real digital divide between an Internet-affluent minority and a large majority consists of infrastructure issues, in addition to limited human capacity and access to data and relevant e-services. Policy efforts should address these factors in association with quality and affordable connectivity, particularly in underserved areas and new neighbourhoods (deployment of passive infrastructure);
- E-commerce in the region is in its nascent stages, limited to an affluent minority and not measured by official statistics. Arab countries should develop their own national and regional e-commerce platforms to help micro, small and medium-sized enterprises sell their products online by contributing to their formalization. This, alongside developing adequate and secure mobile payment solutions, could transform e-commerce from a rich, affluent gadget into a tool for economic transformation of the largely informal, underdeveloped private sector;
- Arab countries should involve health-system stakeholders in developing their national e-health strategies. These should

primarily focus on improving health outcomes with modern ICT, avoid overspending on technology and leverage smart telehealth applications to offer decent health services, particularly to displaced people and those suffering from conflict situations. Countries should improve e-health service monitoring (as a by-product of an effective strategy) and their responsiveness to global surveys, such as that by WHO;

- Limited statistical evidence from a handful of countries shows that ICT use in education suffers from limited investments, and, even among affluent countries, does not have significant impact on education methods. In many Arab countries, improving school ICT equipment (computers and broadband Internet connectivity) is a priority. All countries, however, should focus on introducing ICT use in education in association with a reform of their education methods, and address its impact on education outcomes through better monitoring and enhanced participation of students in international assessment programmes such as PISA;
- Many countries, particularly among the affluent GCC, have made strides in improving e-government services and occupy high positions in global surveys. Yet, citizens' use of these services is largely unknown. This is not only a statistical shortcoming but points to spending – again, GCC countries are particularly guilty – on advanced technologies without considering real needs and priorities. A new approach is needed that involves better evaluation of people's needs and service use, and leverages new ICT technologies associated with open government data, which are notoriously weak in the region, to enhance their participation. Beyond offering better

services at lower cost, e-government should become a tool for enhancing citizen participation in public decision-making at national and local levels and improving civil servants' effectiveness and accountability.

Many challenges lie ahead for Arab countries even if the suggested policy change recommendations are adopted. The suggested Horizon 2030 vision would likely lead to better outcomes than the business-as-usual ones. But digital technologies also entail risks, and this study cannot stress enough that the surrounding framework conditions might lead to adverse effects, such as monopolies, deepened inequalities and control by elites.

Certainly, Arab countries could and should use digital technologies to address development challenges. Their agenda should, however, focus on addressing weak framework conditions and less (for those who can afford it) on buying the best technologies and attracting talent from abroad. The experience of emerging countries that rose as global digital economy

powerhouses proves as much. Although import of advanced technologies through trade and foreign investment plays a key role, ultimately it is hard work and endogenous factors that will lead to success.

Approaches to implementing policies are as important as substance. Within each country, inclusive approaches involving all stakeholders are absolute prerequisites for effective outcomes. The importance of coordinated whole-of-government action cannot be emphasized enough. At regional level, coordination and cooperation among countries, through the Arab Internet Governance Forum and the regional road map on Internet governance and, hopefully, an Arab digital strategy, acquire heightened importance in a globalized world where even developed regions feel the need to act together. The Arab region with its 400 million inhabitants, a huge human dividend with many educated youth, natural resources and privileged geographical position, has a good chance of becoming a digital economy powerhouse, provided its assets are leveraged in the integrated manner suggested.

Annexes



Annex 1

A Policy Framework for the Supply of Internet Services

	The first mile (the point at which Internet enters a country)	The middle mile (the national, intercity Internet backbone of a country)	The last mile (connection between users and nearest Internet point of presence)	The invisible mile (other, less visible network components and potential bottlenecks)
Network components	International Internet access, including submarine cable landing stations, satellite dishes, domain name registration	National backbone and intercity network, including fibre backbone, microwave, Internet exchange points, local hosting of content	Local access network, including local loop, central office exchanges, wireless masts	Non-visible network components, including spectrum, border crossings, databases, SIM cards, cybersecurity
Market competition	<ul style="list-style-type: none"> • Authorization of satellite dishes; • Designation of domain name registry and registrars; • Licensing of competing international service providers and orbital slots; • Authorization for landing stations, and access (co-location) to international gateway facilities. 	<ul style="list-style-type: none"> • Licensing/authorization of nationwide facilities-based operators and service providers; • Interconnection arrangements; • Infrastructure sharing arrangements; • Cross-sectoral participation (cable TV and alternative infrastructures); • Licensing mobile virtual network operators. 	<ul style="list-style-type: none"> • Licensing/authorization of local facilities-based operators and service providers; • Authorization of mobile virtual network operators; • Authorization of value added network service providers, including for mobile money; • Unbundling the local loop. 	<ul style="list-style-type: none"> • Market mechanisms (auctions and resale) for spectrum assignments, especially for 3G and 4G bands; • Arrangements for access to essential network facilities, including national numbers, address database.

	The first mile (the point at which Internet enters a country)	The middle mile (the national, intercity Internet backbone of a country)	The last mile (connection between users and nearest Internet point of presence)	The invisible mile (other, less visible network components and potential bottlenecks)
Public-private partnership	<ul style="list-style-type: none"> • Privatization/liberalization of international gateway; • Development of government data centres; • Participation in international cable and satellite consortiums; • Regulation of legal intercept. 	<ul style="list-style-type: none"> • Privatization of the incumbent operator; • Industry consultation on a network master plan; • Establishment of national and local Internet exchange points; • Local hosting of content, including government data centre. 	<ul style="list-style-type: none"> • Dominantly private operation and ownership, with Public-private partnership approach where market fails (as in rural areas); • Stakeholder consultation on national broadband plan; • Universal service obligations (as for emergency services and accessibility for disabled). 	<ul style="list-style-type: none"> • Negotiation of transit and access to virtual landing stations (for landlocked countries); • Computer security incident response teams at national and institutional levels; • Open access to short code numbers, as for SMS.
Effective regulation	<ul style="list-style-type: none"> • Open access to international facilities; • Open to foreign ownership and investment; • Avoiding excessive import and excise taxes; • National representation at relevant national and regional bodies, such as ITU, ICANN and WTO. 	<ul style="list-style-type: none"> • Coordinating right of way for linear infrastructures; • Safeguards on significant market power; • Open access rules for national backbone; • Promotion of local content and hosting. 	<ul style="list-style-type: none"> • Open access rules for local loop and central office exchanges; • Coordination of planning permission for public works among operators and utilities, and authorization for construction of wireless masts; • E-waste recycling guidelines. 	<ul style="list-style-type: none"> • Spectrum management, including arrangements for allocation of bands and reframing; • SIM card registration arrangements; • Data protection and privacy guidelines.

Source: World Bank, 2016.

