



Empowered lives.
Resilient nations.



مؤسسة محمد بن راشد آل مكتوم
MOHAMMED BIN RASHID
AL MAKTOUM FOUNDATION

2016 ARAB KNOWLEDGE

INDEX



ARAB KNOWLEDGE INDEX 2016



*Empowered lives.
Resilient nations.*



مؤسسة محمد بن راشد آل مكتوم
MOHAMMED BIN RASHID
AL MAKTOUM FOUNDATION



Empowered lives.
Resilient nations.



مؤسسة محمد بن راشد آل مكتوم
MOHAMMED BIN RASHID
AL MAKTUUM FOUNDATION

Arab Knowledge Index has been produced through a partnership between Mohammed Bin Rashid Al Maktoum Foundation (MBRF) and United Nations Development Programme / Regional Bureau for Arab States (UNDP/RBAS)

Printed at Al Ghurair Printing and Publishing, Dubai – United Arab Emirates

on Chlorine – Free paper and using plant-based ink manufactured according to environmentally-friendly technologies.

Cover Design: Entourage Marketing & Events

Layout and Production: Al Ghurair Printing and Publishing, Dubai

Printed in Dubai - United Arab Emirates

The analyses and results presented in this publication do not necessarily reflect the views of Mohammed Bin Rashid Al Maktoum Foundation or United Nations Development Programme, its Executive Board Members or United Nations Member States. The report is an independent publication, produced by a team of prominent consultants and experts.

This report has been originally written in Arabic. The English translation has been edited for flow and clarity, and as such may not reflect all parts or sentences in the Arabic version.

Foreword

Chairman of the Board

Mohammed Bin Rashid Al Maktoum Foundation

Arab Reading and Knowledge Indices... Objectively and scientifically tracking situations and trends for a sustainable development

“History teaches us that no civilisation has endured by relying solely on its might and its wealth, but rather by virtue of the efforts of its people to innovate solutions for the challenges that faced them. Civilisations that stopped learning and researching future opportunities declined and were reduced to being the subject of history books,” said His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, underlining the unparalleled importance of hard work and innovation in building nations.

To be sure, for this paradigm to achieve its objectives, we need to exert tremendous efforts to create the scientific tools that would see us through the challenges; we need to propose solutions and implement best practices to face them. With that in mind, we present you today with the fruit of these efforts, which reaffirm Dubai and the UAE’s lead when it comes to launching innovative initiatives and project that seek to spread knowledge around the world.

The first of its kind in the region, Arab Reading Index initiative was the fruit of a collaboration with the United Nations Development Program (UNDP), and extensive efforts by top-tier experts and specialists in research- and knowledge-related fields. It supports the UAE’s National Reading Strategy, which seeks to instil a reading culture in the country.

The Index is an objective scientific tool that tracks the status of reading and evaluates cultural development in the Arab World. It also serves to measure the extent to which our knowledge-related initiatives have succeeded in realising their objectives. We are confident that the Index will be a go-to source for facts and figures for stakeholders and decision makers in their efforts to set policies that encourage reading and knowledge.

With the same frame of mind, we had previously launched the Arab Knowledge Index, another unique product that studies knowledge in the Arab World along six main axes: pre-university education, higher education, technical vocational education and training, information and communications technology, economy and research, development and innovation.

The Arab Knowledge Index has successfully offered stakeholders in the Arab World a roadmap to rely on when setting strategies, providing them with accurate data and statistics, updated on a yearly basis in accordance with international standards.

The Arab Reading and Knowledge Indices thus become part of the Arab Knowledge Project, which seeks to fill the knowledge gap in our region, enabling our countries to produce and disseminate knowledge, and to use it for the good of our people and future generations.

Sheikh Ahmed bin Mohammed bin Rashid Al Maktoum
Chairman of the Board
Mohammed bin Rashid Al Maktoum Foundation

Preamble

United Nations Development Programme

The release of this report comes as the Arab Knowledge Project enters its 10th year investigating the complementarity between knowledge and development, and how this interaction can contribute to achieving sustainable human development in the Arab region. Over the course of a decade, the Project has moved from studying and analysing the state of knowledge in the region and its theoretical foundations, to applying rigorous quantitative tools to monitor and evaluate the sectors which present a strong link between knowledge and development. These are pre-university education; higher education; technical vocational education and training (TVET); information and communications technology (ICT); economy; and research, development and innovation (RDI).

This year's report encompasses two distinct but related components. First, the 2016 Arab Knowledge Index, an updated and revised version of the 2015 edition to better capture the state of knowledge systems in the Arab region. Second, the Arab Reading Index, a new initiative resulting from an electronic survey on reading practices which received more than 145,000 responses from 22 Arab countries.

While the Arab Knowledge Index focuses on how the relation between knowledge and development can help meet contemporary challenges, the Arab Reading Index assesses the practice of reading in the lives of people across the region. It emphasizes the role of reading as an indispensable tool which empowers individuals, improves skills and capacities, and supports innovation and creativity. Reading is to knowledge what letters are to the alphabet; it is the embodiment of the passion and curiosity that drive advances in knowledge and development. Reading is a distinguishing feature of developed nations that offers limitless opportunities for learning, providing a distinct advantage in an era of unprecedented progress in science and technology. Reading also provides

the means to understand ourselves, others and our social environment, as well as to devise effective and sustainable solutions to complex economic, social, political, environmental and development challenges.

The Arab Knowledge Index and the Reading Index are complementary efforts towards the establishment of knowledge societies in the Arab region. Both indices seek to provide reliable data to inform decision-making processes and to support the development of evidence-based policies aiming at advancing knowledge-led human development in the region and beyond.

The methodology adopted for the Arab Reading Index marks a shift for the Arab Knowledge Project from the utilization of external data and/or development of case studies on specific countries, toward producing its own data by conducting an electronic survey covering 22 Arab countries. In the coming years, the intention is to develop further tools of study and expand their coverage in terms of topics and participation.

Despite the challenging circumstances in the region, the Arab Knowledge Project has remained steadfast. Its milestone achievements are a result of the longstanding and solid partnership between the United Nations Development Programme (UNDP) and the Mohammed Bin Rashid Al Maktoum Foundation, and are guided by the vision of H.H. Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the United Arab Emirates and Ruler of Dubai, who maintains that: "The race for excellence has no finish line".

We would like to express our gratitude namely to the teams at the Arab Knowledge Project, Mohammed Bin Rashid Al Maktoum Foundation; looking forward highly and with eagerness to the yet upcoming initiatives and publications by the Arab Knowledge Project.

Sophie de Caen
Regional Director, a.i.
Regional Bureau for Arab States
United Nations Development Programme

Contributors

Core Team

Najoua Fezzaa Ghriss (Main Author/Pre-University Education), Ali Said Al-Kaabi (Higher Education), Ali Ibrahim (Higher Education), Khaled Al-Wazani (Economy), Mohamad Ismail (Expert Statistician), Motaz Khorshid (RDI), Yousry El Gamal (ICT), Youssef Sadik (TVET)

Chief Technical Advisor (UNDP)

Hany Torky

Mohammed Bin Rashid Al Maktoum Foundation (MBRF)

Jamal Bin Huwairib (Managing Director), Faisal Bujesaim (Executive Director), Saif Al-Mansoori (Corporate Affairs Advisor to Managing Director)

United Nations Development Programme (UNDP)

Sima Bahous (Assistant Secretary-General, Assistant Administrator and Regional Director, Regional Bureau for Arab States 2012 – 2016), Sophie de Caen (Regional Director, a.i.), Khaled Abdel Shafi (Regional Hub Director), Yakup Beris (Regional Programme Coordinator), Alberto Natta (Regional Programme Analyst)

Arab Knowledge Project

Hany Torky (Chief Technical Advisor), Samah Hammoud (Project Analyst), Mariam Itani (Project Researcher), Sirine Saghira (Web Editor, Content Management Analyst), Sara Salame (Research Assistant), Anthony Fakhoury (Research Assistant), Stéphanie Boustany (Research Assistant)

Programme Support

Abusabeeb Elsadig (Results and Resource Management Specialist and Regional Programme Management Support Unit Head), Maya Beydoun (Project Management Specialist), Tarek Abdelhadi (Project Management Consultant)

Editors

Arabic: Ghassan Ghosn

English: Francis Field

Translation to English

Abdulrahman Mohammed

Cover Design

Entourage Marketing & Events

Contents

Concepts and Methodology

Preamble	3
Introduction	3
The significance of establishing the AKI	4
The AKI and the 2030 Agenda for Sustainable Development	4
The conceptual framework	5
Knowledge for comprehensive and sustainable development	6
Methodological framework	6
Guiding principles	6
Generic principles	6
Sector-specific principles	7
Stages of Index development	7
Quality control	8
The AKI 2016	8
Key changes to the first version of the AKI	8
Pre-University Education Index	8
Technical Vocational Education and Training (TVET) Index	9
Higher Education Index	10
Information and Communications Technology (ICT) Index	10
Economy Index	10
Research, Development and Innovation (RDI) Index	11
General results of the AKI 2016	11
Conclusion	13

Pre-University Education Index

Introduction	17
Formulation process and initial structure of the index	18
Revisions	19
Revisions applied to the main structure	20
Revisions applied to the variables	22
Revised structure (2016 version)	24
Results	24

Technical Vocational Education and Training Index

Introduction	31
Formulation process and initial structure of the index	32
Revisions	33
Revisions applied to the main structure	34
Revisions applied to the variables	35
Revised structure (2016 version)	37
Results	37

Higher Education Index

Introduction	43
Formulation process and initial structure of the index	44
Revisions	45
Revisions applied to the main structure	46
Revisions applied to the variables	46
Revised structure (2016 version)	48
Results	48

Information and Communications Technology Index

Introduction	55
Formulation process and initial structure of the index	55
Revisions	56
Revisions applied to the main structure	56
Revisions applied to the variables	56
Revised structure (2016 version)	58
Results	58

Economy Index

Introduction	63
Formulation process and initial structure of the index	63
Revisions	64
Revisions applied to the main structure	64
Revisions applied to the variables	64
Revised structure (2016 version)	66
Results	66

Research, Development and Innovation Index

Introduction	73
Formulation process and initial structure of the index	73
Revisions	74
Revisions applied to the main structure	76
Revisions applied to the variables	77
Revised structure (2016 version)	78
Results	78

Statistical Methodology

Variable selection	85
Data used	85
Data quality	85
Outliers	85
Skewness and kurtosis	86
Normalization	86

Weights	86
Sectoral index calculation	87

References

91

Annex

Table A1: Pre-University Education Index: Variables and Weights	103
Table A2: Technical Vocational Education and Training Index: Variables and Weights	114
Table A3: Higher Education Index: Variables and Weights	118
Table A4: Information and Communications Technology Index: Variables and Weights	123
Table A5: Economy Index: Variables and Weights	130
Table A6: Research, Development and Innovation: Variables and Weights	134

List of Figures

Concepts and Methodology

Figure 1: The six main sectoral indices of the Arab Knowledge Index	7
Figure 2: Performance of Arab countries on sectoral indices	12

Pre-University Education Index

Figure 3: The structure of the 2015 Pre-University Education Index	19
Figure 4: The revised structure of the TVET Index	24
Figure 5: Results of Arab countries on the Pre-University Education Index	25
Figure 6: Results of Arab countries on the main pillars of the Pre-University Education Index	25

Technical Vocational Education and Training (TVET) Index

Figure 7: The structure of the 2015 TVET Index	33
Figure 8: The revised structure of the TVET Index	37
Figure 9: Results of Arab countries on the TVET Index	38
Figure 10: Results of Arab countries on the main pillars of the TVET Index	38

Higher Education Index

Figure 11: The structure of the 2015 Higher Education Index	45
Figure 12: Results of Arab countries on the Higher Education Index	49
Figure 13: Results of Arab countries on the main pillars of the Higher Education Index	49

Information and Communications Technology (ICT) Index

Figure 14: The structure of the 2015 ICT Index	56
Figure 15: Results of Arab countries on the ICT Index	58
Figure 16: Results of Arab countries on the main pillars of the ICT Index	59

Economy Index

Figure 17: The structure of the 2015 Economy Index	64
Figure 18: Results of Arab countries on the Economy Index	67
Figure 19: Results of Arab countries on the main pillars of the Economy Index	67

Research, Development and Innovation (RDI) Index

Figure 20: Methodological framework of the RDI Index	74
Figure 21: The structure of the 2015 RDI Index	74
Figure 22: The revised methodological framework of the RDI Index	75
Figure 23: The revised structure of the RDI Index	78
Figure 24: Results of the Arab countries on the RDI Index	79
Figure 25: Results of Arab countries on the main pillars of the RDI Index	80

List of Tables

Pre-University Education Index

Table 1: Changes applied to variables in the 2015 Pre-University Education Index	23
--	----

Technical Vocational Education and Training Index

Table 2: Changes applied to variables in the 2015 TVET Index	36
--	----

Higher Education Index

Table 3: Changes applied to variables in the 2015 Higher Education Index	47
--	----

Information and Communications Technology Index

Table 4: Changes applied to variables in the 2015 ICT Index	57
---	----

Economy Index

Table 5: Changes applied to variables in the 2015 Economy Index	66
---	----

Research, Development and Innovation Index

Table 6: Changes applied to variables in the 2015 RDI Index	77
---	----

Statistical Methodology

Table 7: Frequency distribution of variables with outliers, severe skewness and/or severe kurtosis	86
--	----



Concepts
and
Methodology

Preamble

With the mutual objectives of promoting knowledge as a key driver of sustainable human development and laying the foundations for a knowledge society, the United Nations Development Programme (UNDP) and the Mohammed Bin Rashid Al Maktoum Foundation (MBRF) joined efforts to implement this shared strategic vision for the Arab region.

