Information and Communications Technology Index

Preamble: The Importance of Information and Communications Technology and Its Role in Acquiring the Knowledge for Development

Information and communications technology (ICT) is considered to be one of the most important factors in building knowledge economy and eventually fostering development. The fast progress achieved in ICT in the way devices, equipment, programs, and tools have been invented and developed has contributed positively to developing and advancing many of the economic, health and educational sectors. The extent of the staggering pace of development in ICT can be compared by looking into the time taken by many modern technologies to reach fifty million users, and the speed with which the Internet has been rolled out to these fifty million users. In fact, it took the Internet less than eight years to reach 143 million users,[1] while telephone was popularised after seventy years, radio thirty-eight years, personal computers close to twenty years, and television twelve years.

Many reports issued by numerous international development organisations such as the World Bank have indicated the importance of ICT in sustainable development economically and socially, through its implementation in the fields of education, health, economic development and good governance. The great importance of information and communications technology is recognised in the United Nations Millennium Declaration adopted by all member states of the United Nations in the year 2000,[2] including Arab states, and again more recently, in the Sustainable Development Goals (SDGs) adopted in 2015. The major industrial countries also emphasised the effect of ICT on development at the G8 summit held in Toyako-Hokkaido in 2008, while also acknowledging the increased risk of the "digital divide". The United Nations has also devoted special attention in recent years to the role of ICT in achieving the development goals for the millennium through a dedicated team that also organised the conference of the World Summit on the Information Society (WSIS). As such, the efforts of international society have focused on promoting the campaign known as "ICT for Development" aiming to apply ICT to the eradication of poverty and improving economic and social conditions.

Ever since Adam Smith published his Absolute Advantage theory for countries able to produce goods and services, the decision-makers began establishing these advantages and maintaining them in the main sectors supporting the economies of their countries. The Global Information Technology Report issued by the World Economic Forum considered that ICT, and digitisation specifically, could fulfil this role in achieving an absolute advantage for countries. ICT (digitisation) is now considered to be the main engine for economic growth and for the creation of numerous job opportunities in various fields, in both developed and developing countries. According to the Report, digitisation boosted the world economy by nearly US$ 200 billion and also helped to create six million jobs in 2001.[3] Furthermore, the data suggest that an increase of about 10 per cent in a country's digitisation rate leads to an increase of 0.75 per cent growth in GDP per capita, and to a 1.02 per cent drop in the unemployment rate.[4] Based on these data, the Report suggests that policymakers and leaders in various countries should maintain the focus on building the infrastructure for digitisation – particularly broadband – and ensure its accessibility to all users at all levels (individuals, companies and governments) so as to enable the information and communications sector to contribute to the comparative advantage for the countries as described by Adam Smith. The Report also called for leaders and policymakers to determine the role that their countries would play in this context, whether in direct development or through financing and facilitating, indicating the existence of successful models in all three areas. As such, all that they have to do is to understand their countries' potential and the available capabilities that could achieve a breakthrough along with social and economic growth.

The Information Economy Report (IER) issued by the United Nations Conference on

Trade and Development (UNCTAD) analyses some of the main trends reflecting the increasing pervasiveness of the information economy and its key role sustainable human development. In its 2010 issue, the IER indicated that digitisation has contributed heavily to economic and social advancement in many countries, and revealed that small and micro-businesses' usage of digitisation lead to an improvement in earnings and business levels.[5] The IER 2010 also confirmed that businesses succeeded in the gigantic transformation in the mobile technology field, especially in developing countries, deriving real benefit from ICT by improving communication throughout the value chain, both regionally and internationally, which then lead to increased productivity. The report concluded that digitisation is playing now a major role in enhancing the competitive capabilities of countries.