Annex 2

The Partnership Core List of Indicators (March 2016)

ICT infrastructure and access	
A1	Fixed telephone subscriptions per 100 inhabitants
A2	Mobile cellular telephone subscriptions per 100 inhabitants
A3	Fixed broadband Internet subscriptions per 100 inhabitants, broken down by speed
A4	Active mobile broadband subscriptions per 100 inhabitants
A5	International Internet bandwidth per inhabitant (bits/second/inhabitant)
A6	Percentage of the population covered by at least a 3G mobile network
A7	Fixed broadband Internet prices per month
A8	Mobile cellular telephone prepaid prices per month
A9	Mobile broadband Internet prices per month
A10	TV broadcasting subscriptions per 100 inhabitants
ICT access and use by households and individuals	
HH1	Proportion of households with a radio
HH2	Proportion of households with a TV
HH3	Proportion of households with telephone
HH4	Proportion of households with a computer
HH5	Proportion of individuals using a computer
HH6	Proportion of households with Internet
HH7	Proportion of individuals using the Internet
HH8	Proportion of individuals using the Internet, by location
HH9	Proportion of individuals using the Internet, by type of activity
HH10	Proportion of individuals using a mobile cellular telephone
HH11	Proportion of households with Internet, by type of service
HH12	Proportion of individuals using the Internet, by frequency
HH13	Proportion of households with multichannel television, by type
HH14	Barriers to household Internet access
HH15	Individuals with ICT skills, by type of skill
HH16	Household expenditure on ICT

ICT access and use by households and individuals (continued)	
HH17	Proportion of individuals using the Internet, by type of portable device and network used to access the Internet
HH18	Proportion of individuals who own a mobile phone
HH19	Proportion of individuals not using the Internet, by type of reason
ICT access and use by enterprises	
B1	Proportion of businesses using computers
B2	Proportion of persons employed routinely using computers
B3	Proportion of businesses using the Internet
B4	Proportion of persons employed routinely using the Internet
B5	Proportion of businesses with a web presence
B6	Proportion of businesses with an intranet
B7	Proportion of businesses receiving orders over the Internet
B8	Proportion of businesses placing orders over the Internet
B9	Proportion of businesses using the Internet by type of access
B10	Proportion of businesses with a local area network
B11	Proportion of businesses with an extranet
B12	Proportion of businesses using the Internet by type of activity
ICT sector and trade in ICT goods	
ICT1	Proportion of total business sector workforce involved in the ICT sector
ICT2	ICT sector share of gross value added
ICT3	ICT goods imports as a percentage of total imports
ICT4	ICT goods exports as a percentage of total export
ICT in education	
ED1	Proportion of schools with a radio used for educational purposes
ED2	Proportion of schools with a television used for educational purposes
ED3	Proportion of schools with a telephone communication facility
ED4	Learners-to-computer ratio in schools with computer-assisted instruction
ED5	Proportion of schools with Internet access by type of access
ED6	Proportion of learners who have access to the Internet at school
ED7	Proportion of learners enrolled at the post-secondary level in ICT-related fields
ED8	Proportion of ICT-qualified teachers in schools
EDR1	Proportion of schools with electricity
ICT in government	
EG1	Proportion of persons employed in central government organizations routinely using computers
EG2	Proportion of persons employed in central government organizations routinely using the Internet
EG3	Proportion of central government organizations with a local area network
EG4	Proportion of central government organizations with an intranet
EG5	Proportion of central government organizations with Internet access, by type of access
EG6	Proportion of central government organizations with a web presence
EG7	Selected Internet-based online services available to citizens, by level of service sophistication

Source: Partnership on Measuring ICT for Development, 2016.

Annex 3

Digital Technology Indicators for SDGs

ICT infrastructure

- The partnership's indicators A1 to A6 on ICT infrastructure reflect administrative data (not needing statistical surveys by national statistics offices) collected by the International Telecommunication Union from its membership (telecom ministries or regulators) and pose no particular challenge for Arab countries;
- Next generation access data are not part of indicator A3 on fixed broadband, which addresses speed but not type of access (though the former could be indicative of the latter). Arab countries should be advised to collect data about next generation access and their breakdown per technology;
- Internet exchange points data are not hard to come by and is available (one or two maximum if none in most Arab countries) but should be closely monitored, with targets for improvement, as it affects Internet access costs. Equally, an intra-Arab Internet exchange point should be developed and monitored;
- International Internet connectivity (A5) needs close monitoring in most Arab countries for improvement as its value is often low and affects Internet cost;
- Data on Internet hosting on local servers (for example, as a percentage of local websites) need to be collected (from hosting services providers and/or national surveys of firms) and monitored (with set targets) as it too affects Internet access cost;
- National broadband backbone presence also affects Internet service quality (speed) and cost and needs close monitoring with targets on capacity and capillarity over the national territory.

ICT sector

- The partnership's indicators ICT1 and ICT2 on ICT sector jobs and share in national value added are not available from any Arab country. National statistics offices should collect this key information through detailed and regular surveys of firms (e-business, below);
- Indicators ICT3 and ICT4 on ICT goods imports and exports are available for Arab countries but key data on re-exports and percentage of local added value are missing;
- Data on ICT services exports are available for most Arab countries but not always a detailed breakdown (IT/telecom components). Many Arab countries for which data are known have a more predominant telecom services component than IT services but the latter has more impact on high value added and qualified jobs. Disaggregation and monitoring of this data are needed.

ICT sector enabling factors

- Foreign direct investment (inflows and stock) data are available for all Arab countries but its breakdown into sectors is often missing, or at least not public. Monitoring flows, and which sectors they are destined for, particularly those involving technology transfer such as ICT, is essential;
- Detailed indicators from the Doing Business Index's access to credit pillar should be closely monitored by Arab countries as they often point to major shortcomings. If data are missing, it should also be collected;
- Data on venture capital volumes, when they exist, are often sourced from international agencies (for example, Thomson Reuters). Data collection and monitoring of venture capital from national sources, particularly if it addresses nascent national initiatives, measuring the impact on the productive sector in general and ICT start-ups development is essential;
- Global Expenditures on research and development (GERD) as a percentage of GDP is not known in a significant number of Arab countries. When available, this data indicate low percentage and concentration in universities and public research, and not in the productive sector. GERD data disaggregated between public and private sector and by economic sector, including ICT, should be collected and monitored for overall improvement in value and a shift towards the productive sector.

ICT sector creativity

- Data on patents in general, and ICT patents, indicate negligible levels in most Arab countries, and dominance of patenting by non-residents in particular. This data should be monitored for improvement both in value (per billion US\$ of GDP output) and percentage of resident patterns;
- Indicators addressing online creativity related to country-code top-level domain and country-code top-level domain registrations, Wikipedia edits and YouTube uploads are certainly useful, but measuring the number of Arab or national digital platforms and cumulated size of their users/followers, related to population size and to their share with respect to global platforms, is an essential data area to monitor;
- Media plays an essential role in the development of Arabic online content. Countries might monitor the number of media with digital presence (as a percentage of the total), and among them those who manage to monetize access to their content in a sustainable manner. This is primarily for the sake of measuring, and addressing issues, if a sustainable online content creation model is emerging, whether at national or regional level.