This partnership, established in 2007, has produced several initiatives, including the Arab Knowledge Report series¹, the Knowledge4All digital portal² and this Arab Knowledge Index (AKI) 2016 – a revised version of the 2015 edition.

The AKI is the fruit of years of research and consultations, starting with the development of the Arab Knowledge Report series, which highlighted the need to devise a knowledge index that adopts international standards while taking into consideration the specificities of the Arab region. The Index serves as a tool for monitoring and evaluating the state of knowledge systems in the Arab region through a number of pillars, sub-pillars and variables.

The first version of the AKI was produced in 2015 in accordance with a rigorous scientific and statistical methodology, following extensive literature review and consultations with experts and stakeholders from the Arab region and beyond. The results of the AKI 2015 were released in a report outlining the conceptual, methodological and statistical approaches of the Index, as well as the results for each Arab country.³ These results were launched in December 2015 during the Knowledge Summit in Dubai, gathering more than 1,000 participants from around the world.

The process of producing the AKI 2015 illustrated the complexity of developing such an index, and confirmed that efforts to this end must be refined over time through the collection of feedback and additional measures to ensure data availability. The AKI 2016 is therefore a continuation of this process and a contribution to the combined effort to illustrate the significance of knowledge as

a primary driving force for achieving sustainable development in the Arab region. It provides an adaptable tool that may even be applied beyond the Arab region to inform evidence-based policies and contribute to the broader monitoring tools to assess progress achieved toward the Sustainable Development Goals (SDGs).

The Arab Knowledge Project (AKP) will continue to develop the Index in the coming years in order to support the establishment of knowledge societies and economies as gateways to sustainable human development in the Arab region.

Introduction

The world is evolving and progressing at an unprecedented speed, whilst simultaneously generating a continuous flow of knowledge. Scientific research and technological innovation play an increasingly central role in driving human development and redefining the concept of development as a knowledge-intensive and people-centred process. This was placed at the forefront of the first Human Development Report, which stressed that “people are the real wealth of a nation”.⁴

“The term ‘knowledge society’ refers to this current phase in the evolution of human progress”,⁵ where knowledge has become a prerequisite for development. However, there is an increasing gap between the minimal progress achieved in the Arab region towards sustainable development and the amount of resources made available to support such progress.⁶ The 2014 Arab Knowledge Report highlighted this challenge, arguing that despite the relative progress achieved by certain Arab countries in terms of knowledge in support of development, results remain below the desired average. This “indicates the absence of the main drivers required to access the knowledge economy and the knowledge society to achieve genuine development.”⁷

The Arab Knowledge Index is among the pioneering initiatives that seek to provide measures for assessing the state of knowledge from a development perspective and guide

policymaking processes by highlighting areas of strength, weakness and potential improvement.

As the international community progresses towards the Sustainable Development Goals, it is important to focus on more efficient and transparent ways to improve not only data collection, reporting and availability, but also the timeliness of data in the context of data harmonization for better comparison across countries.

Source: UNESCO, 2015a.

The significance of establishing the AKI

The development of the AKI represents a milestone in the work of the Arab Knowledge Project, as it marked a shift from the stage of qualitative assessment and diagnosis (Arab Knowledge Report series) to a stage of quantitative assessment and analytics; from using external tools to conceiving standardized adaptable tools that take into account countries' states of knowledge systems and their particular challenges.

The added value of the AKI is its capacity to measure the progress of knowledge acquisition and expansion as a precondition to development. Most importantly, the Index:

- Establishes the concept of knowledge as a precursor to cross-sectoral sustainable human development.
- Integrates the multiple factors that contribute to knowledge and human development, including – but not limited to – enabling environments, cultural specificities and countries' development needs.
- Respects international standards and follows a standardized objective methodology that links the various AKI indices and pillars to relevant global indicators.
- Adopts a participatory approach and proceeds on the basis of consensus among experts regarding conceptual and technical aspects. This was achieved through the organization of regional workshops and discussion panels in a number of Arab countries (Algeria, Egypt, Jordan, Morocco, Tunisia and the United Arab Emirates) in addition to direct personal and electronic consultations with experts and research centres inside and outside the Arab region.⁸

In this regard, the AKI intends to support the implementation of the recommendations of the 2030 Agenda for Sustainable Development that underlines the need for a more comprehensive approach to sustainable development, the importance of indices, the necessity of integration at the global, regional and national levels, and the need to focus on local contexts. The strength of knowledge systems is key to put in place such an approach.

The Sustainable Development Goals and targets are integrated and indivisible, global in nature and universally applicable, taking into account different national realities, capacities and levels of development and respecting national policies and priorities. Targets are defined as aspirational and global, with each Government setting its own national targets guided by the global level of ambition but taking into account national circumstances.

Source: United Nations, 2015b.

The AKI and the 2030 Agenda for Sustainable Development

In September 2015, world leaders agreed upon a bold and ambitious development agenda, the 2030 Agenda for Sustainable Development, which established 17 Sustainable Development Goals (SDGs) and 169 targets, all of which are to be achieved by 2030.⁹

“Today’s global realities and development challenges demanded that the post-2015 development agenda should be more ambitious, interconnected, and universally applicable than its predecessor, with a comprehensive vision and practical means for achieving sustainable development”.¹⁰ As such, the SDGs aim to complete the unfinished business of the Millennium Development Goals (MDGs), while expanding the priority areas, and with a pledge to leave no one behind.

Jan Eliasson, Deputy Secretary-General of the United Nations said:

The 2030 Agenda ... is a global blueprint for ending poverty and building a safer and more equitable world. It is a universal agenda, one which all countries are to integrate with their national plans and aspirations. It enshrines a responsibility to focus on the world’s most

vulnerable and those affected by protracted conflicts and natural disasters.¹¹

Unlike the previous Development Agenda, which focused mainly on the social dimension, the SDGs also integrate the economic and environmental spheres. This highlights how the AKI and the SDGs share some underlying principles, namely:

- Vision: the AKI is based on a strategic vision that places the human being at the core of sustainable development, being both the driver and the target of development efforts. The AKI 2015 makes it clear that development today is a complex concept “reflecting the fact that human beings are by their very nature multifaceted, with a plethora of different needs to which development may respond.”¹² This is the same vision that guided the formulation of the 2030 Agenda for Sustainable Development, which considered people to be the pillar of sustainable human development, thereby distinguishing between human resources development that invests in individuals to serve production, and human development aimed at mobilizing physical and knowledge resources to create a world where people can thrive.¹³
- Methodology: The AKI offers standardized knowledge-specific measures that can assist in monitoring the progress toward the SDGs at four levels: a global level (with 100–120 indicators for the 17 SDGs and their 169 related targets); a sectoral level (with indicators for the areas of the 2030 Agenda); a regional level (with indicators to monitor regional targets); and a national level (with countries setting indicators that reflect their strategies and policies).¹⁴ As such, the AKI represents a contribution in the Arab region to monitoring progress on knowledge generation and use toward the 2030 Agenda, which stresses that “quality, accessible, timely and reliable disaggregated data will be needed to help with the measurement of progress and to ensure that no one is left behind.” It adds that such data is key to decision-making, and that data and information from existing reporting mechanisms should be used where possible.¹⁵ It is an effort to provide a basis through which knowledge can be generated,

acquired, transferred, and localized to empower individuals with the necessary skills and resources to put this knowledge in the best use to support the 2030 Agenda.

- Inclusiveness: The sectoral indices that comprise the AKI include a large number of goals and targets set out in the 2030 Agenda. It is expected, therefore, that the regular implementation of these composite indices (sectoral indices) will provide a rich, reliable and constantly updated database that will act as an essential source for tracking the related progress toward the SDGs. The AKI also represents a valuable contribution to overcoming the challenge of data availability in the region highlighted by the General Assembly Declaration: “We recognize that baseline data for several of the targets remains unavailable, and we call for increased support for strengthening data collection and capacity building in Member States to develop national and global baselines where they do not yet exist.”¹⁶

The conceptual framework

The AKI is based on the three interdependent and functionally complementary basic concepts of knowledge, development and sustainability.

Knowledge:

Knowledge is not limited to the possession of information and facts (explicit knowledge). It encompasses all mental processes, capacities and skills involving research, scrutiny, analysis, criticism and inference (implicit knowledge) with the aim of producing new ideas and tools that may be used to bring about positive changes for people, develop their capabilities and expand their options. This is the foundation of the link between knowledge and development, as emphasized across all AKP initiatives.

Development:

The concept of development goes beyond material progress, social development and economic growth. It accommodates all intellectual, economic, political, social, environmental and other aspects surrounding the individual (i.e. human development).

According to the AKP:

Real development enables societies to transform their physical potentials and natural resources through knowledge, innovation and creativity into a developmental base that lays the foundation for enabling environments that respect human rights, reduce poverty, create decent jobs and ensure that social spending is a real investment for the future and an expansion of the opportunities for youth empowerment.¹⁷

Sustainability:

This concept is defined systematically in three dimensions: economic, social and environmental. Accordingly, sustainable development is development that “meets the needs of the present without compromising the ability of future generations to meet their own needs.”¹⁸

Knowledge for comprehensive and sustainable development

The World Bank was among the first organizations to combine these three concepts by underscoring the relationship between knowledge and development in its Knowledge for Development initiative. It argued that the real gap was not simply in income, but in the ability to acquire knowledge; and that the difference between rich and poor countries or social groups lies not only in weak financial resources, but also in their ability to produce, share or use knowledge to cope with daily challenges.¹⁹

In this regard, the World Bank presented the “knowledge evaluation methodology” as an interactive tool (a set of two indicators on knowledge and knowledge economy) for monitoring the overall level of preparedness of countries for developing a knowledge-based economy. The aim of such initiatives was to help countries identify challenges and opportunities, however they were discontinued in 2012.

At the Arab level, there have been few attempts to measure such aspects of a cognitive or knowledge-related nature, either as separate indices or as indicators in wider composite indices. This highlights the importance of the AKI at a time when the Arab and international

arena search for the methodological tools to assess the relationship between knowledge and sustainable development.

Methodological framework

Work on the AKI began in 2015 with the aim of achieving a composite index by 2017 that measures knowledge from a multi-dimensional development perspective, meets international standards of reliability, and is sufficiently flexible to be adapted and employed in countries with different development contexts.

Guiding principles

Establishing an AKI that is structurally sound, sustainable and competitive requires a set of underlying principles to guide the process in all its stages. These include both generic and sector-specific principles.

Generic principles

- Building the AKI on pillars that relate to the development priorities of the Arab countries, without isolation from wider global development trends.
- Establishing a general framework for the Arab countries while also accommodating country-specific peculiarities and allowing regional and international comparisons.
- Ensuring that Index formulas are accurate, clear and presented coherently as part of the wider context of knowledge development, while providing the necessary details to avoid over-simplification of complex realities.
- Identifying a clear model of pillars and sub-pillars by selecting which and how many variables are relevant to each sectoral index. This constituted one of the key challenges in the process of developing the Index, given the lack of data available for several variables.
- Collecting the data necessary to ensure the Index is compiled from credible and reliable sources. Due to the experimental nature of this stage of Index development, it was agreed that data sources from as early as 2006 may be utilized in order to secure sufficient data to calculate the indices, while recognizing the limitations of this practice in future stages of Index development.

Sector-specific principles

- A composite index is developed by sector experts, while ensuring consistency with the general AKI framework.
- The choice of pillars, sub-pillars, components, sub-components and variables is proposed and finalized by sector experts, in light of consultations and discussions with relevant stakeholders. Each sectoral index should be capable of providing readers with a comprehensive overview of the conditions of that sector in the countries that are currently included in the Index.
- Since the sectors interact with each other, it is accepted that some variables will appear under more than one index. In such cases, coordination between expert authors is necessary to avoid inconsistency and overlap.
- In cases where data is unavailable for suggested fundamental pillars, sub-pillars, components or sub-components, the concerned sector expert shall either employ the most adequate proxy variable for which data is available (providing this does not detract from the essence of the Index), or choose to retain the measure in a limited form until the corresponding data becomes available for the Arab countries. The expert author may thus present an ideal/aspired-for composition versus a current composition in light of what is currently possible and available.

Stages of Index development

The development of the AKI involved four main stages: first, a descriptive stage explored the most important indices available at the local, regional and international levels for each sector. Second, an analytical stage identified focus areas in order to avoid replication of available indices. Third, a development stage set the structure of the general Index with its six sectoral indices. Fourth, an experimental stage during which the external validity of the selected indices and their relative weights are tested and refined through expert consultations.

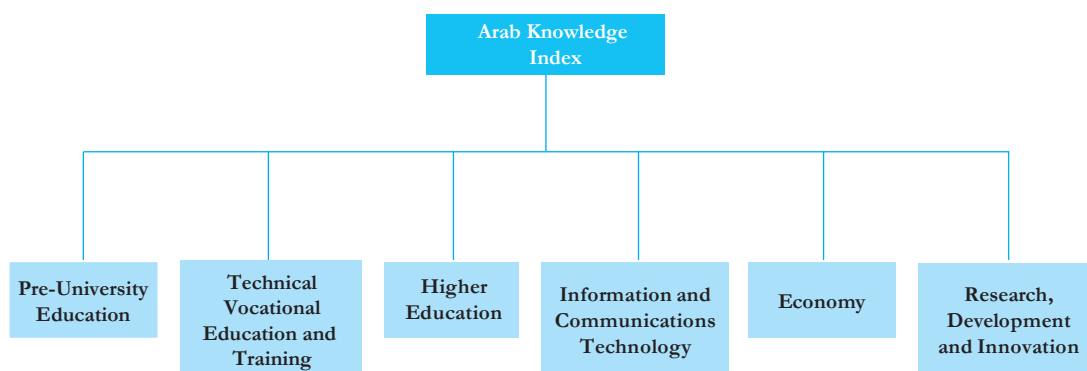
The preliminary structure was adopted following extensive literature review and consultation with Arab and foreign professionals with substantial experience in developing and assessing indicators. Background papers were also produced on a series of topics, and regional workshops were organized to collect input from stakeholders, policymakers, researchers and professional experts.