The report issued by the United Nations and UNESCO in 2013, "ICT in Five Arab States"[6], confirmed the importance of digitisation in developing the educational sytems and processes; especially in the era of the knowledge economy and global economic competition, requiring the need for all countries to prioritise educational quality, lifelong learning and the provision of equal opportunities for all. Activating the role of ICT in the educational process could assist individuals in competing in the world economy through the creation of a skilled workforce and facilitating social movement. It can also help to develop education systems through enhancing learning; providing students with numerous skills; facilitating access to various educational resources, reaching students in rural and remote locations deprived of educational services; assist in training teachers and improving their skills, as well as improving the school administration system. Both Kozma[7] and Dede[8] confirm that digitisation can revive the abstract concept by using pictures, voices, animated images and simulation, which greatly help students in comprehension, imagination and creativity. The use of ICT in improving the development of education system has become inevitable, regardless of the level of economic development.

The World Health Organization confirmed in its report "eHealth for Healthcare Delivery: strategy 2004 – 2007"[9] that, where health policies, resources and institutions are readily available, they become a powerful tool in the hands of the people in charge of improving health services.

The report issued by Food and Agriculture Organisation (FAO) in 2010, entitled "The Role of Information and Communication Technologies for Community-Based Adaptation to Climate Change"[10], showed that ICT will have a key role to play in the fight against hunger in the future, because climate change is one of the most complex challenges that humankind has ever had to face, and it will impact on the availability of food because of the reduction in agricultural production. Within this framework, it is essential to provide the information and communication systems that the farmers will need in order to cope with the new conditions. In the field of energy, the role of digitisation clearly figures prominently in building smart energy grids. The report issued by the International Telecommunication Union in 2012, entitled "Boosting Energy Efficiency Through Smart Grids"[11], points to the emergence of a vital need for smart energy grids to increase the efficiency of the current grids, incorporating the non-constant sources (sun, wind) the lack of fossil resources (carbon, oil) and their depletion, which is one of the main sources of energy production, especially electricity, and due to the increasing and continuous demand for electrical energy to support the modern economies worldwide.

Numerous countries have established ambitious strategies to enhance the benefits of ICT, including; for example, Germany which launched its strategy entitled "Digital Germany 2015"[12] expressing the belief that digitisation is the key to productivity in all sectors. This is confirmed by the measurement of gross value added in the various sectors today. ICT in Germany has forged ahead of mechanical engineering and motor-vehicle manufacturing in terms of employment, despite having been just behind mechanical engineering until 2009, accounting for 846,000 jobs.[13] The German

government is now working on achieving the maximum benefit from ICT in order to achieve growth and provide job opportunities by building smart grids for all sectors, such as energy, transport, health, education, finance, tourism and administration, with the emphasis on the absolute requirement for data confidentiality and protection. The future of digital strategy in Germany has set policy and implementation frameworks for all government ministries involved in planning, and it has taken the necessary measures to implement them successfully through a number of priorities, tasks and projects that aim to achieve the following:

- Strengthen competitiveness through the use of ICT in all sectors;
- Provide infrastructure and networks necessary to meet future challenges;
- Safeguard the rights and freedoms of users;
- Support research and development (R&D) in the ICT sector and translate the R&D findings into products, providing the necessary marketing services;
- Develop education and continuing education and training and provide the skills needed to handle the modern systems;
- Benefit from ICT to cope with social problems, including sustainable development, health, climate protection, immigration and the improvement of the quality of life of citizens. So as to ensure that this is achieved according to plan, indicators for measuring performance in the digitisation sector have been set, studied and discussed. This report benefited significantly from these indicators.

The Importance of an ICT Index

ICT plays an integral and crosscutting role that supports all the other sectors of the Arab Knowledge Index (AKI); Pre-University Education, Technical Vocational Education & Training (TVET), Higher Education, Research & Development (R&D) and Innovation and the Economy. At the same time, an ICT Index is very much affected by the outputs of the educational process in all its stages, the capabilities of a country in areas of R&D and innovation, regulatory and economic environment, efficient use of capital, business administration, labour law and promotion of investment.