Universal access to ICTs

- The partnership's indicators A7 to A9 on pricing of ICT services are known for Arab countries; however, detailed pricing of next generation access in many Arab countries should be monitored to lower its value; also, pricing of bundled access to more than one telecom service should be monitored as they are often associated with lower prices for consumers;
- Monitoring competition in fixed access (number of players) is essential for many Arab countries to drive up low levels of fixed broadband in association of lowering prices;
- A number of the 19 HH indicators have data for Arab countries, but most have not – even for the national percentage of Internet users often estimated by the International Telecommunication Union for many countries. Of particular importance for the SDGs is HH7 and HH15 on detailed types of activities and skills by individuals using the Internet, and HH18 on individuals who own a mobile phone. In general, these should be included by national statistics offices in regular population surveys and/or dedicated surveys on a population's ICT use.

E-business and e-commerce

- The partnership's indicators B1 to B12 on ICT use by business are only partially available and often with outdated data, which suggests an absence of regular business surveys by national statistics offices or no inclusion of the ICT component. Indicator B12 on firm's activities on the Internet is particularly important. Countries should collect this data disaggregated by a firm's size and closely monitor them, particularly for small and medium-sized enterprises;
- In official statistics from all Arab countries, business to consumer and business to business e-commerce are basically unknown, which again points to a lack of regular business surveys by national statistics offices. They should be included in surveys in addition to the B indicators above (B7 and B8 on placing and receiving orders on the Internet do not address quantitative issues);
- Mobile payment is an emerging mode facilitating financial inclusion and contributing to the formalization of the informal sector. In association with policy measures that encourage the emergence of national platforms offering mobile payment solutions, monitoring the value of transactions carried through mobile payment is a key indicator of sustainable and inclusive growth.

E-government

- Systematic national evaluation campaigns of e-government services are absent in almost all Arab countries. Saudi Arabia is a notable exception and an example to follow. The only sources of knowledge on e-government are the United Nations E-Government Survey with its development and participation indexes, and some World Economic Forum opinion survey indicators. Arab countries also show low scores in the Open Data Barometer;
- The partnership's indicators EG1 to EG7 and their associated model survey offer a useful measurement framework that might be adopted by countries as a basis for a national assessment of e-government services;
- Countries should, however, carry out comprehensive surveys addressing the three key issues of service quality, which are partially covered under indicator EG7: volume and sophistication of open public data, and citizen participation to online public services;
- On open data and participation, the e-government surveys offer useful hints on issues to address, though by no means offer a comprehensive framework or a model questionnaire. The Open Data Barometer, particularly under its implementation pillar, offers useful hints on addressing better monitoring and improvement.

E-health

- The WHO e-health survey highlights key issues where data should be collected in a systematic and quantitative way by Arab countries irrespective of any international survey; many of the survey questions were left unanswered by some countries, not to mention those who did not participate;
- Detailed national e-health survey questionnaires should be established within the framework of a national e-health strategy, in accordance with its priorities and targets;
- Countries who have not elaborated a national e-health strategy could contemplate using the WHO survey as a first step to collecting data, in addition to some basic infrastructure, such as health centres with computers and/or connected to Internet for health provision purposes, and skills issues, and health personnel qualified to use ICT). This would be pending strategy establishment of a more detailed measurement framework.

E-education and skills

- The partnership's ED indicators, particularly ED4 to ED8, represent the bare minimum to assess ICT in education. UNESCO's Institute of Statistics database introduces more elaborate indicators, but few data from Arab countries were found;
- Analysis of five Arab countries' data from 2011 indicates major shortcomings in the region despite anecdotal evidence of a better situation in GCC and some other countries, at least with regard to schools equipped with computers – eventually connected to the Internet – for educational purposes;
- Beyond ensuring that data on basic issues are available, the problem for Arab countries lies in missing data on detailed use patterns of ICT in education and attitudes of teachers and students. Countries might use the European Union school survey, among others, as a model to define their own national ICT in education surveys and guide policy-making in this domain;
- Irrespective of ICT use in education, though it would assist in a more rigorous evaluation of its impact, participation of pupils in international tests like OECD's PISA or TIMSS (trends in international mathematics and science study) is important. Few Arab countries take part, and their scores are well below average. Countries should participate in these tests to gain data on student performance, consequently determining what needs to be addressed in their education system.

Source: Author.

Annex 4

The WSIS-SDG Matrix

The matrix shows the relevant WSIS action lines for each of the SDGs, with linkages indicated through the purple colour-filled cells.

	C1	C2	C3	C4	C5	C6	C7 e-government	C7 e-business	C7 e-learning	C7 e-health	C7 e-employment	C7 e-environment	C7 e-agriculture	C7 e-science	C8	C9	C10	C11
SDG 1																		
SDG 2																		
SDG 3																		
SDG 4																		
SDG 5																		
SDG 6																		
SDG 7																		
SDG 8																		
SDG 9																		
SDG 10																		
SDG 11																		
SDG 12																		
SDG 13																		
SDG 14																		
SDG 15																		
SDG 16																		
SDG 17																		

Source: WSIS Forum, 2015.

References

- Brynjolfsson, Erik, and Andrew McAfee (2014). *The second machine age: work, progress and prosperity in a time of brilliant technologies*. New York: W.W. Norton and Company.
- Communications and Information Technology Commission (2015). *ICT investments in the Kingdom of Saudi Arabia*. Riyadh. Available at http://www.citc.gov.sa/en/reportsandstudies/Reports/Documents/ICTInvestments_EN.pdf.
- Deloitte (2017). *Technology, media and telecommunications predictions: Middle East edition*. London. Available at <https://www2.deloitte.com/content/dam/Deloitte/xs/Documents/technology-media-telecommunications/predictions2017/ME-Predictions-2017-5G-in-the-Middle-East.pdf>.
- Dubai Media City and Dubai Press Club (2015). *Arab media outlook 2016–2018. Youth. Content. Digital media. 5th edition*. Dubai. Available at <http://www.dpc.ae/uploads/AMO-eng.pdf>.
- The Earth Institute and Ericsson (2016). *ICT and SDGs: final report – how information and communications technology can accelerate action on the Sustainable Development Goals*. Available at <https://www.ericsson.com/assets/local/news/2016/05/ict-sdg.pdf>.
- Economic Commission for Latin America and Caribbean (2015). *Digital Agenda for Latin America and the Caribbean (eLAC2018)*. Presented at the Fifth Ministerial Conference on the Information Society in Latin America and the Caribbean. Mexico City, 5-7 August. Available at http://repositorio.cepal.org/bitstream/handle/11362/38887/1/S1500757_en.pdf.
- Economic and Social Commission for Western Asia (2014a). *The Broken Cycle: Universities, Research and Society in the Arab region. Proposals for Change*. Available at https://www.unescwa.org/sites/www.unescwa.org/files/page_attachments/broken_cycle_study_-_english_version.pdf.
- _____ (2014b). *Arab middle class: measurement and role in driving change*. Beirut. Available at <https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/arab-middle-class-measurement-role-change-english.pdf>.
- _____ (2015). *Regional profile of the information society in the Arab region 2003–2015*. Beirut. Available at https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/profile-information-society-arab-region-2015-english_0.pdf.
- _____ (2016). *Arab development outlook: Vision 2030*. Beirut. Available at https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/arab-development-outlook-vision-2030-english_0.pdf.
- _____ (2017a). *Innovation policy for inclusive sustainable development in the Arab region*. Available at https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/innovation-policy-inclusive-sustainable-development-arab-region-english_0.pdf.
- _____ (2017b). *Next Generation Digital Infrastructure: Challenges and Opportunities for the Development in the Arab region. Technical Paper 3*. Beirut. Available at <https://www.unescwa.org/sites/www.unescwa.org/files/events/files/next-generation-digital-infrastructure-arab-region-technical-en.pdf>.
- _____ (2017c). *Smart Digital Transformation in Government. Consultancy Report prepared for United Nations ESCWA*. Beirut. Available at https://www.unescwa.org/sites/www.unescwa.org/files/page_attachments/smart-digital-transformation-government-en_1.pdf.