The above process led to the identification of six main sectoral indices (Figure 1).

Data for each sectoral index was statistically verified to ensure the appropriate consistency, sensitivity of variables and distribution of weights. The results have demonstrated a significant consistency between the indices. Cronbach's alpha coefficients exceeded 0.7

Figure 1:

The six main sectoral indices of the Arab Knowledge Index



in more than 80% of the composite indices. Inconsistency in some indices is attributed to the lack of data. In other indices, such inconsistencies resulted from the nature of the variables. The coefficient of determination for indices generally exceeded 50%. More technical details are available in the chapter on Statistical Methodology.

Quality control

Quality control in Index development is essential to ensure the validity, reliability and significance of the product, as well as to correctly monitor the evolution of a particular sector and enable time and geographical comparisons. The AKI team was keen to introduce quality control measures throughout the development stages (planning, designing, application, evaluation and modification), and to apply corrective measures where necessary. Data was audited, verified and cleaned at all stages of sourcing, collection, processing, presentation and interpretation. The results of the Index were evaluated against similar credible international indicators and regular reviews were conducted to deal with any emerging issues.

As evaluation is an important factor in quality improvement, the AKI 2015 has been subject to comprehensive revision, and refinements have been introduced in light of feedback and consultations with experts and stakeholders.

The AKI 2016

The review of the first edition of the Index led to a higher degree of accuracy and reliability, the expansion of its scope and use, as well as improvements in its sustainability. Revisions are essential in constructing indices, especially as they ensure that the index in question reflects regional and international developments and includes data that is updated in light of available information and recently released statistics.

Revisions are also essential because development is a constantly evolving process which requires continued reconsideration of its components, applicability to local contexts and responsiveness to emerging challenges.²⁰

Key changes to the first version of the AKI

The review of the AKI aimed to inform a revision of its structure in light of the results of statistical analysis, as well as to address data availability issues. Concerning the lack of data, the research team sought to expand the number of sources and reviewed some choices in relation to variable selection to ensure better alignment with the conceptual foundations of the Index.

Changes to sector-specific indices included:

- Adoption of a revised structural model, as in the case of the Technical Vocational Education and Training (TVET) Index.
- Changes in the sub-pillars, as in the case of the Pre-University Education Index.
- Changes in the components, as in the case of the Research, Development and Innovation (RDI) Index and the Higher Education Index.
- Addition, deletion and replacement of variables, as in the case of all six indices. Some changes were also applied to the nomenclature and categorization of certain variables.

The following section is a general introduction to each of the six AKI indices and their relation to sustainable development, with an overview of the indices' main composition and the key changes introduced in the 2016 version.

Pre-University Education Index

The inclusion of this sector as a main constituent index of the AKI reflects its vital role in developing human capital and advancing knowledge. The Pre-University Education Index seeks to reflect the state of education in a specific context, without being limited to the traditional measures of literacy, science, technology, engineering, and mathematics (STEM) education and rates of enrolment.

The Pre-University Education Index measures the efficiency of, and identifies challenges to, the key components of the educational system, taking into account the interaction between outputs, enabling environments and general development contexts.

Based on a desk review of reports and current indices as well as individual and group consultations, the team developed a composite index in 2015 comprising four main pillars: *knowledge capital*; *enabling environments*; *general developmental context*; and *management and governance of the educational system*.

Data for this index was collected from credible international datasets produced by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Bank, and the TIMSS and PISA surveys, among others.

The revised 2016 version of the index devotes additional attention to early childhood programmes and pre-school preparation, assigning them a dedicated sub-pillar under the *enabling environment* pillar. It also added a *health context* sub-pillar under the *development context* pillar, and replaced some variables.

Education is a fundamental right and the basis for progress in every country. Parents need information about health and nutrition if they are to give their children the start in life they deserve. Prosperous countries depend on skilled and educated workers. The challenges of conquering poverty, combatting climate change and achieving truly sustainable development in the coming decades compel us to work together. With partnership, leadership and wise investments in education, we can transform individual lives, national economies and our world.

UN Secretary-General Ban Ki-moon

Source: UNESCO, 2014b.

Technical Vocational Education and Training (TVET) Index

The development of the TVET Index is an attempt to capture the direct results of modern technological advances and corresponding transformations in the labour market, occupations and required skills. Such advances have made acquiring knowledge skills and technological capabilities an essential prerequisite, not only in developing a knowledge economy but also in eliminating unemployment, increasing efficiency and productivity, and empowering youth with skills to achieve sustainable human development.

The first version of the TVET Index (2015) was developed to reflect three dimensions that currently constitute the main features of this

sector in the Arab region:

- 1) The gap between TVET system outputs and labour market needs.
- 2) The very low rates of entrepreneurship despite the prevalence of the concept of self-employment in political, economic and media discourse.
- 3) The Shanghai Consensus on “Transforming TVET: Building Skills for Work and Life”, being a referential document outlining the importance of this sector in the context of human development.

Based on the above, the 2015 TVET Index consisted of three pillars: *labour supply*; *labour demand*; and *entrepreneurship*. However, lack of data represents a key challenge in this sector.

The revised version of the Index (2016) presents a new refined structural model, with changes at the level of the main pillars and the introduction of new sub-pillars to reflect the environments and factors that influence this vital sector. New variables were also added to better understand the dynamics of the TVET sector in the Arab region and identify major areas of weakness. The 2016 TVET Index comprises three main pillars: *education and training*; *organizational framework*; and *development context*.

The objective of Sustainable Development Goal No. 4 is to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Among other things, it aims to:

- By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.
- By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.
- By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.
- By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries.

Source: United Nations, 2015b.

Higher Education Index

The higher education sector constitutes a vital gateway for societies to develop knowledge-based economies that improve development and promote human welfare. Higher education institutions produce the human capital needed by the labour market to achieve comprehensive social and economic development.

The AKI 2015 Higher Education Index is built on a systemic approach based on three interrelated pillars, namely: *higher education inputs, processes* and *outputs*, and their mutual influence with the local context. Data was drawn from credible international datasets such as those of the UNESCO, the World Bank and the Global Innovation Index (GII), while also employing the data collected from the AKR 2014 and other indicators on economic competitiveness and knowledge economy.

The revised version of the index for 2016 maintained the same general structure, but some additional variables were introduced to expand the thematic coverage of the index as well as to address gaps in data availability.

Sustainable human development cannot be brought into being without the existence of a culture of peace ... Conversely, a culture of peace cannot develop in contexts where development levels are tending to stagnate or even fall back, and where private short-term interests take precedence over the quest for sustainable human development for all. ... Higher education establishments have a key role to play by contributing to equitable and sustainable development and to the culture of peace by actively promoting intellectual and moral solidarity (Palermo, I, 1st para) on the basis of respect for human rights, active citizen participation and mutual respect (Beirut).

Source: UNESCO, 1998a.

Information and Communications Technology (ICT) Index

The importance of ICT lies in its direct impact on all sectors, to an extent that has placed it at the centre of governments' visions and strategies aimed at achieving knowledge-based societies. At the same time, the ICT sector is equally influenced by the performance of other sectors related to the knowledge systems. The role of ICT in development is also central because it enhances "North-South, South-

South and triangular regional and international cooperation on and access to science, technology and innovation and ... knowledge sharing on mutually agreed terms".²¹

The 2015 ICT Index was structured around two main pillars: the first consists of sub-pillars that reflect: capacity of information technology infrastructure; communication; cost-to-income ratio; and daily usage by individuals, institutions and governments. The second pillar comprises: the enabling environment, including the quality of elementary, vocational and higher education systems; the state of scientific research and innovation; regulatory framework; ease of doing business; and the efficiency of the healthcare system.

Data was collected from the World Bank, the UNESCO Institute for Statistics, and the World Health Organization's (WHO) Global Health Observatory, as well as from the World Economic Forum's (WEF) annual Global Information Technology Reports.

The revised version of the Index (2016) has seen some changes at the level of nomenclature and variable selection, with no major structural changes.

We are at the cusp of an opportunity to achieve sustainable development, improving the lives of millions of people around the world—and ICTs have an important and distinct role to play in realizing this future. ICTs deliver important, cross-cutting synergies across different sectors, already delivering services such as mobile banking, e-education, e-government and mHealth; making them universally available will create new opportunities, help to protect the environment, and achieve the sustainable development that will transform our world.

Source: Zhao, 2015.

Economy Index

Economy has always been key to human civilization and development, and is at the heart of vital sectors such as politics, education, health and justice.

There is increasing consensus among researchers and economic experts that the economic challenge is the most difficult and important of all, because a sound economy is a decisive

factor in maintaining the independence and sovereignty of a country, in addition to achieving its ambitions in terms of progress and wealth. In light of this, the 2030 Agenda for Sustainable Development dedicates Goal 8 to: “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.”²²

Since economic reform requires an environment conducive to investment (both at financial and human capital levels),²³ the first version of the Economy Index (2015) comprised three pillars to assess countries’ overall economic sectors, namely: *organizational performance and human resources; competitiveness and creative development of the economic structure; and economy-related ICT.*

Data was drawn from credible international sources, notably the WEF, the International Labour Organization (ILO), the UNESCO Institute for Statistics and the World Bank.

Sustained, inclusive and sustainable economic growth is essential for prosperity ... We will work to build dynamic, sustainable, and innovative and people-centred economies, promoting youth employment and women’s economic empowerment, in particular, and decent work for all.

Source: United Nations, 2015b.

Research, Development and Innovation (RDI) Index

Research, development and innovation are among the main elements that distinguish the economies of developed countries from developing ones, and a precondition to achieving sustainable development.

RDI activities are essential to human development as they:

Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors ... Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-

sized enterprises, including through access to financial services and... Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.²⁴

The first version of the RDI Index (2015) highlighted the interactive relationship between the three main pillars of this sector: *political, economic and social environment and infrastructure; innovation; and research and development.*

Data was gathered from international datasets including those of the World Bank, the UNESCO Institute for Statistics, the WEF, the Organisation for Economic Co-operation and Development (OECD) and the Global Competitiveness Reports.

The revised version of the index (2016) saw one key change at the level of the sub-pillars, where the innovation pillar was restructured into two sub-pillars: innovation in production, and social context conducive to innovation and creativity. A number of variables were also added under the pillar *research and development.*

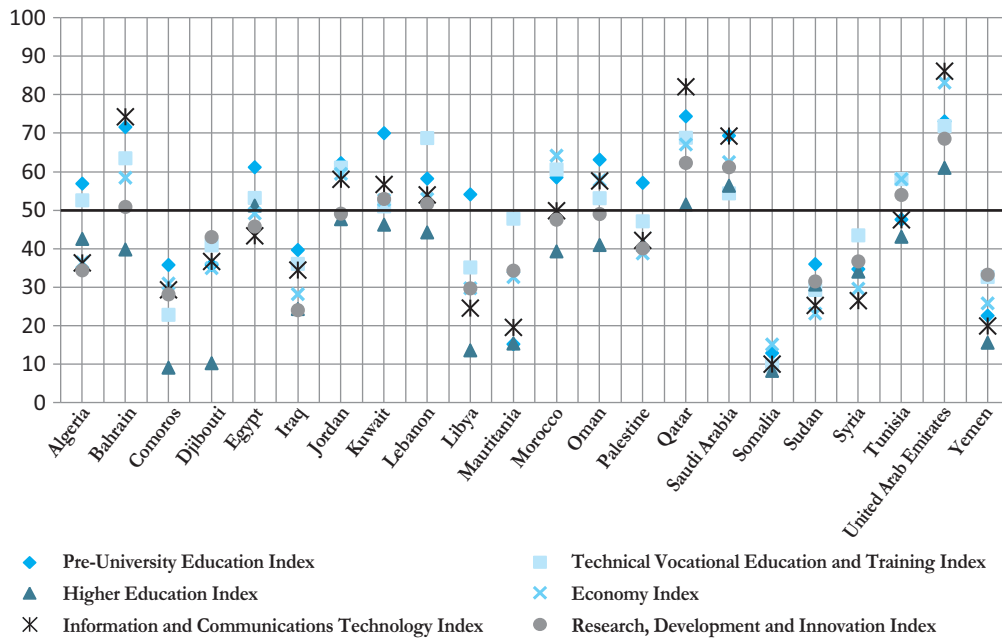
General results of the AKI 2016

According to the general structure of the AKI, six sectoral indices were calculated on a scale from 1 to 100. Results show a wide disparity between Arab countries, as well as between various sectors in the same countries (Figure 2).

- In general, the Gulf Cooperation Council (GCC) countries ranked higher than all other Arab countries on all sectoral indices. The United Arab Emirates ranked first in five sectors (TVET, higher education, economy, ICT, and RDI), while Qatar topped the pre-university education sector. On the other hand, the performance of Comoros, Djibouti, Libya, Somalia, Syria and Yemen was overall poor. Needless to say, some of these countries have been suffering from unstable social, political and security conditions for several years, while the others are achieving low economic growth.

Figure 2:

Performance of Arab countries on the sectoral indices



- Twelve countries made progress in the pre-university education sector, four countries in the TVET sector, two countries in the ICT sector, one country in the economy sector and three countries in the RDI sector.

These trends, which will be analysed in the following chapters, indicate that some Arab countries – such as Bahrain, Qatar, Saudi Arabia and the United Arab Emirates – have recently begun to make advances in several fields. This is a good sign for the Arab region, especially if these countries are willing to share their experiences to allow other poorer-performing countries to replicate and localize their achievements.