The development of this technology has recently exceeded all expectations, and has begun to represent a new theoretical model applied in a systematic manner in economic and social areas. This has resulted in a quantum leap and core changes in production and services, and represents a new basis for research methods, innovation and renovation. The knowledge-intensive production became conditioned by the availability and abundance of advanced technologies. The density of Internet networks has also provided an unprecedented opportunity for the collection, linkage and distribution of knowledge on an unprecedented scope; leading to an increase in the opportunities for creativity, innovation and the development of products and services.

With the increasing use of ICT and its direct impact on development in the various sectors in a country, it has become necessary to measure the usage of digitisation to show the extent of its benefits, and to even go beyond through finding more competitive opportunities and comparative advantages in this area. It is important for all the Arab states to have a set of specific indicators reflecting the conditions of ICT in the country, one that complies with international indicators in order to ensure the most benefit, whether in terms of governments, enterprises, or individuals setting future plans and/or monitoring progress in terms of attainment of sustainable development goals as well as in terms of facilitating individuals, governments and enterprises.

The methodology followed in the production of the ICT Index took into consideration the international dimension in the production of the sub-indicators for the infrastructure of networks, media, digital content, wireless service tariffs and bandwidth for Internet communication, in line with international reports published by the World Economic Forum, the World Bank and the International

Telecommunication Union (ITU). Based on these reports, the impact on ICT on the other components of the general AKI was studied; namely, Pre-University Education, TVET, Higher Education, R&D and Innovation, the Economy and the Legal Environment, to configure a comprehensive ICT Index as one of the fundamental constituents of the general Index.

Methodology for Selecting ICT Sector Indicators and Their Construction

Methodological Tools

A clear scientific methodology has been followed for constructing the ICT indicators. It is presented in the following steps:

- Desk review of local and international studies: local and international studies related to establishing information and communication indicators were reviewed, in addition to the concepts of international organisation and agencies that deal with measuring and assessing performance in the information and communication sector. These include reports issued by the United Nations, the World Economic Forum, the International Telecommunication Union and reports of strategic plans for many leading countries in this area;

- The new SDGs framework[14], recently adopted by all UN member states provided an overarching framework for the work on the Index for the Arab countries. The AKI authors looked into how ICT could contribute to achieving, monitoring and measuring the achievement of these goals;

- A questionnaire was conducted on information and communication indicators. This questionnaire was shared interactively and completed electronically by a number of academics from within and outside the Arab region, as well as by a number of manufacturers and service providers in the information and communication sectors - both private and public;

- Consultations were held with a large number of specialists in this area, including academics, experts in local, regional and international companies, and with those responsible for providing information and communication services in both private and public sectors, as well as users of various age groups;

- Three background papers were used as guidance:
  - Developments in ICT and international trends and the requirements for the Arab states to become active participants in this area in the future;
  - Big data: The challenges of securing it and benefiting from it in the future;
  - Cloud computing networks.

Production Stages of the ICT Index

Review, Collection and Description Stage

At this stage, many indicators by international organisations and bodies were examined and reviewed. This phase focused on the indicators of the main infrastructure, the digital content and the affordability of communication as well as the usages of technology by individuals, institutions and government.

A number of documents including national strategies were reviewed from developed countries that achieved remarkable progress in the areas of communication and information.

Some of these reports and studies are:

- The Global Competitiveness Reports 2014-2015[15] and 2015-2016;[16]
- Measuring the Relationship between ICT and the Environment 2009;[17]
- World Development Indicators 2015;[18]
- Measuring and Monitoring the Information and Knowledge Societies: A Statistical Challenge 2003;[19]
- E- Government Survey Report 2014;[20]
- Strategic Plan for Germany 2015;
- Strategic Plan for Ireland 2014;
- Strategic Plan for South Korea 2014;
- Strategic Plan for Singapore 2015;

- Strategic Plan for New Zealand up to 2017;
- Strategic Plan for South Africa 2014;
- Towards 2020 Science report.[21]

Critique and Analysis Stage

This stage is of great importance given the necessity for the Arab countries to have a vision as to how their ICT will develop until it achieves international levels, which requires realistic and accurate analysis of the current situation through a set of indicators that could measure the current condition with utmost precision and another set that would offer an accurate outlook. Other problems also relate to facilitating the necessary data for measuring these indicators, and the unification of the methodologies, definitions and references across the Arab states.

