Information and Communications Technology Index

Introduction

Information and communications technology (ICT) has always played a pivotal role in supporting productivity, which represents the main precursor of development in the knowledge age. Over time, owing to its wide reach and continuous development, the scope of ICT has expanded and the correlation between ICT, innovation, and development has become more evident. This is particularly valid for developing economies with high value-added.

ICT has provided significant social benefits by improving access to basic services, contributing to the creation of new job opportunities, and facilitating access to financial services, educational resources, and information of high social return. ICT has also generated new patterns of interactive communication that have helped increase production efficiency and flexibility, shaping new organizational structures, and offering innovative ways of performing operations and transactions. As such, ICT affects interactions between individuals, companies, and government organizations both locally and internationally, and across all human activities. Direct interaction between the public and the government has increased thanks to the development of government e-services, contributing to increased efficiency, transparency, and inclusiveness in decision-making, while also improving governance and strengthening accountability.

Technological advances in storage capacity and processing speed have resulted in an increasing volume of globally stored information, estimated at 2.8 zettabytes in 2012, which is forecast to increase 50-fold by 2020.[1] This is also attributable to the higher penetration of remote micro-devices, hi-tech sensors, and smart phones[2] with integrated high-resolution cameras as well as increased access to Internet services and mobile applications. If technology can process and analyse such large amounts of data, this will open the doors to unprecedented possibilities for more comprehensive and accurate decision-making concerning development challenges facing the knowledge society. ICT offers tremendous opportunities for reducing social and economic inequality and supporting local wealth creation, thereby contributing to the achievement of the Sustainable Development Goals (SDGs) adopted by the international community in 2015.

The increasingly central role of ICT in development has led to the emergence of a new field of literature and international reporting that focuses on ICT use and penetration at the country level. In particular, this new stream examines network and communications infrastructure and the availability of hardware, software, and various applications. The International Telecommunication Union (ITU) and the World Economic Forum (WEF) were pioneers in conducting research and reporting on countries' ICT use and development, informing decision makers about the benefits of ICT when formulating and implementing development strategies. The annual Global Information Technology Report (GITR) may serve as a good example of this kind of research.

Measurement processes have evolved from merely determining the extent of ICT absorption to assessing its direct and indirect impacts on research and development activities, innovation, business management, governance, and social participation. Such measures serve to chart the success of countries in their transition to knowledge economies.

There is a need for a specific set of ICT indicators for the Arab countries to determine current patterns of access, usage and absorption. Such a resource would serve multiple purposes. It will inform policymakers and governments, facilitate sustainable development, and empower both individuals and institutions. It will also facilitate the creation of a unique and unified database of knowledge society indicators in the Arab countries, thereby facilitating cooperation and integration across various fields.

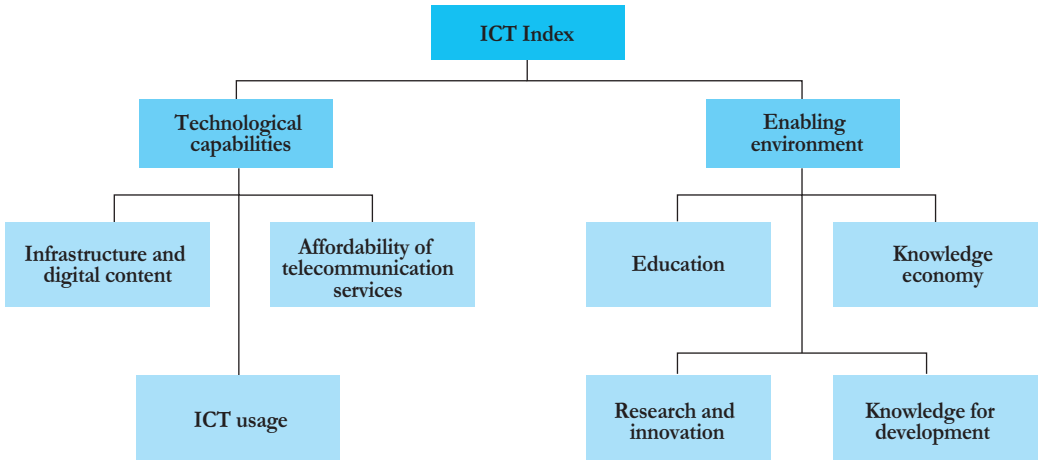
Formulation process and initial structure of the index

The key stages of the methodological approach employed in developing the ICT Index were as follows:

- Reviewing national and international literature in the areas of ICT, knowledge and

Figure 14:

The structure of the 2015 ICT Index*



* The names have been updated to include changes resulting from the 2016 revisions.

development – mainly studies by United Nation agencies, the WEF and the ITU, including country-specific reports. These encompass data from standardized measurements of information and communications indicators, as well as theoretical concepts developed by international organizations and agencies to measure performance in the information and communications sector.