When comparing the performance of countries in various sectors a certain disparity emerges. In particular, the following trends are noted:

- There is a narrow disparity between sectors in high ranking countries, which indicates a case of general excellence.
- There is a narrow disparity between sectors in low ranking countries, which indicates a case of general deterioration.
- There is a wide disparity between sectors in countries with medium scores. This indicates unbalanced development efforts, leading to

a significant advance in a certain sector at the expense of another.

Based on the above, it is not possible to talk about an AKI average score. This is because such a score would be misleading for at least two reasons. Firstly, it will not show the results of each country, which defeats the purpose of the AKI (to be a diagnostic tool rather than a ranking tool). Secondly, there is a group of Arab countries which have not performed well because they are experiencing exceptional circumstances; their results will lower the average of the Arab region and offset progress achieved in other countries.

In addition, the scores of the Arab countries highlight the strong link between development and political, social and economic stability. Development has integral, inseparable dimensions. Therefore, development challenges must be countered with integrated and coordinated solutions. Appropriate security conditions are vital; sustainable development cannot be achieved unless there is peace and security, as noted in the Agenda for Sustainable Development (2030 Agenda). As such, the current conditions in some Arab countries could have serious future consequences in terms of knowledge and development, and there is

an urgent need for joint Arab and international efforts to assist these countries in overcoming their crises.

Conclusion

The multitude of challenges faced by the Arab region in the fields of development and knowledge underscore the need for a comprehensive and objective diagnosis of existing gaps and of the root causes behind them. Achieving knowledge-centred sustainable human development necessitates the establishment of reliable and systematic tools to monitor and evaluate the state of knowledge and the related systems in Arab countries.

The Arab Knowledge Index therefore represents a key initiative in achieving sustainable human development in the Arab region. It not only identifies strengths and weaknesses in the

vital sectors of knowledge, but also confirms their close relationship with development, and presents a clear vision for how knowledge may be best employed in a development context.

By monitoring countries' progress in the field of knowledge, the AKI provides many of the diagnostic data required to support development policies and strategies across various sectors in the Arab region. These diagnostic data enable countries to set realistic visions, goals and feasible implementation policies that take into consideration both local contexts and emerging international trends in knowledge and human development.

While observing that no great leap in knowledge may be achieved without measuring and evaluating all contributing sectors, the AKI serves as a tool to centralize and store information as a first step towards devising customized development solutions.

Endnotes

- ¹ The AKR series seeks to establish an objective assessment of the current state of knowledge in the Arab region and present, based on this diagnosis, a set of recommendations on the most suitable means for creating knowledge societies as a prelude to achieving the Sustainable Development Goals (SDGs). Three reports have been co-authored to date by the UNDP and the Mohammed Bin Rashid Al Maktoum Foundation: *Towards Productive Intercommunication for Knowledge* (2009); *Preparing Future Generations for the Knowledge Society* (2012); and *Youth and Localisation of Knowledge* (2014).
- ² Knowledge4All is a digital portal, available in both a web version (www.knowledge4all.com) and a mobile application version (available on the Apple App Store and Google Play) which supports both Arabic and English languages. It seeks to become the referential hub for data and literature on knowledge and development in the Arab region.
- ³ UNDP and MBRF, 2015.
- ⁴ UNDP, 1990.
- ⁵ UNDP, 2003.
- ⁶ Korany et al., 2014.
- ⁷ UNDP and MBRF, 2014.
- ⁸ The workshops were organized with IEA-DPC and the OECD.
- ⁹ United Nations, 2015b.
- ¹⁰ United Nations, 2015a.
- ¹¹ United Nations, 2016b.
- ¹² UNDP and MBRF, 2015.
- ¹³ United Nations, 2016a.
- ¹⁴ UNESCO Institute for Statistics, 2014b.
- ¹⁵ United Nations, 2015b.
- ¹⁶ Ibid.
- ¹⁷ UNDP and MBRF, 2014.
- ¹⁸ World Commission on Environment and Development, 1987.
- ¹⁹ World Bank, 1999.
- ²⁰ Saleh, 2014 (in Arabic).
- ²¹ United Nations, 2015b.
- ²² Ibid.
- ²³ Al-Sunbil, 2002 (in Arabic).
- ²⁴ United Nations, 2015b.



Pre-University
Education Index

Introduction

There is a need to reconsider existing philosophies of teaching and education to better respond to the increasingly complex economic and social challenges and catch up with the continuous scientific and technological advances. Knowledge lies at the core of this rethinking on education and teaching to support a vision that empowers individuals and ensures quality of life to support human development. As Power writes:

An empowering education is one that builds the human resources we need to be productive, to continue to learn, to solve problems, to be creative, and to live together and with nature in peace and harmony. When nations ensure that such an education is accessible to all throughout their lives, a quiet revolution is set in motion: education becomes the engine of sustainable development and the key to a better world.¹

Education is granted increasing prominence in national, regional and international development strategies as well as in the programmes of the United Nations, the World Bank and government as well as non-governmental institutions.

Most notable among these programmes has been the Global Education First Initiative (GEFI), launched by the United Nations Secretary-General Ban Ki-moon on September 26, 2012 to accelerate efforts towards achieving global education goals by 2015 through which he urged countries to fulfil their related obligations. In the words of the Secretary-General, “when we put education first, we can reduce poverty and hunger, end wasted potential and look forward to stronger and better societies for all.”² This personal commitment helped rally “a broad spectrum of actors, including governments, donor nations, the business community, philanthropic organizations and the media ... [to] put education at the heart of the social, political and development”.³

The World Bank offers considerable support in the form of funding and provision of knowledge services such as analytical work, policy advice and technical assistance to help

countries achieve their educational goals. The World Bank’s Education Sector Strategy 2020, *Learning for All: Investing in People’s Knowledge and Skills to Promote Development*, is considered an important framework emphasizing the need to invest in education early, smartly and for all.⁴ The World Bank encourages countries to “jump-start learning through Early Childhood Development (ECD) programs, create a robust learning environment that measures learning and improves accountability, and build skills for a productive workforce”.⁵

Education is also central to the 2030 Agenda for Sustainable Development, where the fourth goal aims to “ensure inclusive and quality education for all and promote lifelong learning”.⁶ The agenda states that “obtaining a quality education is the foundation to improving people’s lives and sustainable development”, and that “bolder efforts are needed to make even greater strides for achieving universal education goals.”⁷ The Incheon Declaration, adopted at the World Education Forum in the Republic of Korea in May 2015, entrusted the United Nations Educational, Scientific and Cultural Organization (UNESCO) with the role of leading and coordinating efforts towards this goal.⁸ The declaration constitutes a historic commitment to achieve education for all and transform people’s lives through a new and more comprehensive vision. A policy paper published in 2015 by UNESCO under the title *Sustainable Development Begins with Education* further underlines the critical role of education in achieving global goals, highlighting that “sustainable development for all countries is only truly possible through comprehensive cross-sector efforts that begin with education”.⁹

Owing to the strong interconnections between education, knowledge and development, governments and international organizations have placed quality education at the top of their strategic priorities. This has led to discussions regarding how best to mobilize the necessary financial and human resources in order to guarantee a renewed and more effective educational system whilst ensuring improved outputs and efficient management of resources. Such discussions have given rise to the emergence of monitoring and evaluation tools as a reliable means for assessing the knowledge status, performance and progress of educational systems.

The use of indicators is essential for developing educational systems, as they help monitor and evaluate the various planning and implementation phases of educational programmes. Their importance also stems from their contribution to promoting accountability and transparency by providing accurate information and data on educational policies and the quality of their outputs. If indicators are well-designed and regularly updated, they can facilitate comparisons of the outcomes of educational systems over time and across different geographical areas, which is important in identifying strengths, weaknesses and best practices. This will equip leaders with the necessary information to efficiently apply resources to driving educational projects forward.

The Pre-University Education Index therefore represents the first step towards developing a methodological tool to measure the efficiency of the pre-university educational system, from pre-school through secondary education. Experts in the Arab region and elsewhere have underscored the relevance of this index while stressing its validity, consistency and reliability. This chapter presents the methodology and results of a review of the 2015 edition of the index, with a view to identifying needs for additional data and means to enhance its overall structure.¹⁰

Formulation process and initial structure of the index

The development of the first edition of the index in 2015 was based on three foundations. The first was drawn from the vision adopted across the three Arab Knowledge Reports, which:

Linked knowledge with development and introduced the goals of joining the broader knowledge society and establishing individual knowledge economies within the framework of an integrated project. Such a project requires the production of high-efficiency human capital with effective cognitive skills (reading, scientific and other skills), social skills (values, attitudes and behaviour dedicated to the principles of positive citizenship and active interaction in daily life) and economic competencies (ability to integrate with the labour market and contribute to developing

the economy), among others. It also aims to provide enabling environments that nurture and motivate the acquisition, production and localisation of knowledge.¹¹

Secondly, the initial index was conceived to expand the concept of knowledge performance beyond measuring educational outputs to also reflect values and the broader contextual environment. Thirdly, the ultimate goal of the index was not simply considered to be about the production of data, but it was rather envisaged to inform decision makers and assist them in devising sound and effective development policies.

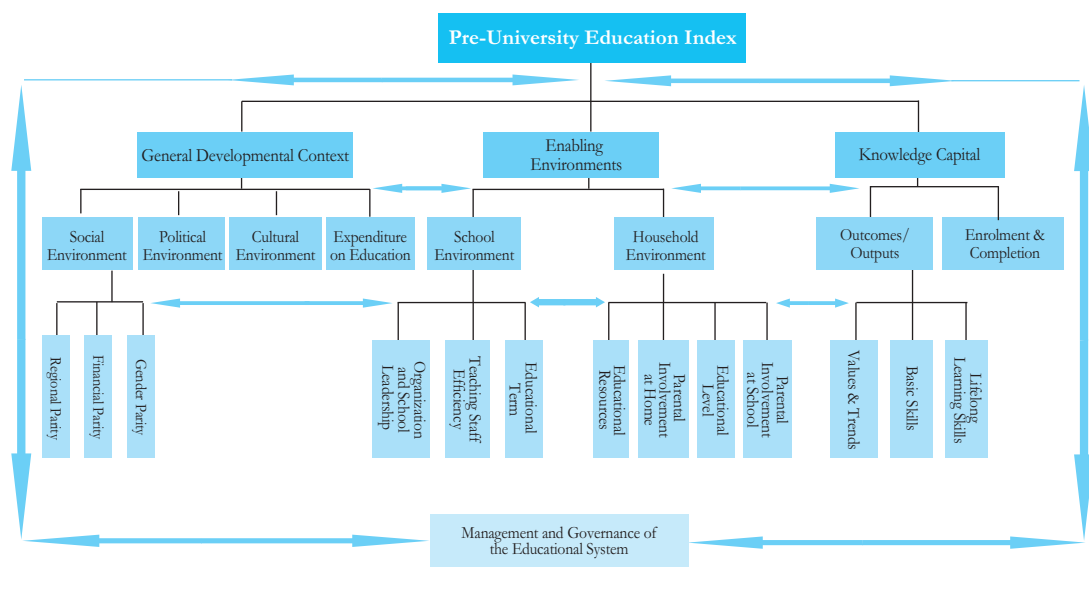
In developing the index, a desk review of a number of reports on education published by regional and international organizations (including UNESCO, the United Nations Development Programme [UNDP], the Arab League Educational, Cultural and Scientific Organization [ALECSO] and the Organisation for Economic Co-operation and Development [OECD]). The review identified existing methodologies, techniques, and databases designed to measure and compare the development of educational systems. Furthermore, a regional workshop was held with education experts from a number of Arab countries and individual consultations were undertaken with specialists on conceptual and technical issues. In addition, three background papers were prepared by experts from Tunisia, Morocco and the State of Palestine on specific constituents of the index.

The process of developing the index included four stages: a preparatory stage to gather and classify available indicators on education; a second stage to examine indicators and analyse their strengths and weaknesses; a third stage to develop the index's general structure; and a final stage to apply the index to the available data, validate the integrity of its structure and ensure alignment with international standards.¹²

In light of the above methodology, a composite index was proposed consisting of four complementary and interconnected pillars: *general developmental context*; *enabling environments*; *knowledge capital*; and *management and governance of the educational system*. The structure of the index is provided in Figure 3.

Figure 3:

The structure of the 2015 Pre-University Education Index



Revisions

The 2016 Pre-University Education Index features some revisions in the structure of the 2015 version. The revision process began with a compilation of the results of the statistical analysis of the 2015 data, the gathering of comments provided by experts, and meetings with international organizations such as the OECD and the Data Processing and Research Center of the International Association for the Evaluation of Educational Achievement (IEA).

Based on this review of the AKI 2015, a number of suggestions were made for enhancing the Pre-University Education Index, the most significant of which were as follows:

- Address data availability challenges for a more comprehensive application of the index.
- Integrate additional variables on social justice and equality, given their influence on the quality of education.
- Link the index and its pillars to the 2030 Agenda for Sustainable Development, thereby adding global benchmarks for comparative analysis.
- Develop additional medium- and long-term recommendations, such as coordinating with national and international education-related

institutions to speed up and improve the process of data collection.

Consultations with international organizations mainly revolved around the following points:

- Conceptually: the term 'pre-university education' was identified as being potentially misleading, as in some educational systems its use is not necessarily limited to pre-school, elementary, preparatory and secondary educational stages, which form the focus of this index. Therefore, a suggestion was made to use the classification of the Supervisory Control and Data Acquisition (SCADA) system, especially considering the intention to broaden the scope of the index from the regional to the global level in the future.
- Statistically: views were exchanged regarding statistical approaches, especially in terms of data availability, weight distribution and data normalization.
- Procedurally: it was proposed that the AKI team could coordinate more systematically with the UNESCO Institute for Statistics and the World Bank Group to gather data and avoid overlaps.

As a result, a limited number of revisions were made to the 2015 Pre-University Education Index, as shown in the following sections.