Construction and Validation Stage

Based on the two previous stages, simple and composite indicators were identified through which it would be possible to measure and monitor the performance of ICT in the Arab countries as well as forecasting the future, especially in those areas that depend on advanced technology, such as cloud computing, the Internet of Things and Big Data. These indicators were presented, via a questionnaire, to a number of experts and specialists in this area, offering a review and validation, and ensuing the indicators' ability to measure, assess and monitor the current condition, forecast the future and support policy-makers on all levels.

Main ICT Indicators Used Regionally and Internationally

The United Nations: The Partnership on Measuring ICT for Development

In 2005, the United Nations produced a detailed report about the core indicators for using ICT through the World Summit on the Information Society, in collaboration with international institutions and authorities including:[22]

- The International Telecommunication Union;
- The Organisation for Economic Co-operation and Development;
- The UNESCO Institute for Statistics;
- United Nations Conference on Trade and Development;
- UN Regional Commissions (ECA, ECLAC, ESCAP, ESCWA);
- The United Nations Information and Communication Technologies Task Force;
- The World Bank.

The indicators were divided into four core sets, namely:[23]

- Indicators of infrastructure and access;
- Indicators of individuals households usage;
- Indicators on use in the various businesses sectors;
- Indicators on trade in ICT-related goods and circulation of these goods.

World Economic Forum Indicators

The World Economic Forum issued a number of reports concerning competition in the area of information and communication, the last of which was The Global Information Technology Report 2015.[24] In this report, a composite index was presented for measuring ICT readiness and its level in the countries of the world. It was divided into four main categories, sub-divided into a number of sub-indicators. Each set of indicators was described as follows:

- Environment
  - Political and regulatory (9 indicators);
  - Business and innovation (9 indicators).
- Readiness
  - Infrastructure (4 indicators);
  - Affordability (3 indicators);
  - Skills (4 indicators).
- Usage
  - Individual usage (7 indicators);
  - Business usage (6 indicators);
  - Government usage (3 indicators).
- Impact
  - Economic impact (4 indicators);
  - Social impact (4 indicators).

International Telecommunication Union Indicators

In its annual "Measuring the Information Society Report" (MIS), the International Telecommunication Union (ITU) measures the efficiency of the information society in the countries of the world, and monitors growth and development in this direction. ITU's MIS 2014 established a composite indicator for measuring developments in the information and communication sector – [ICT Development Index - IDI]. The indicator contains three categories, each of which was described by a number of sub-indicators, and each indicator was weighted according to its importance:

- Infrastructure and access (5 indicators);
- Usage (3 indicators);
- Skills (3 indicators).

Analytical Critique of These Other Indicators

The index produced by the World Economic forum depends on what it is known as the "Networked Readiness Index"[25], the weights of the index being divided equally between four main areas. These are the sub-indices for environment, readiness, usage and impact. Despite the inclusiveness of the list of indicators covering the general environment, pre-university education falls under the readiness sub-index which covers the information technology infrastructure and the affordability of access. This Index does not include indicators covering vocational education and its rate of enrolment within the readiness sub-index. Despite the significance of schools' access to the Internet for efficiency in a modern school, such an indicator is among a number of other indicators for ICT outcomes, rather than within indicators on education. Furthermore, higher and pre-university education sectors are counted among other indicators for business environment and investment, with a focus on business administration faculties. The index places R&D and innovation within the sub-indicators for usage in business, without underlining their particular significance.