- Developing a framework based on the SDGs to assess how ICT might contribute to their fulfilment and to monitoring their progress.
- Adopting a consultative approach through online and face-to-face consultations with academics and ICT professionals in the Arab region and beyond, in addition to an online questionnaire on information and communications variables. The consultations and questionnaire also included experts from local, regional and international companies, leading information and communications service providers – from both the private and public sectors – as well as users from various age groups.

Furthermore, in order to develop a more comprehensive ICT Index, it was also necessary to conduct an impact analysis for ICT variables across the five remaining areas of the Arab Knowledge Index, namely pre-university education, technical vocational education and training, higher education, economy and research, development and innovation.

ICT measures are affected by the outputs of all stages of education, the country's capabilities in the areas of R&D and innovation, the regulatory and economic environment, investment promotion, efficiency in the use of capital and business management, and the flexibility of labour laws. The ICT Index also encompasses some factors that drive development, such as the impact of ICT on business models, the proportion of the workforce employed in knowledge-intensive activities, e-participation, and healthcare.

Figure 14 illustrates the conceptual model for the ICT Index, consisting of two pillars and seven sub-pillars.

Revisions

Some revisions have been introduced to the 2015 version of the ICT Index at the variable level only to better reflect available data. The relative weights of all elements have also been revisited to improve the index.

Revisions applied to the main structure

No structural changes were made at the level of the pillars and sub-pillars of the index.

Revisions applied to the variables

Revisions to the 2015 version of the ICT Index have been introduced at the variable level.

A new variable, *active mobile-broadband subscriptions per 100 inhabitants*, was added to reflect the significant changes related to the availability and use of broadband communication networks, which is also related to the use of smart phones. The number of smart phones in use has been increasing notably and is expected to reach 2.1 billion by 2016.[3] Smart phones can run a broad array of applications that had been previously limited to PCs and PDAs. Taking into consideration the fact that smart phones are portable and constantly within the user's reach, software and application development companies have shifted their focus to mobile applications, providing smart phone users with access to a wealth of information and services, including financial and banking services, educational resources, and e-government services. This has paved the way for governments to move toward smart governance in their business management activities and interactions with general service providers. One of the most important determinants for the success of this new model in terms of ICT use among individuals, businesses, and/or governments is the availability of a broadband communication network that offers the requisite speed, quality, and also efficiency of communication. Such a network has become the standard required for serving multiple applications, having begun with the Global System for Mobile Communication (GSM) technology. It later evolved through its 2nd, 3rd and (present) 4th Generations (2G, 3G and 4G respectively). Preparations are also underway for the 5th Generation (5G), expected to be launched by 2020.

Another revision to the index was the removal of the variable *access to digital content* in light of the now widespread use of portable and mobile devices. This variable is indirectly reflected in the sub-pillar *ICT usage*.

For similar reasons, the variables *percentage of households with radio* and *percentage of households with television* were also removed, to increase the focus on the variables *percentage of households with computer* and *percentage of households with internet*.

Within the *enabling environment* pillar, in order to better emphasize the importance of the Patent Cooperation Treaty (PCT), patent applications in general – and specifically ICT patent applications – in assessing a country's capacity for research and innovation, the variable *number*

Table 4:

Changes applied to variables in the 2015 ICT Index†

Variable	Modification
Technological capabilities pillar	
Access to digital content	Removed
Proportion of households with radio	Removed
Proportion of households with television	Removed
Active mobile-broadband subscriptions per 100 inhabitants	Added
Enabling environment pillar	
Extent of staff training	Moved*
Extent of institutional level of modern technology absorption	Moved*
Extent of business-to-business Internet use	Moved*
Extent of individual-to-business Internet use	Moved*
Establishing ICT in the future vision of the state	Moved*
Level of government success in developing ICT	Moved*
Number of patent applications	Replaced**
Extent of university staff training	Removed

* The variable has been moved to another pillar in the index. For more information, refer to Table A3 in the Annex.
** The variable has been replaced with another one. For more information, refer to Table A3 in the Annex.
† The names of the pillars have been updated to include changes resulting from the 2016 revisions.

of patent applications was replaced with two new variables: *PCT patents, applications per million population* and *ICT PCT patents, applications per million population*. The variable *extent of university staff training* under the *education* sub-pillar was also removed.