Revisions applied to the main structure

The scope of the index was expanded to reflect the important role of pre-school education in building a child's personality and equipping him/her with knowledge that facilitates learning in subsequent stages, as well as enhancing cognitive and social skills. The 2015 Index focused on enrolment rates at the pre-elementary level to assess a country's education coverage. However, it proves to be equally important to explore qualitative aspects. Therefore, a third sub-pillar, *early childhood education*, was added under the *enabling environment* pillar.

The World Bank's Education Sector Strategy 2020 calls for encouraging early childhood learning and stresses the importance of continuity, both within and outside the formal schooling environment. The science of early childhood development indicates that healthy brain growth in children requires inputs and attention long before the officially-recognized age for starting school – six or seven years old. This potential for development necessitates investment in prenatal health care and early childhood development programmes. Similarly, the quality of education received in the first few years of learning is critical to equipping children with basic reading and mathematics skills, both of which are essential for lifelong learning.¹³

Many studies show the existence of a strong link between early childhood learning and educational attainment in the subsequent stages of education. More than twenty studies conducted in Latin America, sub-Saharan Africa, and both South and South-East Asia indicate that “stimulating children's cognitive development early has large positive effects on children's future trajectories”, and that “good early childhood care and education has a more significant positive impact on children from disadvantaged groups, making it a sound investment, and linking it to long-term positive impacts on education outcomes.”¹⁴

As such, the decision to create a sub-pillar for early childhood (pre-school) programmes under the Pre-University Education Index is consistent with global understanding and trends, as well as with the 2030 Agenda for Sustainable Development.

The variables adopted to represent and reflect this relation are derived from UNICEF's Multiple Indicator Cluster Surveys database¹⁵, which are based on periodical surveys conducted internationally, including in a number of Arab states.

Secondly, the use of technology in education and school management was included in this year's version given the wide reach and use of ICT within classrooms and beyond, ICT integration in teaching and learning has become a common feature of educational system reform plans. The end is not solely to introduce ICT, but rather to encourage its employment as a means to improve curricula, teacher qualification programmes, and planning and administration processes, in conjunction with the provision of appropriate teacher training programs and technical support.

Modern technology defies traditional teaching methods, enriches skill sets and expands digital horizons. It can “improve the teaching/learning process by reforming conventional delivery systems, enhancing the quality of learning achievements, facilitating state-of-the-art skills formation, sustaining lifelong learning and improving institutional management.”¹⁶

The functional role of ICT in improving education has led to the creation of indicators that monitor its application and consequent results. Examples of this are the Eurydice Network, which gathers information on how education systems in Europe function, and the OECD Centre for Educational Research and Innovation (CERI), which offers a series of case studies on integrating technologies in the education sector. In addition, a number of countries, including the United States, Australia, Singapore and China, have developed guiding principles and standards specific to the use of ICT in education.

In light of the above, the AKI team decided to focus on ICT usage and its contribution to the quality of education within the teaching/learning process. As such, ICT use which was previously a sub-component (*ICT equipment*) of the *organization and school leadership* component in the 2015 index, is now featured and elevated to be a separate component on its own, titled *use of education technology*. This component now has two

sub-components: *technological infrastructure and use of CAI technologies*.

Third, a sub-pillar on the health environment under the *development context* pillar was added. This change was introduced to reflect the reciprocal relationship between health and the educational system. Providing proper health care from early childhood, including basic medical attention in schools, improves children's chances of learning and developing skills. In turn, as societies reach higher levels of educational attainment, individuals are more aware of health risks and of the preventative measures required to maintain their health. Health is one of the main Sustainable Development Goals, which emphasize the necessity of ensuring good health and well-being for people of all ages through the provision of quality health-care services and coverage.

A health environment that is conducive to knowledge and development includes a health care system that provides high quality services to all. However, wide discrepancies in the quality and accessibility of services exist in the Arab region today. In this regard, the World Health Organization's (WHO) Global Health Observatory (GHO) publishes the World Health Statistics annual report to provide data on key health indicators and progress toward the health-related SDGs. Therefore, to reflect the above in the *health context* sub-pillar, the AKI team relied on a set of variables published by the GHO relating to quality of education.

Moreover, sub-components targeting groups with special needs (such as disabled and talented persons) were added. Most human characteristics (physical, mental, sensory, social, reactory, communicative, etc.) in any given society are viewed in terms of what is "average" and is therefore perceived as "normal". This leads to the emergence of two minorities: those below average and those above average – the disabled and the talented, respectively. There is a need to monitor the conditions experienced by these groups and track their integration, and the extent to which they enjoy good quality education adhering to the principles of justice and equality.

The tenth Sustainable Development Goal aims to reduce inequality within and among countries,

and recommends adopting a holistic approach to policies that consider the needs of disadvantaged and marginalized populations.¹⁷ Its objective is "by 2030, [to] empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status".¹⁸

Those with disabilities are accorded more attention than highly talented people both at the national and international levels. For example, two out of ten education-related goals in the 2030 Agenda for Sustainable Development refer to the disabled, while none refer to gifted and talented individuals. Furthermore, no United Nations convention exists concerning talented people, whereas the UN Convention on the Rights of People with Disabilities was adopted in 2006.¹⁹ In recent years, ALECSO developed a strategy to nurture talented persons in the Arab region, but no practical steps were taken to implement it. Both of these groups have special needs that need to be given due consideration in order to avoid their exclusion or marginalization.

The AKI core team believed it was necessary for the Pre-University Education Index to assess the measures taken by policymakers to support students with special needs. Therefore, the aim was to introduce variables related to the legal, institutional, regulatory and educational requirements for the integration of all kinds of people with special needs in society under the *school environment* sub-pillar. However, lack of sufficient data constitutes a challenge for the AKI team, as it requires conducting systematic surveys in the short term to fill the data gap.

As for the fourth pillar, *management and governance of the educational system*, the persistent lack of data (such as on the management styles of various authorities, the distribution of powers at the central and local levels, monitoring and evaluation processes, control and accountability systems, etc.) still hinders its activation.

The only initiative launched in this regard is the Systems Approach for Better Education Results (SABER),²⁰ which fills a critical gap in knowledge and data related to international education.²¹ Despite its incomplete status, the SABER initiative could still help countries conduct comprehensive evaluations and analysis

of their education policies and institutions, in addition to providing stakeholders with a tool for effective policy dialogue.

As for the relative weights of the various constituents of the index in its new structure, the first pillar, *knowledge capital*, will still have the highest weight of 40%, with the remaining 60% being equally distributed between the other two pillars: *enabling environment* and *development context*. The weights of the pillars were then equally distributed among all corresponding sub-categories taking into account the new changes, as detailed in Table A1 in the Annex.

Revisions applied to the variables

The newly added *early childhood education* sub-pillar consists of two components, *enrolment* and *outcomes*, that together include a total of three variables; two variables constituted the *enrolment* component, namely, *gross enrolment ratio in pre-primary education* (previously part of *enrolment and completion*) and *attendance in early childhood development* (new variable). The one newly added variable *Early Child Development Index* was placed under the *outcomes* component. The relative weight of the sub-pillar was divided equally among its two components, whose weights were in turn distributed across their respective variables in an equal manner.

The new component *use of education technology* under the *school environment* sub-pillar consists of five variables: *Internet access in schools*, *educational institutions with computer-assisted instruction (CAI)*, *educational institutions with computer laboratories*, *strategies to promote integration of ICT in education and curriculum including recommendations for ICT-assisted instruction in mathematics, natural sciences, social sciences, reading, writing and literature and second language*. The weights of the sub-components were equally divided among their corresponding variables.

The six variables incorporated under the *health context* sub-pillar include the following: *access to improved sanitation facilities*, *total health expenditure*, *life expectancy at birth*, *total density of hospitals per 100,000 population*, *average of 13 international health regulations core capacity scores* and *skilled health professional's density per 10,000 population*.

The revised version of the *development context* pillar includes new variables calculated by the AKI team to better reflect required data related to gender and regional parity.

The new variables under the *regional parity* component are: *urban vs. rural improved sanitation facilities*, *urban vs. rural improved water source*, and *urban vs. rural Composite Coverage Index*; also four previous variables reflecting the difference in the net attendance rate in primary education and the poverty gap between urban and rural areas were replaced with two new ones calculated by the AKI team namely, *urban vs. rural net attendance rates in primary education* and *urban vs. rural poverty gap at national poverty lines*.

As for the *gender parity* component, three team-calculated variables were added: *gender parity index for youth literacy rate (15-24 years)*, *gender parity index for literacy rate (25-64 years)* and *gender parity index for elderly literacy rate (65 years and above)*. Additionally, two team-calculated variables *difference between rates of unemployment for females and males* and *difference between the percentage of women and the percentage of men in parliament* replaced previous related variables for more accurate results.

Certain variables were also removed after careful consideration as their impact on the 2016 index was negligible compared to other variables or factors.

These are *do you trust or distrust the following groups: teachers* under the *knowledge capital* pillar; *how much do you agree that you feel comfortable using computers in your teaching* (opinions of mathematics and science teachers separate) under the *enabling environments* pillar; the eight variables *gross enrolment ratio for pre-primary education*, *gross enrolment ratio for primary education*, *gross enrolment ratio for lower secondary education*, *gross enrolment ratio for secondary education*, *gross graduation ratio from first degree programmes in tertiary education (gender parity index)*, *female labor force participation rate*, *income share held by lowest 20%* and *income share held by highest 20%* also under different constituents of the *general developmental context* pillar.

The changes applied to the variables of the 2015 Pre-University Education Index are summarized in Table 1.

Table 1:

Changes applied to variables in the 2015 Pre-University Education Index[†]

Variable	Modification
Knowledge capital pillar	
Gross enrolment ratio, pre-primary, both sexes (%)	Moved*
Do you trust or distrust the following groups: the teachers?	Removed
Enabling environment pillar	
Attendance in early childhood development (36-59 months)	Added
Early Child Development Index	Added
Computers available for instruction	Replaced**
How much do you agree that you feel comfortable using computers in your teaching? [‡] (mathematics teachers)	Removed
How much do you agree that you feel comfortable using computers in your teaching? [‡] (science teachers)	Removed
Educational institutions with computer laboratories	Added
Strategies to promote integration of ICT in education	Added
Curriculum includes recommendations for ICT-assisted instruction to form part of subject delivery in mathematics, natural sciences, social sciences, reading, writing and literature and second language	Added
Development context pillar	
Access to improved sanitation facilities (% of population)	Added
Total health expenditure (% of GDP)	Added
Life expectancy at birth, both sexes (years)	Added
Total density per 100000 population: hospitals	Added
Average of 13 international health regulations core capacity scores	Added
Skilled health professional's density (per 10000 population)	Added
Gross enrolment ratio, pre-primary, both sexes %	Removed
Gross enrolment ratio, primary, both sexes %	Removed
Gross enrolment ratio, lower secondary, both sexes %	Removed
Gross enrolment ratio, secondary, both sexes %	Removed
Gross graduation ratio from first degree programmes (ISCED 6 and 7), in tertiary education gender parity index (GPI)	Removed
Unemployment, female (% of female labor force)	Replaced**
Proportion of seats held by women in national parliaments (%)	Replaced**
Labor force participation rate, female (% of female population ages 15+)	Removed
Income share held by lowest 20%	Removed
Income share held by highest 20%	Removed
Net attendance rate, primary, urban, both sexes (%)	Replaced**
Net attendance rate, primary, rural, both sexes (%)	Replaced**
Rural poverty gap at national poverty lines (%)	Replaced**
Urban poverty gap at national poverty lines (%)	Replaced**
Youth literacy rate, population 15-24 years, gender parity index (GPI)	Added
Literacy rate, population 25-64 years, gender parity index (GPI)	Added
Elderly literacy rate, population 65+ years, gender parity index (GPI)	Added
Improved sanitation facilities (%), urban vs. rural (net difference)	Added
Improved water source (%), urban vs. rural (net difference)	Added
Composite Coverage Index (%), urban vs. rural (net difference)	Added

* The variable has been moved to another pillar in the index. For more information, refer to Table A1 in the Annex.

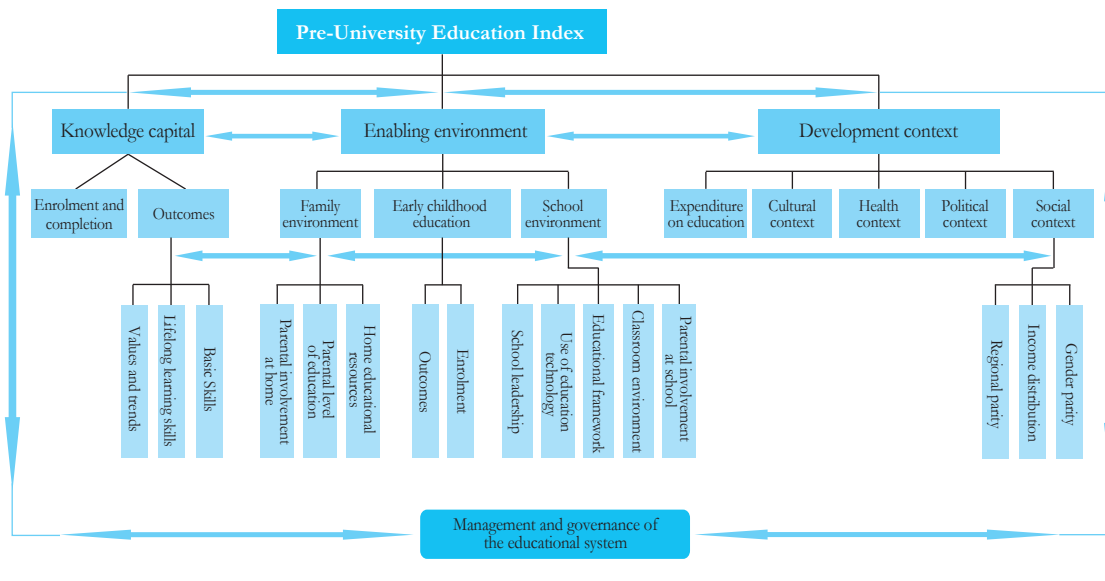
** The variable has been replaced with another one. For more information, refer to Table A1 in the Annex.