In MIS 2014,[26] ITU assigns 40 per cent of the relative weight of the index to access, represented by fixed and mobile telephone line subscriptions, households owning a computer and households with Internet access; 40 per cent for usage represented by the rate of individuals using the Internet and the rate of fixed (wired) broadband and wireless broadband subscriptions. The remaining 20 per cent are assigned to the skills represented in the adult literacy rate and enrolment rates in secondary and higher education. As such, the general focus in this index lies in inputs without consideration as to the legislative and economic environment in the state or issues of R&D, innovation, healthcare and the general impact of ICT usage on developmental pillars.

Presenting the ICT Index

Based on the methodology presented in the previous section, and an analysis of the experts opinions and comments, it can be concluded that the ICT Index – as one of the main pillars of the Knowledge Index – should not solely depend on the strength of the information technology infrastructure, the digital content, the usages of technology by individuals, institutions and government in everyday transactions. It should also depend, with the same degree of importance, on the general environment for development in a state including the quality of pre-university, vocational and university education, the capacity for R&D and innovation, along with other elements of the knowledge economy relating to the legislative environment, dispute resolution, protection of intellectual property, process efficiency in establishing and running businesses and the ability to compete. The elements also relate to the development driving factors due to the impact of technology on goods, services, the level of employment in knowledge-intensive activities, and the extent of electronic contribution to healthcare.

Establishing the Initial Version of the Index

An initial intellectual model was prepared consisting of 65 sub-indicators divided into 24 direct indicators and 41 indirect indicators. It was decided to distribute the weights totalling

1000 points equally between the direct and indirect indicators at 500 points each:

Direct Indicators – 24 Indicators (500 points)

- Infrastructure and digital content- 5 indicators (170 points);
- Affordability of telecommunication services – 3 indicators (80 points);
- Usage of individuals, companies and government – 16 indicators (250 points).

Indirect Indicators – 42 Indicators (500 points)

- Pre-university Education – 7 indicators (50 points);
- Vocational Education – 5 indicators (30 points);
- Higher Education – 7 indicators (50 points);
- Research and Innovation – 2 indicators (80 points);
- Knowledge Economy – 14 indicators (200 points).

This initial model was shared with a group of experts and specialists in Egypt, Canada, United Kingdom and the United States via a special questionnaire, enabling the participants to express their opinions as to whether they approved the indicator and its relative weight or totally rejected it, with a possibility to perform their proposed adjustments to the designation and relative weight of the indicators.

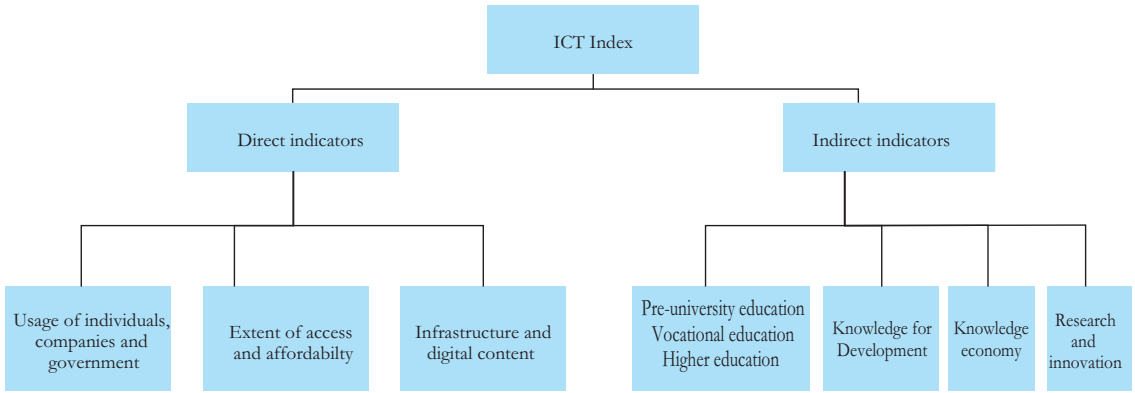
Final Version of the Index

Based on the questionnaire's feedback, the participants' suggestions and comments on the various components of the ICT Index, along with discussions with some participants and the rest of the Index core team members, a final version of the Index was developed for this report. The suggestions included a recommendation not to separate the components of pre-university, vocational and higher education but to include them in one specific item under education while keeping the total relative weight for the education indicator (130) and redistributing the sub-weights for this indicator. Another recommendation was the production of further field research on vocational education, especially with respect to the quality of the education system, the level of in-service training, the quality of vocational schools administration and the proportion of vocational schools with Internet access.