The revisions in the variables also entailed changes in the relative weights, which are detailed in Table A4 in the Annex.

Based on the above, the revisions introduced to the 2015 ICT Index are summarized in Table 4.

Revised Structure (2016 version)

The 2016 ICT Index maintains the initial general structure presented in Figure 15; no structural changes were introduced to its pillars and sub-pillars.

Results

The results of the ICT Index reveal wide disparities in the Arab region, with a gap of 76.11 points between the highest (86.08 in the United Arab Emirates) and lowest scores (9.97 in Somalia). Only eight countries (the GCC states, Jordan and Lebanon) scored above 50. Three countries scored below 20 (Figure 15).

A comparison of scores on both pillars of the ICT Index shows that out of the eight countries with values above 50 on the index, seven countries (Bahrain, Jordan, Lebanon, Oman, Qatar, Saudi Arabia and the United Arab Emirates) achieved almost equal scores on both pillars, while Kuwait scored below 50 on the *enabling environment* pillar. Morocco and Djibouti scored above 50 on the *enabling environment* pillar, but below 50 on the overall index. Disparity between scores on both pillars for the same country ranged from 1.36 to 32.1 points. Twelve countries scored higher on the *enabling environment* pillar, while the other ten scored higher on the *technological capabilities* pillar. This indicates a lack of coordination between efforts to improve the aspects represented by the two pillars (Figure 16). In the case of countries with highest rankings and almost equal scores on both pillars, a correlation coefficient of 0.831 was observed. This indicates coordinated efforts in both areas, which contributed to a high score on the index.

Regarding the sub-pillars of the *technological capabilities* pillar, remarkable progress was noted in most Arab countries on the *affordability of telecommunication services* sub-pillar, followed by the *ICT usage* sub-pillar and the *infrastructure and digital content* sub-pillar. Six countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) scored above 50 on the *infrastructure and digital content* sub-pillar, with scores ranging from

Figure 15:

Results of Arab countries on the ICT Index

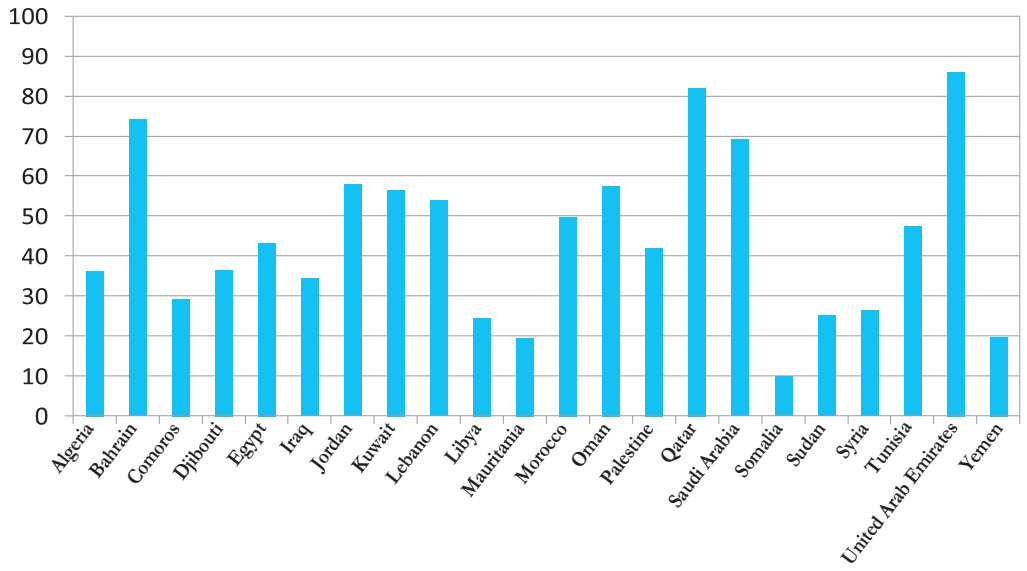
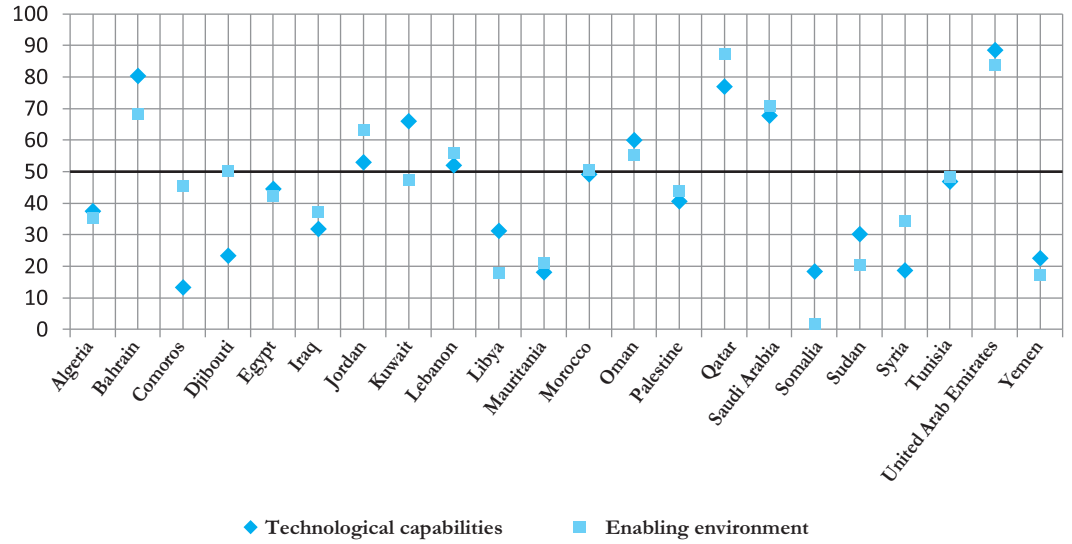