[†] The names of the pillars have been updated to include changes resulting from the 2016 revisions.

Revised structure (2016 version)

Figure 4:

The revised structure of the Pre-University Education Index



Results

The results of the Pre-University Education Index show that the Gulf Cooperation Council (GCC) countries topped the rankings (Figure 5), where Bahrain, Qatar, and the United Arab Emirates all scored above 70. This is consistent with the results of other international studies such as the TIMSS and PISA surveys.

The progress in the performances of the education sectors of GCC countries is particularly due to the high scoring in those indicators capturing the general state of development. For example, the Global Innovation Index, the Innovative Capacity and Localization of Technology indices, as well as the Global Competitiveness Indicators, Arab Competitiveness Indicators and others confirm that the GCC countries outperform other Arab countries and even some countries in other regions. This is not merely the result of access to financial resources - as many might assume. In fact, other Arab countries with a significant financial capacity scored less than others with fewer resources.

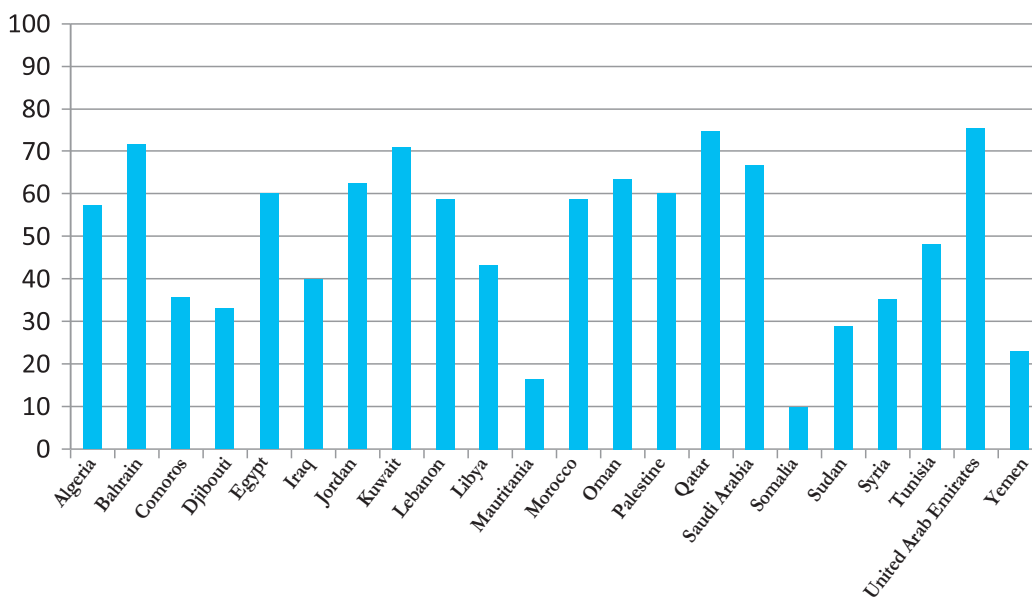
Arab countries that scored less than 50 all suffer from volatile conditions as a result of political

and social crises or conflict. This confirms that performance of the education system is sensitive to the social, political and economic environment. According to UNICEF's report, *Education Under Fire: How Conflict in the Middle East is Depriving Children of their Schooling*,²² conflicts in the Middle East have prevented at least 13.7 million children from attending school in Iraq, Libya, Sudan, Syria and Yemen. This represents 40 percent of total school-age children in these countries, with at least two million children out of school in each country. War and conflict not only damage infrastructure, but are also an obstacle to teaching and affect children's desire to study and learn. In this respect, Peter Salama, Regional Director for UNICEF in the Middle East and North Africa, pointed out: "It's not just the physical damage being done to schools, but the despair felt by a generation of schoolchildren who see their hopes and futures shattered".²³

The results of the pillars mainly reflect the ones of the sectoral index. Among countries which scored above 50 on the overall index, six countries (Bahrain, Jordan, Kuwait, State of Palestine, Qatar and the United Arab Emirates) scored above 50 on all three pillars, but with wide disparities between them. Some countries scored below 50 on the *enabling environment* pillar (Morocco, Oman and Saudi Arabia), and

Figure 5:

Results of Arab countries on the Pre-University Education Index



the *development context* pillar (Algeria, Egypt and Lebanon). Three countries scored above 50 on only one pillar (Djibouti and Tunisia on the *development context* pillar, and Iraq on the *enabling environment* pillar). The remaining countries scored below 50 on all three pillars (Figure 6).

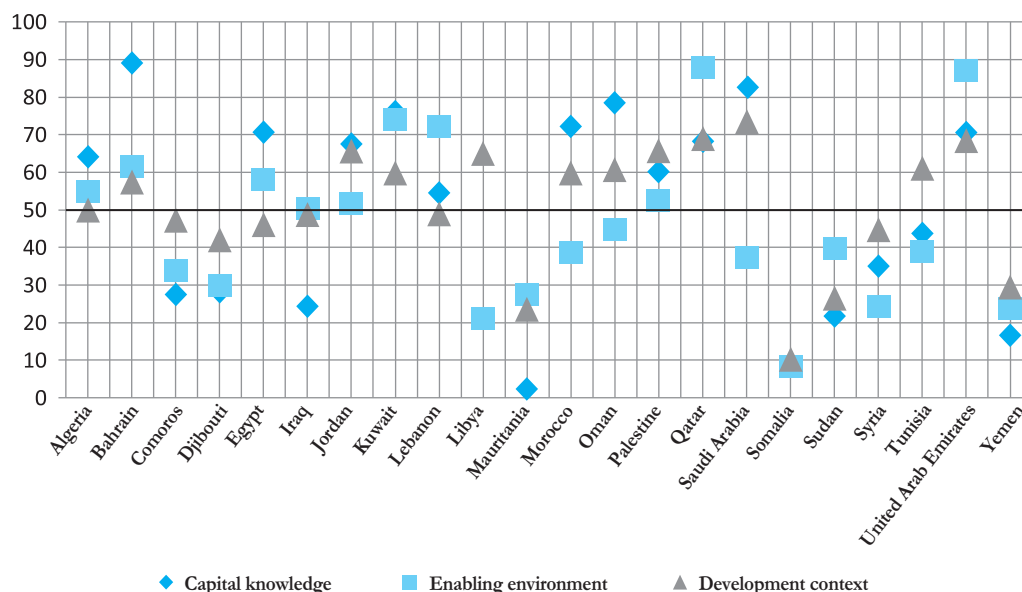
Generally, there is a positive correlation between these pillars, but this is not sufficient to confirm the existence of coordinated efforts to improve the various components of these education

systems. Correlation coefficients ranged from 0.573 to 0.668, which indicates a need for more coordination and integration.

In terms of the sub-pillars, lack of data prevented the calculation of scores for some countries. For example, the *outcomes* sub-pillar was not calculated for seven countries, including Egypt and Libya. The *family environment* sub-pillar was not calculated for 11 countries, including Algeria, Egypt, Iraq, and Kuwait. The *early*

Figure 6:

Results of Arab countries on the main pillars of the Pre-University Education Index



childhood education sub-pillar was not calculated for seven countries, including Bahrain, Kuwait, Saudi Arabia and the United Arab Emirates. This is in itself an important sign, as it indicates a lack of interest in these environments, which results in the inability to monitor their progress and make consequent improvements.

The available data reveals wide disparities at two levels: among Arab countries, and between the components of the sub-pillars within the same countries:

- The first pillar, *knowledge capital*, consists of two sub-pillars: *enrolment and completion* and *outcomes*. Most Arab countries performed well on the first sub-pillar (Oman scored highest at 92.39), while Djibouti, Iraq, Syria, and Yemen lagged behind. In terms of the *outcomes* sub-pillar, 10 countries scored above 50, with Bahrain, Morocco, Saudi Arabia, and the United Arab Emirates scoring the highest. Five countries scored below 50, and data was not available for seven countries.
- For the second pillar, *enabling environment*, the results showed different scoring in its sub-pillars. Only five countries (Bahrain, Jordan, Lebanon, Qatar and the United Arab Emirates) scored above 50 on the *family environment* sub-pillar. Seven countries scored above 50 on the *early childhood education* sub-pillar, with Lebanon at the top with 95.92 points. Scores on the *school environment* sub-pillar were relatively better, as 13 countries (including Qatar, United Arab Emirates and Kuwait at the top) scored above 50. In general, these results show an interest by most countries in improving the education environment through the provision of educational equipment, teacher training, reducing classroom overcrowding, increasing cooperation with parents, etc. All of these are important and necessary steps, but they are not sufficient to improve the quality of the education system's outputs. There is an urgent need to exert greater effort towards improving the household environment, nurseries, and other institutions that contribute to children's upbringing. More attention should also be devoted to monitoring and evaluating the performance of these institutions through regular collection of relevant data.

- Regarding the *development context* pillar, strong positive correlations were noted between its sub-pillars. The highest correlation coefficient was between the *health context* and *social context* sub-pillars (0.896), followed by that of between the *health context* and *cultural context* sub-pillars (0.811). Scores on these sub-pillars varied between and within countries. Looking at the countries for which scores could be calculated on all five sub-pillars, only Saudi Arabia maintained scores of above 50 on all sub-pillars, while Bahrain, Jordan, Oman, Qatar and the United Arab Emirates scored above 50 on four sub-pillars; namely *cultural context*, *health context*, *political context*, and *social context*. The results for the remaining countries were varied, rising above 50 on some sub-pillars and falling below 50 on others. This indicates lack of a clear and balanced approach in dealing with different aspects of development.

A comparison of the performances of countries on various sub-pillars identified an interesting conclusion regarding the link between expenditure on education and the quality of the education system. Six countries scored above 50 on the *expenditure on education* sub-pillar (ranging from 61.27 for Syria to 80.12 for Tunisia). However, no statistically significant correlation was noted between *expenditure on education* and the overall score on the Pre-University Education Index. This confirms the conclusion of previous reports – e.g. World Bank and Arab Knowledge Reports – that returns on investments in education are low when it comes to learning quality because most of the funds are spent on infrastructure, wages, and logistical requirements. This does not mean that financial resources are not important for improving the performance of education systems; it rather implies that no matter how big or small these resources are, the required results will not be achieved in the absence of: a strategic vision that prioritizes the right aspects of the education system; a leadership that is capable of effectively directing the development of the system; and consistent social support for development efforts.

Rather than ranking Arab countries on a scale – which might encourage them to simply improve their results without solving the actual

weaknesses in the system – the Pre-University Education Index focuses on identifying trends based on the scores on the overall sectoral index, as well as its individual pillars and sub-pillars. This helps identify some general characteristics of Arab education systems and the different factors which might affect them.

Comparative analysis of the pillars and constituents of the Pre-University Education Index confirm the need for a coordinated approach in dealing with various aspects of the education system to avoid focusing on one area at the expense of others. Some countries scored highly in certain areas, but very poorly in others, which negatively affected their overall performance. The Pre-University Education Index is based on the influence that enabling environments have on the quality of education outputs. Therefore, there is a need to develop education reform policies that take into account a number of internal links (between components of the education system) and external links (between these components and the surrounding factors which have a direct impact on them).

In addition, the analysis revealed certain areas of excellence in some Arab countries. Having such success stories in Arab countries offers


two advantages. First, it offers the possibility for replicability, given the similar conditions and cultural characteristics in the Arab states (instead of applying lessons from the experiences of countries from other regions that may require lengthy and detrimental adaptation processes). Second, it provides an opportunity for nurturing Arab cooperation and information sharing, especially in those areas of excellence.

Finally, this improved version of the Pre-University Education Index represents an important methodological tool to support the implementation of the fourth SDG which aims to ensure inclusive and quality education for all and promote lifelong learning in the Arab region and beyond. The pillars and components of the index cover several concepts that are included in the education-related SDG targets, such as gender equality, early childhood programmes, literacy for all, education facilities, training teachers, measuring knowledge, skills and values, etc.

Finally, ensuring the availability of adequate data for the index is a critical issue. Plans must be developed to collect such data on a regular basis using methods that guarantee the highest levels of accuracy and objectivity.

Endnotes

- ¹ Power, 2015.
- ² UNESCO, 2016b.
- ³ UNESCO, 2012.
- ⁴ World Bank, 2011.
- ⁵ World Bank, 2014d.
- ⁶ United Nations, 2015b.
- ⁷ Ibid.
- ⁸ UNESCO, 2015b.
- ⁹ UNESCO, 2014b.
- ¹⁰ UNDP and MBRF, 2015.
- ¹¹ Ibid.
- ¹² Ibid.
- ¹³ World Bank, 2011.
- ¹⁴ UNESCO, 2014b.
- ¹⁵ UNICEF, 2016a.
- ¹⁶ UNESCO Institute for Statistics, 2009.
- ¹⁷ United Nations, 2015b.
- ¹⁸ Ibid.
- ¹⁹ United Nations, 2006.
- ²⁰ World Bank, 2016b.
- ²¹ World Bank, 2014b.
- ²² UNICEF, 2015b.
- ²³ UNICEF, 2015a.

The background of the image is white and filled with numerous grey arrows of varying sizes and orientations, all pointing generally upwards and to the right. A prominent blue square is centered on the page, containing the title text in white. The text is arranged in three lines, centered within the square.

**Technical Vocational
Education and
Training Index**

Introduction

Technical vocational education and training (TVET) plays an important role today in harmonizing the outputs of the education sector with the emerging needs of the labour market. It prepares and equips individuals with the skills needed to adapt to the changes occurring in modern economies – specifically in the labour market – and represents a gateway both for building knowledge economies and societies, and achieving sustainable human development.