The following figure illustrates the conceptual model for the ICT Index, consisting of 56 sub-indicators:

Figure 1:

General Structure of the ICT Index



The constituents for each pillar along with their weights are detailed below:

Direct Indicators (24 indicators with a total weight of 500)

Table 1:

Infrastructure and Digital Content: Indicators and Weights (5 indicators)

Indicators	Weights (170)
Electricity production, kWh per capita	30
Extent of mobile network coverage as a percentage of population	35
Internet bandwidth, kb/s per user	35
Number of secure Internet servers per million inhabitants	35
Access to digital content	35

These indicators reflect the government's efforts in providing the necessary technological environment for all usages of ICT.

Table 2:

Affordability of Telecommunication Services (3 indicators)

Indicators	Weights (80)
Prepaid mobile phone tariffs, PPP $ per minute	30
Fixed broadband Internet tariffs, PPP $per month	30
Extent of competition in telephony and Internet sectors	20

These indicators express the extent of affordability telecommunication services and Internet services to the members of society.

Table 3:

Usage by Individuals, Companies and Government (16 indicators)

Indicators	Weights (250)
Fixed telephone subscriptions per 100 inhabitants	15
Mobile phone subscriptions per 100 inhabitants	20
Broadband Internet subscriptions per 100 inhabitants	15
Proportion of households with radio	15
Proportion of households with television	15
Proportion of households with a computer	15
Proportion of households with Internet service	15
Proportion of individual users of the Internet	20
Extent of social networks usage	15
Extent of institutional level of modern technology absorption	15
Extent of business-to-business Internet use	15
Extent of individual-to-business Internet use	15
Extent of staff training	15
Establishing ICT in the future vision of the state	15
E-government services	15
Level of government success in developing ICT	15

These indicators reflect the extent of ICT absorption by society elements in terms of individuals, enterprises and government.

Indirect Indicators (32 indicators with a total weight of 500)

Table 4:

Education Sector (9 indicators)

Indicators	Weights (130)
Quality of primary education	15
Quality of math and science education	15
Secondary education enrolment rate	14
Adult literacy rate	14
Rate of schools with Internet access	15
Enrolment rate in vocational education	14
Enrolment rate in higher education	14
Quality of university education	15
Extent of university staff training	14

These indicators express the level of the human capital readiness for active participation in absorbing and localising ICT (digitisation).

Table 5:

Economy Sector (14 indicators)

Indicators	Weights (200)
Effectiveness of law-making bodies	14
Laws relating to ICT	14
Judicial independence	14
Efficiency of the legal system in settling disputes	14
Intellectual property protection	16
Software piracy rate	16
Number of procedures required to enforce a contract	14
Number of days required to enforce a contract	14
Availability of latest technologies in business	14
Venture capital availability	14
Total tax rate	14
Time required to start a business	14
Number of procedures required to start a business	14
Intensity of local competition	14

These indicators reflect the general environment necessary for the development and flourishing of the economy in terms of regulation effectiveness particularly in the fields of ICT, and the extent intellectual property protection, efficacy of the investment environment, business administration and intensity of local competition.

Table 6:

Scientific Research and Innovation Sector (two indicators)

Indicators	Weights (80)
Capacity of the state for innovation	40
Number of patent applications	40

These two indicators reveal the overall capacity of the state for development, innovation and scientific research and the extent of its contribution to the global intellectual repository through patents registration.