Figure 16:

Results of Arab countries on the main pillars of the ICT Index



52.16 to 90.83. Six other countries (Comoros, Mauritania, Somalia, Sudan, Syria and Yemen) scored below 20 on the same sub-pillar. The high scores of the GCC countries come as no surprise, given their advanced rankings globally. Bahrain ranked first in *electricity production (kWh/capita)*, while Kuwait, Qatar and the United Arab Emirates topped the list in terms of *mobile–cellular telephone subscriptions per 100 inhabitants*. Two countries scored below 50 on the *affordability of telecommunication services* sub-pillar: Qatar (32.34) and Syria (3.23).

Regarding the *ICT usage* sub-pillar, the United Arab Emirates ranked first in terms of *use of virtual social networks, business-to-consumer internet use, ICT use for business-to-business transactions,* and *firm-level technology absorption*. Qatar topped the list in *extent of staff training* (and ranks fifth globally).[4] The United Arab Emirates ranks first globally in terms of the *importance of ICTs to government vision of the future* and *the government success in ICT promotion*.[5] Conversely, Algeria, Libya, Mauritania, and Yemen scored the lowest in the areas of ICT *use for business-to-business transactions* and *extent of staff training*.

A comparison of results on the sub-pillars of the *enabling environment* pillar shows similar scores by countries on the *education, knowledge economy* and *knowledge for development* sub-pillars. With the exception of Qatar, Saudi Arabia, and the United Arab Emirates, all Arab countries scored below 50 on the *research and innovation* sub-pillar. The number of countries scoring above 50 varied from one sub-pillar to another, but almost the same group of countries appeared at the top or bottom of the scale each time.

The above results show a wide digital gap between the five GCC countries (Bahrain, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates) and the four countries Djibouti, Libya, Mauritania and Sudan). While the United Arab Emirates and Qatar have achieved top global rankings, other Arab countries remain outside the bounds of interregional competition, and therefore need to exert greater efforts to improve their technological capabilities in the knowledge age. Given the positive relationship between the level of average individual income and the strength of ICT indices, these indices should be given priority in future plans, and more attention should be paid to research and innovation and the quality of education in general.

Endnotes

1 World Economic Forum et al., 2015.
2 In the absence of an agreed definition, a smart phone is generally described as a phone with an operating system similar to that of a personal computer, typically with a powerful processor, a large internal memory, a touch screen, a high resolution integrated camera and with access to the Internet or other similar devices.
3 Statista, 2016.
4 World Economic Forum et al., 2016.
5 Ibid.