Given that economic prosperity is closely related to knowledge accumulation and to the level of technological advancement in the production process, which are in turn related to the outputs and development of skilled labour, it is vital to create highly skilled human capital by promoting sustainable TVET and the related institutional development. TVET plays an essential role in addressing unemployment and underemployment, especially among youth, as individuals spend more time in the production system, resulting in better adaptation to its activities and needs. TVET therefore constitutes a means for individuals to transition from training and unemployment to production and work.¹

Arab countries today face a major challenge in revising their TVET policies and better aligning them with emerging trends in knowledge, economics, and development. The two main objectives of this review is to identify and analyse imbalances at the structural level (such as the relation between TVET systems and the requirements of the labour market) and the contextual level (such as traditionally negative stereotypes associated with TVET education and associated professions) that limit the efficiency and social importance of TVET. In this context, the private sector plays an important role and should be more involved in formulating public policies, identifying requirements and priorities, and developing training programmes.²

The United Nations Educational, Scientific and Cultural Organization (UNESCO) and the European Training Foundation (ETF) are among several international organizations that

have stressed the importance of TVET in adapting to emerging development challenges and achieving sustainable human development.

Of particular note is the International Centre for Technical and Vocational Education and Training (UNEVOC), UNESCO's specialized centre for TVET. UNEVOC's mission is to assist United Nations member states in developing policies and programmes related to education for the world of work and skills development for employability and citizenship.³ It sets the basis for methodological approaches to the development of this sector, especially via the definition and introduction of key performance indicators (KPIs) and in emphasizing the link between TVET and sustainable human development.⁴ These efforts have helped to shape a global plan for developing and improving TVET that was adopted as part of the Shanghai Consensus in 2012⁵ and was further developed by UNESCO to form a draft strategy for TVET for the period 2016–2021.⁶

In a similar context, the European Training Foundation (ETF) is the European Commission's centre of expertise for human resource development in partner countries outside the European Union (EU). It focuses on TVET and labour market expertise, while stressing the importance of in-depth knowledge of concerned countries. The ETF has launched several initiatives to develop the TVET sector in partner countries⁷ and its work is distinguished by its innovation and high standards of quality, in addition to its perspective that takes into consideration the specificities of each local context and sector.

The World Bank has also led several initiatives to support the development of the TVET sector, such as the Skills Development Support Project in developing countries, and it has produced a number of framework studies on advancing the TVET sector and youth skills.⁸ This work has been instrumental in developing the concept, structures, and inputs of the TVET index.

At the regional level, interest in the TVET sector has risen as a result of increasing levels of youth unemployment and a growing gap between youth qualifications and the needs of the labour market. In its first report in 2008,

the Arab Labor Organization (ALO) concluded that Arab countries are facing the challenge of structural unemployment owing to a rate of demographic growth that exceeds the adaptation capacity of their systems of production.⁹ This was confirmed in the 2015 Arab Economic Report, which added that the 15–29 year-old age group is the most vulnerable in this cycle of misalignment, especially with the increasing rates of educational attainment.¹⁰ Similarly, reports by the International Labour Office (ILO) observed an increase in unemployment rates among youth in Middle Eastern countries from 27.6 percent in 2012 to 28.2 percent in 2014, and from 29.7 to 30.5 percent during the same period for North African countries.¹¹

These observations point out the need for Arab countries to develop a more comprehensive approach to TVET. Although many Arab countries have attempted such reforms, the effectiveness of these actions remain limited in the absence of clear objectives, systematic KPIs and tools for the monitoring and evaluation of the sector. This makes it difficult to assess the current status of the TVET sector, its inputs, processes, institutions, and outputs, and even harder to develop evidence-based policies to take appropriate corrective actions. Thus, this index on TVET is the first regional Arab attempt to establish such a system of KPIs and apply it systematically as part of a wider vision based on the complex relationship between knowledge and development.¹²

Comparative approaches in the study of TVET systems gained increasing relevance when advanced economies began to enhance labour conditions and work settings, as two main conditions for quality improvement processes. This led many countries to revisit their TVET sector policies, enriching their practices, and directing efforts toward making the sector more capable of attracting and retaining talent.

Consequently, national authorities were established to better align the training system with emerging labour market requirements, while creating more job opportunities for young people, and enabling them to efficiently contribute to the production system. This has had a positive effect on the general perception of the role of TVET systems, no longer simply

considered as support to traditional (primary, secondary and tertiary) education systems. In this regard, many developed countries have already formulated revised strategies for defining regulatory frameworks with clear short-, medium- and long-term objectives and indicators to assess levels of progress and success. International organizations examining the TVET sector are simultaneously expanding their datasets in order to consolidate indicators and definitions, and produce analysis identifying marked growth or underdevelopment and their respective causes.

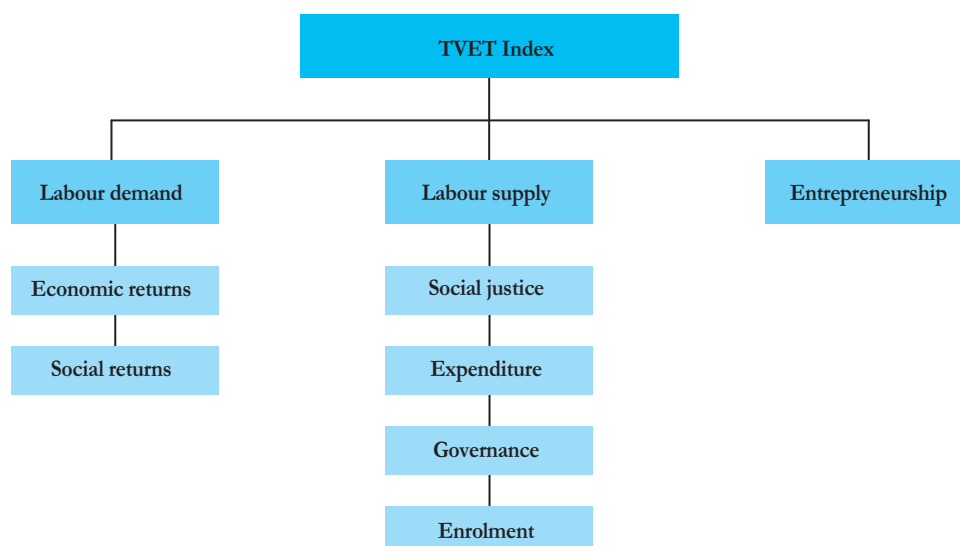
Literature related to TVET remains limited in the Arab region as is emphasized in the Arab strategy for TVET adopted by the Arab Labor Organization in 2010.¹³ Additionally, the generally deficient statistical data is not updated regularly, except in countries working closely with international organizations such as the ILO, UNESCO and the World Bank that require specific information for building their databases set up for studying the sector.

This lack of data also reflects a shortage in the human resources needed to gather the required information, as well as the nature of the governance of this sector. In fact, in the majority of Arab countries, the sector is governed by a subsidiary authority falling under a ministry such as that of education (Egypt), higher education (Sudan, Yemen and the United Arab Emirates) or labour (Algeria, Morocco and Tunisia).

Formulation process and initial structure of the index

This section briefly outlines the methodology used in the construction of the AKI TVET Index of 2015. The methodology involved several stages, including:

- 1) Systematic review of literature available from local, regional and international sources on TVET and various related indicators, particularly in the contexts of knowledge and sustainable human development. The focus was centred on identifying theoretical and statistical concepts and standards that could be applied in the Arab context.¹⁴

Figure 7:
The structure of the 2015 TVET Index


- 2) The establishment of a preliminary theoretical and structural model, with an ideal set of desired KPIs that could be used to regularly monitor and evaluate the TVET sector in Arab countries and inform future policies and reform plans. The suggested model was evaluated against existing models at the international level, especially in terms of TVET indicators from UNESCO–UNEVOC, without compromising the specificities of the local context for Arab countries.
- 3) The suggested model was then refined and evaluated by a select group of experts and stakeholders from the Arab region and beyond using collective workshops, as well as through personal direct and virtual [electronic] consultations.

At the application stage, the lack of reliable and updated data on the Arab region constituted a major challenge. The variables used to populate the indicators were thus modified in light of the statistics available for the Arab region, while certain constituents were temporarily suspended and kept at the theoretical level for potential use at a later stage.

This process resulted in the development of a 2015 TVET Index consisting of three main pillars and six sub-pillars (Figure 7).

Revisions

Following the release of the 2015 Index, a revision process began to refine the quality of the index based on another round of literature review. This process identified three main trends in the TVET literature for the Arab region:

- 1) Generic approaches that cover the Arab region as a whole, and thus present a general overview and some of the regional data (regional average).
- 2) Constructive approaches that introduce a brief overview at the regional level but then move to present specific details at the country-level – for countries where data is available.
- 3) Comparative approaches among specific country-level practices and analysis. This approach is mainly visible in the literature produced by UNEVOC and the Torino Process.¹⁵

The revision process focused on the second and third approaches – i.e. the constructive and comparative approaches – to take into consideration the local contexts to a better extent (enabling environment, direct and indirect economic factors in addition to the TVET

systems and outputs, with emphasis on factors relating to the knowledge economy).

Because the TVET Index revision involved significant changes to the 2015 version, the AKI team sought a further round of expert consultations for the revised structure, which included consultation with the UNESCO–UNEVOC headquarters in Bonn. This process:

- Confirmed that the theoretical and methodological conceptualizations of the AKI TVET Index are realistic and relevant to the current development needs and challenges facing the Arab region.
- Re-emphasized the need for the Arab countries to be more involved in international efforts to monitor, evaluate, and develop the TVET sector, including at the level of data collection.
- Recommended the use of quantitative indicators, whenever possible, because these indicators better facilitate analysis and constructive comparison across time and countries.
- Recommended that the index results be read and analysed in relation to UNESCO's *Education 2030 Framework for Action* (based on the Incheon Declaration and Framework for Action).¹⁶
- Recommended that greater emphasis be given to the indicators relating to the general assessment of the TVET sector, use of new technologies, entrepreneurship, lifelong learning, green learning, self-employment, and other relevant variables in the context of TVET and sustainable human development.

In addition to these consultations, statistical application confirmed the capacity of the index to reflect some of the main features of the TVET sector in the Arab region.¹⁷ The main challenge, however, remains the need to collect reliable and credible data, and enhance mechanisms of cooperation through the involvement of relevant stakeholders.

Revisions applied to the main structure

The main structure of the index underwent considerable changes, reflecting more data.

The first pillar of the TVET Index is now the *education and training* pillar. In addition to focusing on the systems and structures of training, this pillar considers the dynamism of human capital in order to assess the reception structures and qualifications of TVET institutions as well as the relation between TVET and the labour market.

Through its two sub-pillars (*enrolment and relation with the labour market*), this pillar focuses on the capacity of TVET institutions, their ability to attract and retain talent, and the training of teaching and managerial/administrative staff. It also takes into consideration the geographical distribution of TVET students, TVET education tracks, and TVET education patterns.

The revisions made to the 2015 Index aimed to enrich this pillar, particularly in terms of placing more emphasis on both human capital and interaction with the labour market. UNESCO–UNEVOC, among other international organizations, has always noted the critical role of the human factor in improving the quality of this sector and achieving better alignment with the labour market.¹⁸

The *relation with the labour market* sub-pillar was introduced in light of the review of international literature; it links the inputs of the TVET sector with its outputs, and compares them in terms of alignment with the requirements of the labour market, reflecting a collaborative perspective.

Another conceptual indicator under this pillar is the ability of the TVET sector to compete with other sectors of formal education. The pillar attempts to reflect the capacity of this sector to attract youth, at least at the quantitative levels of enrolment, completion, and graduate employment. This capacity goes hand in hand with enhancing the visibility of the TVET sector in the policymaking process.

Reference here should be made to the balanced relationship between the sector's capacity to attract youth and talent, its institutional capacity, and its budget. The latter is often a challenge, especially in light of the rising number of

students and administrative costs, which leave little or no budget for quality improvement, the revision of the education process and curricula, and capacity building.

The second structural change in the index is the introduction of the second pillar *organizational framework* that seeks to assess the organizational framework of TVET sector institutions and the economy in relation to TVET. It consists of two sub-pillars: *economic policies* and *labour market features*.

The regulatory framework of the labour market contributes to the establishment of a production environment that can adapt to the increasing number of graduates and provide more opportunities, especially to educated youth. In this context, UNESCO–UNEVOC has continuously highlighted the importance of devising and using scientific indicators to assess the quality of the regulatory environment for the TVET sector, including pedagogical assessment of TVET institutions, the effectiveness and efficiency of available processes and frameworks, sector-specific strategies, and regulatory authority.¹⁹

Also under the *organizational framework* pillar, a new sub-pillar was introduced on *quality regulations*. However, this sub-pillar has been temporarily suspended given a general lack of data.

The third change at the level of the main structure consisted of a third pillar focusing on the contextual factors that affect the technical vocational education and training sector. It includes three sub-pillars – *education, demography, and state of development* – and a wide array of variables that help create a clear picture of the general development context.

The weights of the main pillars were also revised after all structural changes were applied; a weight of 0.2 was given to the *education and training* pillar, 0.5 was attributed to the *organizational framework* pillar, and 0.3 to the *development context* pillar. These weights were then equally divided among their respective sub-pillars and subsequent constituents as shown in details in Table A2 in the Annex.