- _____ (2017d). *Perspectives of Digital Economy in the Arab Region*. Available at <https://www.unescwa.org/publications/perspectives-digital-economy-arab-region>.
- _____ (2017e). Information and Communication Technology for Development Issues. Reports presented at the Committee on Technology for Development, first session. Dubai, February. Available at https://www.unescwa.org/sites/www.unescwa.org/files/events/files/information_and_communications_technology_for_development_issues_international_and_regional_processes.pdf; https://www.unescwa.org/sites/www.unescwa.org/files/events/files/lqtsd_lrqmy_wlthwl_nhw_lmjtmt_ldhky_fy_lmntq_lrby.pdf.
- _____ (2017f). *Arab multidimensional poverty report*. Beirut. Available at https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/multidimensional-arab-poverty-report-english_0.pdf.
- _____ (2017g). *The state of gender justice in the Arab region*. Beirut. Available at <https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/state-gender-justice-arab-region-english.pdf>.
- _____ (2017h). *Status of Arab women report 2017: violence against women – what is at stake?* Beirut. Available at <https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/arab-women-report-violence-against-women-english.pdf>.
- Economic and Social Commission for Western Asia and the League of Arab States (2010). Arab Regional Roadmap for Internet Governance: Framework, Principles and Objectives. Technical paper. 5. New York. Available at <https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/ictd-10-tp-5.pdf>.
- _____ (2014). Disability in the Arab region: an overview. Technical Paper 1. Available at https://www.unescwa.org/sites/www.unescwa.org/files/page_attachments/disability_in_the_arab_region-_an_overview_-_en_1.pdf.
- Economic and Social Commission for Western Asia and United Nations Environment Programme (2015). *Arab sustainable development report: first edition, 2015*. Beirut. Available at <https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/arab-sustainable-development-report-1st.pdf>.
- European Commission (2010). A Digital Agenda for Europe. Communication to the European Parliament, Council, European Economic and Social Committee and Committee of the Regions. Brussels, May. Available at <https://ccdc0e.org/sites/default/files/documents/EU-100519-DigitalAgenda.pdf>.
- _____ (2013). *Survey of schools: ICT in education – benchmarking access, use and attitudes to technology in Europe’s schools. Final report*. Luxembourg. Available at <http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/KK-31-13-401-EN-N.pdf>.
- _____ (2017). Europe’s Digital Progress Report 2017. Commission Staff Working Document. Brussels. Available at http://ec.europa.eu/newsroom/document.cfm?doc_id=45188.
- International Labour Organization (ILO). (2017). *World employment social outlook: Trends 2017*. Geneva. Available at http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_541211.pdf.
- INSEAD (2017). *The Global Innovation Index 2017: innovation feeding the world*. Available at <https://www.globalinnovationindex.org/gii-2017-report>.
- International Telecommunication Union (2007). *Trends in telecommunication reform 2007: the road to next-generation networks (NGN)*. Geneva. Available at <http://www.itu.int/pub/D-PREF-TTR.9-2007>.
- _____ (2014). *Manual for measuring ICT access and use by households and individuals, 2014 edition*. Geneva. Available at https://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-ITCMEAS-2014-PDF-E.pdf.
- _____ (2016). *Measuring the Information Society Report 2016*. Geneva. Available at <https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2016/MISR2016-w4.pdf>.

- Salem, Fadi (2017a). *The Arab World Online 2017: Digital Transformations and Societal Trends in the Age of the 4th Industrial Revolution*, vol. 3. Dubai: Mohammed Bin Rashid School of Government. Available at <http://www.mbrsg.ae/HOME/PUBLICATIONS/Research-Report-Research-Paper-White-Paper/The-Arab-World-Online-2017.aspx>.
- _____ (2017b). *The Arab Social Media Report 2017: Social Media and the Internet of Things – Towards Data-driven Policymaking in the Arab World*, vol. 7. Dubai: Mohammed Bin Rashid School of Government. Available at <http://www.mbrsg.ae/HOME/PUBLICATIONS/Research-Report-Research-Paper-White-Paper/Arab-Social-Media-Report-2017.aspx>.
- Elmasry, Tarek, and others (2016). *Digital Middle East: Transforming the Region into a Digital economy*. McKinsey Global Institute. Available at <http://www.mckinsey.com/~media/mckinsey/global%20themes/middle%20east%20and%20africa/digital%20middle%20east%20transforming%20the%20region%20into%20a%20leading%20digital%20economy/digital-middle-east-final-updated.ashx>.
- McKinsey Global Institute (2017). *China's Digital Economy: A Leading Global Force*. Discussion Paper. Available at <http://www.mckinsey.com/~media/McKinsey/Global%20Themes/China/Chinas%20digital%20economy%20A%20leading%20global%20force/MGI-Chinas-digital-economy-A-leading-global-force.ashx>.
- NETmundial (2014). *Multistakeholder Statement*. Presented at the NETmundial conference. São Paulo, April. Available at <http://netmundial.br/wp-content/uploads/2014/04/NETmundial-Multistakeholder-Document.pdf>.
- Organisation for Economic Co-operation and Development (2010). *Improving health sector efficiency: the role of information and communication technologies*. OECD Health Policy Studies. Paris. Available at http://www.oecd-ilibrary.org/social-issues-migration-health/improving-health-sector-efficiency_9789264084612-en.
- _____ (2011). *OECD Guide to Measuring the Information Society 2011*. Available at <http://www.oecd.org/sti/ieconomy/oecdguidetomeasuringtheinformationsociety2011.htm>.
- _____ (2014). *Recent FDI trends in the MENA region*. Draft background note presented to the LAS-OECD Regional Conference and MENA-OECD Regional Investment Working Group. Cairo, December. Available at https://www.oecd.org/mena/competitiveness/Draft%20Note_FDI%20trends%20in%20MENA_Dec.%202014.pdf.
- _____ (2015a). *OECD digital economy outlook 2015*. Paris. Available at <http://dx.doi.org/10.1787/9789264232440-en>.
- _____ (2015b). *Students, computers and learning: making the connection – Programme for International Student Assessment*. Available at <http://dx.doi.org/10.1789/9789264239555-en>.
- _____ (2016). *PISA 2015 results (volume I): excellence and equity in education – Programme for International Student Assessment*. Paris. Available at <http://dx.doi.org/10.1787/9789264266490-en>.
- _____ (2017). *OECD Digital Economy Outlook 2017*. Paris. Available at <http://dx.doi.org/10.1787/10.1787/9789264276284-en>.
- Partnership on Measuring ICT for Development (2016). *Core List of Indicators: March 2016 version*. Available at http://www.itu.int/en/ITU-D/Statistics/Documents/coreindicators/Core-List-of-Indicators_March2016.pdf.
- United Nations (2015a). *Addis Ababa Action Agenda*. Final text of the outcome document adopted at the Third International Conference on Financing for Development and endorsed by the General Assembly in its resolution 69/313 of 27 July 2015. New York. Available at http://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf.
- United Nations (2015b). *General Assembly Resolution A/RES/70/1*. Available at http://www.un.org/ga/search/viewm_doc.asp?symbol=A/RES/70/1.
- United Nations (2015c). *General Assembly Resolution A/RES/70/125*. Available at http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/70/125.