Table 7:

Knowledge for Development Sector (7 indicators)

Indicators	Weights (90)
Impact of ICT on new services & products	12
Impact of ICT on new organisational models	12
Level of employment in knowledge-intensive activities	12
Impact of ICT on access to basic services	12
ICT use and government efficiency	12
E-Participation	12
Healthcare indicator	18

These indicators reflect the active impact of ICT on new products and services, new organisational models and access to basic services, enhancing government efficiency and the active governmental electronic participation; all taking healthcare into consideration:-

Conclusion

Final results of the ICT Index are consistent with the results of other reports by international institutions and bodies such as the United Nations, the World Economic Forum and the International Telecommunication Union. This confirms the precision of the weighted system applied, whether for direct or indirect indicators.

The philosophy behind measuring ICT within the framework of Arab Knowledge Index relies on the fact that it is not possible to consider ICT as one of the main pillars for building competitiveness for countries within the framework of knowledge economy without considering the numerous social, economic and political aspects. These aspects are key elements in achieving the aspired impact of using ICT. It was therefore necessary to incorporate some indirect indicators for calculating the final ICT Index such as indicators for education, the economy, scientific research, innovation and knowledge for development. Consequently, any discussion of the use of ICT in development needs to give the adequate consideration to the human element qualified to deal with the technology and absorb it. This has become quite clear throughout the experiences of numerous Arab states that have used ICT for developing the education system, but failed to achieve many of the desired goals due to lack of human cadres capable of dealing with the new system, whether in terms of teachers or administrators. Additionally, the significant role of the economic sector is clear in terms of providing the suitable procedural, financial and legal environment to support the development and flourishing of the information and communication sector.

In the light of global competitiveness and the efforts of all countries to acquire competitive advantages, it is not possible to overlook the role of scientific research and innovation in this area, and its role in the absorption, use and development of ICT.

The statistical data-processing reveals an increase in Cronbach's alpha coefficient (greater than 0.07) and in the explanatory

rate (greater than 0.5), thus pointing to the consistencies of the chosen variables for measuring the indicators. It can also be seen that the value of 0.212 for Cronbach's alpha coefficient for the second sub-indicator (affordability of access) is a small value. Nevertheless, this should not be taken into consideration since individual variables are only available for few countries. The statistical analysis also revealed the impact of indirect indicators in the final ICT Index.[27] This impact is noticeable among some countries that maintained the rank they earned in the international reports due to the consistent results of the indirect and direct indicators as was the case of the United Arab Emirates and Qatar. Other states, however, witnessed a difference in their ranking; Bahrain scored higher than Saudi Arabia in other international reports, while the latter was ranked ahead of the former in the ICT Index due to higher results in the indirect indicators.

Prospects for Developing the Current Index

Vast and staggering developments have occurred in ICT that directly and indirectly impact on various aspects of life, socially, economically and politically. Modern trends, models and technologies have emerged in this context, such as cloud computing, the Internet of Things, mobile technology, big data-processing and social networks, thus leading to the emergence of new business models based on these technologies. This has driven developed countries to setting future plans that are reliable in terms of finding more competitive values in the field of ICT. This issue highlights the significance of developing the current ICT Index to become capable of measuring the capabilities of the Arab countries along with their capacity and competence in keeping pace with scientific developments in this direction. For example, the indicators should be capable of measuring these eight aspects:

- The availability of the required infrastructure, especially for communication and data processing and storing;
- The availability of institutional environment to support entrepreneurship in these areas;
- The extent and type of usage of these technologies by governments, companies, institutions and individuals;
- Data confidentiality and privacy;
- The availability of skills that could absorb and deal with modern technology;
- The extent of governmental support and investment in these trends;
- The classification of service providers and assessment of the services provided;
- The quality of the available electronic services in the areas of education, health, e-commerce and the like.

Finally, in order to allow for a genuine and realistic measurement of the capabilities of the Arab states in ICT, there is an emphasis on the need to ensure the accessibility of all of the data necessary for measuring the ICT Index in all the countries in question and by all the responsible authorities. Such measurements would then enable these states to develop and catch up with the progress of developed countries in ICT, so as to ensure the prospects of a brighter future for all the Arab countries.

Endnotes

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