- United Nations, (2016a). *United Nations e-government survey 2016: e-government in support of sustainable development*. Department of Economic and Social Affairs. New York. Available at <https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2016>.
- United Nations (2016b). *Global sustainable development report, 2016 Edition*. Department of Economic and Social Affairs. New York. Available at <https://sustainabledevelopment.un.org/globalsdreport>.
- United Nations Conference on Trade and Development (1994). *Trade and development report, 1994*. Geneva. Available at http://unctad.org/en/PublicationsLibrary/tdr14_en.pdf.
- _____ (2016). UNCTAD B2C E-Commerce Index 2016. UNCTAD Technical Notes on ICT for Development, No. 7. Available at http://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d07_en.pdf.
- United Nations, Economic and Social Council (2017). Report of the Secretary-General on progress made in the implementation of and follow-up to the outcomes of the World Summit on the Information Society at the regional and international levels. Prepared by the United Nations Conference on Trade and Development (UNCTAD) secretariat. Available at http://www.unctad.org/en/PublicationsLibrary/a72d64_en.pdf.
- UNESCO Institute for Statistics (2013). Information and communication technology (ICT) in Education in five Arab States. Information paper. Montreal. Available at http://uis.unesco.org/sites/default/files/documents/information-and-communication-technology-ict-in-education-in-five-arab-states-a-comparative-analysis-of-ict-integration-and-e-readiness-in-schools-en_0.pdf.
- United Nations Statistical Commission (2017). *Report on the forty-eighth session (7-10 March 2017)*. New York. Available at <https://unstats.un.org/unsd/statcom/48th-session/documents/Report-on-the-48th-session-of-the-statistical-commission-E.pdf>.
- United Arab Emirates, Ministry of Economy (2015). *Annual Statistical Report 2014*. Abdu Dhabi. Available at <http://www.economy.gov.ae/StatisticsReportsEn/Statistical%20Report%202014%20-%204th%20Issue.pdf>.
- World Bank (2016). *World development report 2016: digital dividends*. Washington, D.C. Available at <http://www.worldbank.org/en/publication/wdr2016>.
- _____ (2017a). *Doing Business 2017: equal opportunity for all*. Washington, D.C. Available at <http://www.doingbusiness.org/reports/global-reports/doing-business-2017>.
- _____ (2017b). *The little data book on information and communication technology 2017*. Washington, D.C. Available at <https://openknowledge.worldbank.org/bitstream/handle/10986/25737/9781464810282.pdf>.
- World Economic Forum (2016). *The global information technology report 2016: innovating in the digital economy*. Geneva. Available at http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf.
- World Health Organization (2016). *Global diffusion of eHealth: making universal health coverage achievable – report of the third global survey on eHealth*. Geneva. Available at <http://apps.who.int/iris/bitstream/10665/252529/1/9789241511780-eng.pdf?ua=1>.
- World Health Organization and International Telecommunication Union (2012). *National eHealth strategy toolkit*. Geneva. Available at https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-E_HEALTH.05-2012-PDF-E.pdf.
- World Summit on the Information Society (2005). Tunis Agenda for the Information Society. Outcome of the second phase of WSIS. Tunis, November. Available at <http://www.itu.int/net/wsis/docs2/tunis/off/6rev1.html>.
- _____ (2014). *WSIS+10 outcome documents*. Statement on the implementation of WSIS outcomes. Geneva. Available at <http://www.itu.int/net/wsis/implementation/2014/forum/inc/doc/outcome/362828V2E.pdf>.
- _____ (2015). *WSIS-SDG matrix: linking WSIS action lines with Sustainable Development Goals*. Available at https://www.itu.int/net4/wsis/sdg/Content/Documents/wsis-sdg_matrix_document.pdf.

Endnotes

Chapter 1

1. United Nations, 2015b.
2. Agenda 21. See <https://sustainabledevelopment.un.org/outcomedocuments/agenda21>.
3. United Nations, 2015a.
4. United Nations, 2015c.
5. WSIS Forum, 2014. This document sets general priority areas for the post-2015 period and further enhances each of the 11 WSIS Action Lines defined by the Geneva Plan of Action.

Chapter 2

6. United Nations, 2016b. This discussion primarily refers to chapter 3 of this report.
7. Ibid., pp. 43-44.
8. Ibid., p. 52.
9. World Bank, 2016.
10. World Bank, 2016.
11. Ibid., p. 5.
12. WSIS Forum, 2015.
13. UN, Economic and Social Council, 2017.

Chapter 3

14. ESCWA and UNEP, 2015.
15. ESCWA, 2015 for ICT infrastructure; ESCWA, 2017a for science, technology and innovation.

Part II

16. OECD, 2017.
17. WSIS Forum, 2015.

Chapter 4

18. WSIS Forum, 2015, pp. 7-8.
19. ESCWA, 2015, Table 1.1, pp. 18-19. Arab update will be provided in upcoming ESCWA study on Arab Digital Development Report (work in progress, 2019).
20. Some Arab countries have already elaborated such national visions (e.g. United Arab Emirates Vision 2021, Saudi Arabia Vision 2030 or Egypt Vision 2030).
21. The EU, for instance, set an example in 2010 when it coordinated its digital agenda for Europe with its broader Europe 2020 Vision.
22. European Commission, 2010.
23. United Nations, 2015b.

Chapter 5

24. WSIS Forum, 2015, p. 55.
25. CITC, 2015.
26. OECD, 2015a.
27. UNCTAD, 1994, pp. 49-75.
28. FDI inflows with a negative sign indicate that at least one of the three components of FDI (equity capital, reinvested earnings or intra-company loans) is negative and not offset by positive amounts of the remaining components. These are instances of reverse investment or disinvestment. See http://unctad.org/en/Pages/DIAE/Investment%20and%20Enterprise/FDI_Flows.aspx.
29. The average for 2005-2010 stood at 4.28 per cent of GDP and for 2011-2016 at only 1.60 per cent of GDP. Author's calculations on the basis of World Bank data. <http://data.worldbank.org> (accessed on November 2017).
30. OECD, 2014.
31. In the number of venture capital deals per billion US\$ of GDP, only Lebanon (0.08), the United Arab Emirates and Tunisia (0.05) have relatively sizeable values (data for year 2016) still way beyond leading countries. Other Arab countries have meaningless values and even no data at all. See INSEAD, 2017, p. 354.
32. Business climate, gauged by the Doing Business Index, shows that emerging countries such as Malaysia and Turkey outperform all other Arab countries except for the United Arab Emirates; similarly, for the getting credit component from the same index, its value is much higher in Malaysia (80 per cent) and Turkey (65 per cent) than all Arab countries. As for venture capital, although the phenomenon is mostly concentrated in developed countries, it is notable that China, due to the size of its economy, even with 0.06 deals per billion US\$ GDP, has quite a high number of nearly 700 deals. As for foreign direct investment inflows, Malaysia stood at 4.56 per cent of its GDP in 2016 with an average of 3.62 per cent during the 2006-2016 period; China and Turkey, even if they witnessed a fall in 2016, have averages of respectively 3.18 per cent and 1.97 per cent over the past 10 years, with China attracting \$170.5 billion in 2016 and Turkey \$12.3 billion (about a third of all Arab countries combined).
33. United Arab Emirates, 2015, p. 62.
34. Data are for year 2013 but it is a good approximation to evaluate orders of magnitude; see OECD, 2015a.
35. Authors' calculation from OECD, 2017, and World Bank GDP data.
36. <http://stat.wto.org/StatisticalProgram/WSDBViewData.aspx?Language=E>.
37. And a massive \$4.5 billion average in the 2014-2016 period, dwarfing all other Arab countries combined; one might check if there is no sizeable re-export component in this total.
38. ESCWA, 2015, chapter 9, pp. 115-123. Arab update will be provided in upcoming ESCWA study, titled Arab Digital Development Report (work in progress, 2019).
39. Elmasry and others, 2016, p. 25.
40. Ibid.
41. Ibid., p. 28.
42. Ibid., p. 29.
43. ESCWA, 2016, p. 71.
44. ILO, 2017, p. 17.
45. ESCWA, 2016, pp. 82-83.
46. Elmasry and others, 2016, pp. 30-31.
47. ESCWA, 2017a.
48. Even in absolute terms, Arab countries' total expenditure on research and development (for countries for which we have available data) approached \$27 billion per annum (with Saudi Arabia, Egypt and the United Arab Emirates representing nearly 80 per cent of it). This represents only one-third of Korea's expenditure of \$75 billion and a little above 2 per cent of the \$1.12 trillion spent by OECD countries. See UNESCO (<http://data.uis.unesco.org>) and OECD (<https://data.oecd.org>) databases (accessed on November 2017).
49. On this latter issue, see ESCWA, 2014a.

50. https://meta.wikimedia.org/wiki/List_of_Wikipedias_by_language_group (accessed on August 2017); percentages calculated by author based on data provided on this page. By comparison, Hebrew (not even among the top ten languages) is just second after Arabic among the Semitic languages group with 211,000 articles and 2,700 active users (Ibid.).
51. <http://www.internetworldstats.com/stats7.htm#links> (accessed on August 2017).
52. ESCWA, 2015, p. 103. Arab update will be provided in upcoming ESCWA study, titled Arab Digital Development Report (work in progress, 2019).
53. https://w3techs.com/technologies/overview/content_language/all (accessed on August 2017).
54. ESCWA, 2015, p. 104. Arab update will be provided in upcoming ESCWA study, titled Arab Digital Development Report (work in progress, 2019).
55. Google, except Tunisia and Algeria where YouTube prevails, comes first sometimes in its national domain name version; the only three exceptions in 19 Arab countries are the news sites alwakeelnews.com (#3 in Jordan), alwatanvoice.com (#2 in State of Palestine) and alyamanalaraby.com (#3 in Yemen); <http://www.alexa.com> (accessed on August 2017).
56. Ibid.
57. This discussion is based on Arab digital media draws from: Dubai Media City and Dubai Press Club, 2015. The report scopes 14 Arab countries: the six GCC countries, plus Jordan, Lebanon, the State of Palestine, Egypt, Sudan, Tunisia, Morocco and Algeria.
58. These are Saudi Arabia, Bahrain, Kuwait, Lebanon, Jordan, Iraq and Morocco.
59. Ibid., p. 61.
60. These projections are based on estimates that telecom services revenues represent 80-90 per cent of the ICT sector in most developing (and Arab) countries and the remainder is mainly expenses on ICT imports and much less in local added value.
61. This is only 20 per cent lower than the current average value reached by OECD countries; with most at 4 and even below. See OECD, 2017, p. 117.
62. See INSEAD, 2017, p. 354 for comparative values with most leading countries standing in the span of 0.1-0.2 and only the top five leading countries above, reaching 0.55 for Canada and about 0.4 for Israel and the United States.
63. Elmasry and others, 2016, p. 23.
64. The comparison results from the total value of \$1.72 trillion for this market in 2015; see <https://www.statista.com/statistics/237749/value-of-the-global-entertainment-and-media-market/> (accessed on November 2017).
65. ESCWA, 2014b.
66. See policy recommendations of ESCWA, 2017a.
67. Dubai Media City and Dubai Press Club, 2015, p. 14.
68. A gig economy is an environment in which temporary positions are common and organizations contract with independent workers for short-term engagements.
69. Perceptions of the impact of sharing economy apps are overwhelmingly positive in the Arab region. More than 96 per cent of users said they personally experienced a positive impact from sharing apps: 55 per cent said that it saved them time, 33 per cent that it saved them money and 8 per cent said that they have personally generated income from delivering services on sharing economy apps. On the other hand, 3 per cent of users said there was a negative impact on income, mainly due to these services affecting their existing sources of income (for example, taxi drivers and hotel owners). See Arab world online 2017 Report.

Chapter 6

70. WSIS Forum, 2015, pp. 9-10.
71. Other variants include the cabinet in the street (FTTC); essentially, FTTB/C allows for less costly installation work inside buildings or in their vicinity where the last tens or hundreds of metres are generally "taken care of" by digital subscriber lines (DSL) over telephony copper. This has a cost in terms of speed but any FTTx technology, irrespective of whether it is in the B, C or H variant, fetches in the order of 50-100 Mbit/s, much higher than the best DSL technology.
72. ESCWA, 2017b.
73. http://www.ftthcouncilmena.org/documents/FTTH_GlobalRanking_EndSeptember2016.pdf.
74. Cable television is virtually non-existent and high-speed over DSL is often constrained by bad quality copper.

75. This is due to rapid returns on investments even in poor countries with low average revenues per user; beyond the Arab region, this applies to many other developing and poorer countries in Africa and south Asia.
76. Although there are variants of 4G in terms of speed; for details, see <http://www.worldtimezone.com/4g.html>.
77. Deloitte, 2017.
78. For instance, according to International Telecommunication Union data, an Internet user in the United States has an average 100,000 bit/s of international bandwidth, slightly less than peers in the United Arab Emirates; however, the probability that he/she effectively needs this bandwidth for access to content and services over the Internet is much lower thanks to corresponding servers being located and accessed (thanks to many Internet exchange points (IXPs) within their own country).
79. IXPs exist in a good half of Arab countries but there is a lack of proper interconnection among national IXPs to build a regional IXP; see ESCWA, 2015, pp. 31-32. Arab update will be provided in upcoming ESCWA study, titled Arab Digital Development Report (work in progress, 2019).
80. ESCWA, 2015, p. 31. Arab update will be provided in upcoming ESCWA study, titled Arab Digital Development Report (work in progress, 2019).
81. A technological shortcut valid at least until 2025 allows one to use as fibre for the former and 5G for the latter.
82. The apps – or, more properly over-the-top – economy is characterized by the emergence of actors offering services without owning any network; this raises new regulatory challenges as regards revenue share with network owners and non-discrimination by them of the traffic between end users and the apps servers (the so-called net neutrality issue).
83. The term NGN, or next generation networks, was introduced in the 2000s to designate a type of core network architecture championed by 3G standardization. Already some networks offering unified voice and data services (over DSL for instance) adopt an NGN type of architecture. However, it is unlikely that NGA, or next generation access, will not be associated with an NGN-type architecture. See ITU, 2007.
84. See details in ESCWA, 2017b.

Chapter 7

85. WSIS Forum, 2015, pp. 29-32.
86. ESCWA, 2015, p. 68. Arab update will be provided in upcoming ESCWA study, titled Arab Digital Development Report (work in progress, 2019).
87. Ibid., p. 70.
88. Ibid., p. 69.
89. Although a Council of Europe instrument, it is equally open to non-members; efforts by United Nations bodies like the Office on Drugs and Crime (UNODC) to establish an international treaty on cybercrime are yet to come to fruition due to lack of consensus among countries.
90. https://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/185/signatures?p_auth=hUuNZr7A.
91. <https://www.first.org/members/teams/>.
92. No website for the Arab regional cybersecurity centre was found or a link leading to it from the host Oman CERT site <http://www.cert.gov.om>.
93. An example for such a framework is provided in World Bank, 2016, pp. 22-1228 (table 4.2).
94. <https://www.first.org/>.
95. <http://www.itu.int/en/cop/Pages/default.aspx>.
96. See <https://opennet.net/>.
97. World Bank, 2016, pp. 221-222.
98. Salem, 2017a.

Chapter 8

99. See http://www.itu.int/en/ITU-D/Statistics/Documents/statistics/2017/ITU_Key_2005-2017_ICT_data.xls. Internet users significantly differ in the intensity and sophistication of their use patterns as discussed in the sequel.
100. World Bank, 2016, p. 104.
101. This WSIS action line is the unique one impacting all SDG; see annex 4.

102. WSIS Forum, 2015, pp. 10-23.
103. ITU, 2014, p. 54.
104. One could question the methodology of the United Arab Emirates reporting with such a perfect equality.
105. ITU, 2014, pp. 57-58.
106. ITU, 2016, p. 179.
107. The discussion of Internet use patterns and factors affecting Internet use are drawn from chapter 6 of ITU, 2016. The International Telecommunication Union claims that data for this analysis include 67 developed and developing countries and is drawn from Eurostat – likely for developed countries (at least the European) – and its own resources. The document, however, does not provide a comprehensive profile for each of the 67 countries; individual (particularly Arab) country situations must be “chased” from the general diagrams, hence the sometimes approximate values given in the sequel.
108. *Ibid.*, p. 205.
109. Salem, 2017b.
110. ITU, 2016, pp. 207-208.
111. *Ibid.*, p. 192.
112. *Ibid.*, p. 210.
113. *Ibid.*, p. 194. The criteria used by the International Telecommunication Union for representing the seniors’ age group (74 and more) is debatable as it is more usual to consider an age group of 65-74 as representative of the senior population, as used in OECD, 2015a, p. 50. An analysis of this group’s use of Internet in the latter reference shows that only 48.8 per cent among this group are using the Internet (global OECD average for year 2013) with big differences among countries (up to 85 per cent in Sweden but only 5 per cent in Turkey).
114. Only half of the 67 countries analysed. ITU, 2016, p. 197.
115. Another extreme case is that of Israel, offering a unique example with even higher percentages in rural than in urban areas. ITU, 2016, p. 197.
116. For instance, the cost of fixed broadband, mobile broadband and mobile cellular services cumulated does not exceed on average 2 per cent among the top 25 countries (nearly all developed) as shown in (ITU, 2016) see tables pp. 107, 120, 136.
117. ITU, 2016, pp. 234-35 for detailed basket calculation methodology.
118. 12 countries among the 18 countries shown in table 13 are at below 2 per cent and eight among them at below 1 per cent.
119. ITU, 2016, pp. 235-37 for detailed basket calculation methodology.
120. ESCWA, 2017b, p. 16.
121. Which, in passing, needs a better measurement in most Arab countries.
122. Among Arab countries, it is worth noting that Lebanon, despite having access problems that the authorities have recently developed plans to address, had an increase in the percentage of its fixed telephony subscribers relative to population over the 2000-2016 period. This was likely due to it now being the Arab country with the largest percentage of fixed broadband subscribers. The Syrian Arab Republic, despite destructions due to conflict, also improved its fixed infrastructure, from 10 per cent to 15 per cent, having reached nearly 20 per cent before the conflict in 2011, while the United Arab Emirates share decreased from 34 per cent to 23 per cent over the period. See http://www.itu.int/ITU-D/Statistics/Documents/statistics/2017/Fixed_tel_2000-2016.xls.
123. It is useful to point out that the statistical definition of an Internet user by the Partnership HH7 Indicator (ITU, 2014, p. 54 and list in annex 2) does not make a difference between a person who, for instance, essentially uses an application like WhatsApp (for voice messaging and calls) through his/her mobile phone and another person who (maybe in addition) spends hours per day on the net sending/receiving mails and retrieving information. There is no value judgement in this, but the capabilities needed for the two types of activities – both deemed as ‘Internet users’ – are quite not the same.
124. The Partnership introduced an Indicator, HH15 (ITU, 2014, p. 69 and list in annex 2), addressing ICT skills might be used for this purpose.
125. Brynjolfsson and McAfee, 2014.
126. By 2030 it is not unrealistic to forecast that nearly all person-to-person communication services will be carried over the Internet or, at least, an IP platform.
127. Salem, 2017b.

Chapter 9

128. WSIS Forum, 2015, pp. 38-40.
129. Ibid., pp. 40-43.
130. Ibid., p. 40.
131. Ibid., p. 25.
132. OECD, 2011.
133. In market estimates there is no "Arab region", rather a MENA region (often encompassing the whole African continent). Crossing MENA data with market estimates focused on the GCC might be considered a good approximation for the Arab region, at least for global comparisons purposes.
134. See http://www.middle-east.atkearney.com/consumer-products-retail/featured-article/-/asset_publisher/S5Uk00zy0vnu/content/getting-in-on-the-gcc-ecommerce-game.
135. See <https://www.emarketer.com/Article/Worldwide-Retail-Ecommerce-Sales-Will-Reach-1915-Trillion-This-Year/1014369>.
136. Other estimates of global business to business for 2020 put it at \$6.7 trillion. See <https://www2.frost.com/news/press-releases/global-b2b-e-commerce-market-will-reach-67-trillion-usd-2020-finds-frost-sullivan/>.
137. European Commission, 2017. Data are for 2016.
138. Ibid., p. 71.
139. Little and mostly outdated data in the UNCTAD database on the percentage of all businesses receiving or placing orders over the Internet. See ESCWA, 2017d.
140. World Health Assembly resolution WHA58.28. See <http://www.who.int/healthacademy/media/WHA58-28-en.pdf>.
141. OECD, 2010.
142. WHO and ITU, 2012.
143. Pilot countries are Brazil, Canada, Finland, Germany, Israel, Netherlands, Republic of Korea, Switzerland and the United States. See <http://www.oecd.org/els/health-systems/measuring-icts-in-the-health-sector.htm>.
144. WHO, 2016.
145. Ibid.
146. Algeria, Bahrain, Iraq, Jordan, Lebanon, Mauritania, Morocco, Oman, Qatar, Sudan, Syrian Arab Republic and Tunisia.
147. For consistency purposes, data from the previous survey are not reported.
148. Opinion survey requests a rating from 1-7 and takes the average for each country. Arab versus global averages were respectively 4.25/4.2, 4.24/4.3 and 4.19/4.3 in the years 2014, 2015 and 2016.
149. UIS, 2013.
150. European Commission, 2013.
151. The EU survey provides data for students at grade 4, 8, and 11 (in both general and vocational education for grade 11), while the UIS data address primary, lower secondary and upper secondary levels. For comparison purposes, grades 4, 8, and 11 (general) of the EU survey are considered as proxies of the UIS levels, and use their terminology.
152. OECD, 2015b.
153. Top performer/low performer categories are not defined from a country's individual score distribution but on global absolute terms related to points obtained in the test.
154. For detailed analysis of PISA scores see ESCWA, 2017d.
155. The current value in most developed countries stands at 4-5 per cent.
156. Less than 20 per cent of SMEs even in developed regions sell their services online; it is expected this value will dramatically increase and that a target of 60 per cent will match that of developed countries by 2030.
157. UNCTAD, 2016, pp. 26-28.
158. For example, in China in 2016 almost 68 per cent of mobile users made payments via their handset. See <https://www.mobileworldlive.com/money/news-money/china-mobile-payment-usage-up-31-in-2016/>.
159. See <https://etradeforall.org/>.
160. See <https://etradeforall.org/ressources/data-indicators/>.
161. This recommendation might easily be transposed at intra-Arab level.

162. McKinsey Global Institute, 2017.
163. WHO and ITU, 2012.
164. There is a wealth of literature on the Arab education system and how to reform it, including the useful Arab Knowledge Reports. See <http://knowledge4all.com/en/26/Pages/About-the-Arab-Knowledge-Reports>.

Chapter 10

165. WSIS Forum, 2015, pp. 37-38.
166. United Nations, 2016a.
167. World Economic Forum, 2016.
168. United Nations, 2016a, chap. 5.
169. World Economic Forum, 2016.
170. World Bank, 2016, p. 157.
171. *Ibid.*, p. 152.
172. ESCWA, 2017c, chap. 8.
173. For detailed discussion of Bahrain and the United Arab Emirates e-government status, see ESCWA, 2017c.
174. An initiative of the World Wide Web Foundation, the Opendatabarometer.org claims to provide a global measure of how governments are publishing and using open data for accountability, innovation and social impact.
175. For example, in the European Union 34 per cent of Internet users made use of e-government services in 2016, see EC, 2017, p. 78.
176. World Bank, 2016, p. 273.
177. *Ibid.*, pp. 272-279.
178. For details on the action priority matrix approach, see ESCWA, 2017c.
179. World Bank, 2016, p. 177.
180. *Ibid.*, pp. 177-181.
181. World Bank, 2016, p. 180.
182. See <https://www.slideshare.net/unglobalpulse/big-data-and-the-sdgs>.
183. The E-Participation Index of the United Nations E-Government Survey does not measure real participation but assesses capabilities of government portals to engage with citizens and make them contribute to decision-making. See UN, 2016a, pp. 49-77.

The study entitled *Arab Horizon 2030: Digital Technologies for Development* is a central part of ESCWA efforts to promote radical policy changes towards utilizing digital technologies for sustainable development in Arab countries. It sets out proposals and recommendations for harnessing these technologies for social, economic and human development opportunities. The following seven thematic policy areas relevant to digital technologies are identified: digital strategies; information and communication technology (ICT) sector; ICT infrastructure; cybersecurity; the digital divide; e-applications; and e-government. The study addresses these policy areas by analysing the intersection of the 10-year review of the World Summit on the Information Society (WSIS) and the 2030 Agenda.

Taking a common approach for each of the identified thematic policy areas in digital technology, the study proposes an analysis organized under four sections: (1) Contextualization of the thematic issues with respect to their impact on the SDGs; (2) Situation of Arab countries in the context of the prevailing policies, measuring the gap with respect to more advanced countries, and setting some future implications; (3) Outlining a Horizon 2030 vision and policy change recommendations for the better fulfilment of the SDGs; and (4) Laying out a business-as-usual trajectory and one that takes into consideration the horizon 2030. It concludes with a summary of the Horizon 2030 vision and provides a blueprint of policy recommendations for each of the seven policy areas discussed in this document.