Revisions applied to the variables

New variables were added to the first pillar *education and training*, which include the following: *inadequately educated workforce, extent of training for TVET students, availability of specialized training services, percent of firms offering formal training, TVET involvement in entrepreneurship, participation of TVET authorities in the organising body for the TVET examinations, and finally, participation of TVET authorities in the committees responsible for setting the TVET curricula.*

The *organizational framework* pillar also consists of new variables that present an overview of the social element of the work environment, and of the extent to which Arab countries adhere to the requirements of international labour rights. These variables include: *availability of a government authority to regulate labour to supply and demand, percentage of labor force not contributing to social security, disputes rate per 1000 workers, mean weekly hours actually worked per employed person, and female participation in the labor force as a ratio to men.*

The pillar also includes other newly added variables: *total investment as percentage of GDP, tax incentives for young businesses, number of procedures for starting a business, ease of doing business, high-skilled employment share, poor work ethic in national labor force, labor force with less than primary education as a percentage of the total labor force, total tax rate as a percentage of commercial profits, ratio of minimum wage as a share of value added per worker, pay and productivity, labor market efficiency, restrictive labor regulations, and labor regulations.*

Finally, the new variables constituting the *development context* include the following: *government expenditure per primary and secondary student as a percentage of GDP per capita, higher education and training, adult literacy rate, gender parity index for gross enrolment ratio in primary education, rate of out-of-school children of primary school age, net enrolment rate in secondary education, net enrolment rate in primary education, percentage of employment in agriculture, percentage of population growth rate, AKI 2015 Economy Index, Human Development Index and finally GDP per capita.*

The variables that were added this year under the new pillars of the TVET Index are shown in Table 2.

Table 2:**Changes applied to variables in the 2015 TVET Index*†**

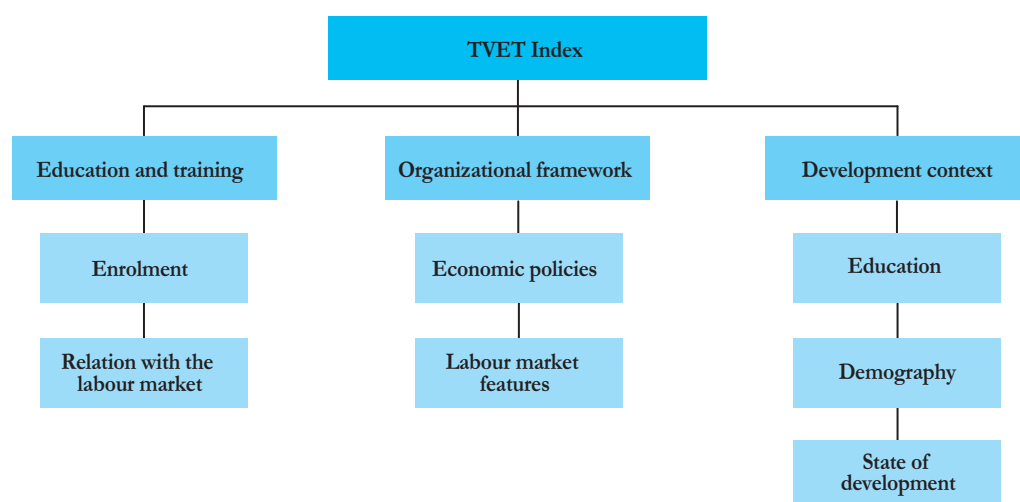
Variable	Modification
Education and training pillar	
Percentage of students in secondary education enrolled in vocational programmes, both sexes (%)	Added
Percentage of students in secondary vocational education who are female (%)	Added
Inadequately educated workforce	Added
Extent of training for TVET students	Added
Availability of specialized training services	Added
Percent of firms offering formal training	Added
TVET involvement in entrepreneurship	Added
Participation of TVET authorities in the organising body for the TVET examinations	Added
Participation of TVET authorities in the committees responsible for setting the TVET curricula	Added
Organizational framework pillar	
Total investment (% of GDP)	Added
Tax incentives for young businesses	Added
Starting a business, procedures (number)	Added
Ease of doing business	Added
High-skilled employment share (25-54 age group)	Added
Poor work ethic in national labor force	Added
Labor force with less than primary education (% of total labor force)	Added
Total tax rate, % of commercial profits	Added
Ratio of minimum wage as a share of value added per worker	Added
Disputes rate per 1000 workers	Added
Mean weekly hours actually worked per employed person	Added
Pay and productivity	Added
Female participation in the labor force, ratio to men (15+)	Added
Labor force not contributing to social security (percent)	Added
Labor market efficiency	Added
Restrictive labor regulations	Added
Labor regulations	Added
Availability of a government authority to regulate labour supply and demand	Added
Development context pillar	
Government expenditure per primary and secondary student as % of GDP per capita (%)	Added
Government expenditure on education as % of GDP (%)	Added
Higher education and training	Added
Adult literacy rate, population 15+ years, both sexes (%)	Added
Gross enrolment ratio, primary, gender parity index (GPI)	Added
Rate of out-of-school children of primary school age, both sexes (%)	Added
Net enrolment rate, secondary, both sexes (%)	Added
Net enrolment rate, primary, both sexes (%)	Added
Employment in agriculture, both sexes (%)	Added
Population growth rate (%) (Average annual)	Added
AKI 2015 Economy Index	Added
Youth unemployment rate (%), 15-24 age group	Added
Unemployment rate (%), (15+)	Added
Human Development Index (HDI)	Added
GDP per capita (current US\$)	Added

* For more information on the variables populating the previous structure, refer to Table A2 in the Annex of AKI 2015.

† The names of the pillars have been updated to include changes resulting from the 2016 revisions.

Figure 8:

The revised structure of the TVET Index



Revised structure (2016 version)

The revision process led to the adoption of a refined structure for the TVET Index 2016 (Figure 8).

Results

The TVET Index results show wide disparities among countries, with a gap of 62.24 points between the highest score (71.81 for the United Arab Emirates) and the lowest score (9.57 for Somalia). Twelve countries scored 50 and above. These include all of the GCC states, as well as Algeria, Egypt, Jordan, Lebanon, Morocco, and Tunisia. Four countries (Comoros, Somalia, Sudan and Yemen) scored 33 and below (Figure 9), where the unstable political, economic and security conditions play a major role in determining such low results.

The GCC countries topped the *development context* pillar, while Egypt, Lebanon, Mauritania, Morocco, and Tunisia topped the *education and training* pillar (Figure 10).

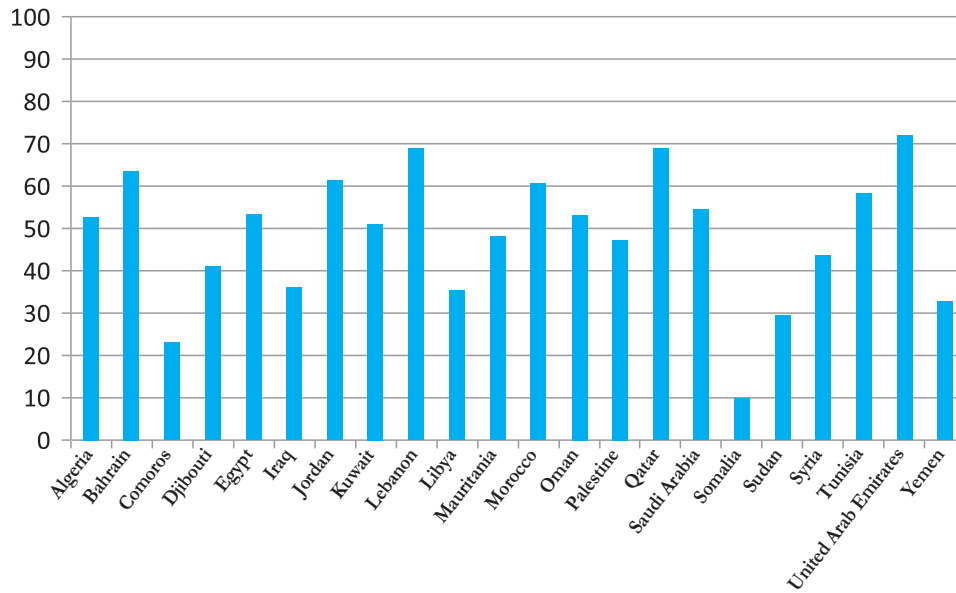
The *organizational framework* pillar shows correlation with the *education and training* pillar (a correlation coefficient of 0.513) as well as the *development context* pillar (a correlation coefficient of 0.599). No statistically significant correlation was noted between the *education and training* pillar and the *development context* pillar.

For the *organizational framework* pillar, the scores varied widely. This can be explained by the disparity in efforts made by Arab countries to modernize their legal and administrative structures, including those related to employment and labour markets. The United Arab Emirates ranked first, which is a natural result of its efforts over the years to reform its economic structures, link development with the qualification of human capital, and ensure that a knowledge-based economy becomes a key pillar of its competitiveness. Qatar came second with a score of 69.87, followed by Morocco at 65.32. These three countries were able to dynamically modernize their administrative structures and develop their investment sectors.

The *education and training* pillar covers variables that measure aspects of the TVET sector such as *enrolment* and *relation with the labour market* (i.e. inputs and outputs). Scores on the enrolment variables were above 90 in Egypt and Lebanon, but below five in Oman, Qatar, and Somalia. These scores certainly reflect development priorities that are linked to the economic and demographic realities of these countries. Low TVET enrolment levels in some countries imply these countries will not face a crisis of unemployment in this sector specifically – or at least that such crisis will not be as severe as in Egypt, Morocco, or Algeria, where the numbers of TVET graduates have reached record levels, forcing TVET authorities to deal with the problem of vocational training quantitatively

Figure 9:

Results of Arab countries on the TVET Index

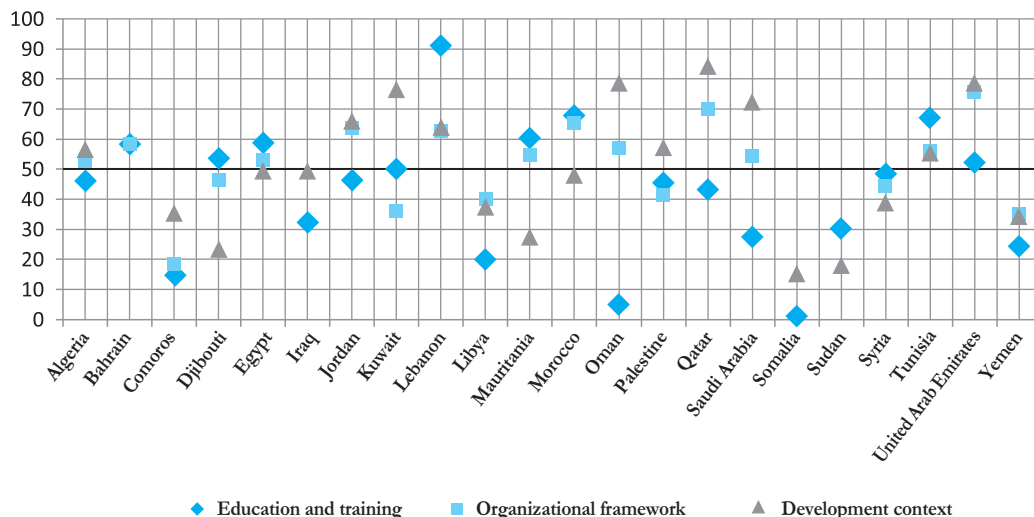


rather than qualitatively. The scores achieved under the *relation with the labour market* sub-pillar indicate important progress in some Arab countries in terms of building a training system that meets the requirements of employers and takes into account the general conditions of the labour market. They also indicate a mismatch between education/training and employment, which can also be seen in other sectors such as economy, higher education, and pre-university education.

A review of the scores on the *organizational framework* pillar shows that 12 countries scored more than 50. Their scores were almost identical for both constituting sub-pillars, except that three countries (Djibouti, Mauritania and Morocco) scored below 50 on the *labour market features* sub-pillar, and four countries (Libya, Oman, State of Palestine and Syria) scored below 50 on the *economic policies* sub-pillar. Scores of the remaining countries were below 50 for both sub-pillars.

Figure 10:

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



Regarding the third pillar, which relates to the *development context* and consists of three sub-pillars; scores were above 50 for 16 countries on the *education* sub-pillar, 12 countries on the *demography* sub-pillar, and eight countries on the

state of development sub-pillar. In fact, these eight (comprising the six GCC countries plus Lebanon and Jordan) topped all three sub-pillars, which indicates a strong correlation between them within the TVET system.

Endnotes

- ¹ European Training Foundation, 2015a.
- ² Arab Monetary Fund, 2015 (in Arabic).
- ³ UNESCO–UNEVOC, 2016a.
- ⁴ UNESCO–UNEVOC, 2014.
- ⁵ UNESCO, 2012b.
- ⁶ UNESCO, 2016a.
- ⁷ The European Training Foundation initiatives include Europass, Skills for Progress, the Open Method of Coordination, the Community of Practice cooperation platform model for TVET teachers and educators in South Eastern Europe, and the Skills for Poverty Alleviation electronic network for the Caucasus and Central Asia.
- ⁸ World Bank, 2013b.
- ⁹ Arab Labor Organization, 2008 (in Arabic).
- ¹⁰ Arab Monetary Fund, 2015 (in Arabic).
- ¹¹ International Labour Organization, 2015.
- ¹² UNDP and MBRF, 2014.
- ¹³ Arab Labor Organization, 2010.
- ¹⁴ Notable in this context is the work of the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit [German Society for International Cooperation]). See for reference: GIZ, 2013; GIZ, 2012; and GIZ, 2009.
- ¹⁵ European Training Foundation, 2010.
- ¹⁶ UNESCO, 2015b.
- ¹⁷ UNESCO–UNEVOC, 2014.
- ¹⁸ UNESCO–UNEVOC, 2013a and 2013b.
- ¹⁹ Ibid.

The image features a central blue square containing the text "Higher Education Index". This square is set against a background of numerous grey arrows of varying sizes and orientations, all pointing generally upwards and to the right, creating a sense of growth and progress. The text is centered within the blue square in a white, serif font.

Higher Education
Index

Introduction

Higher education¹ today serves as a catalyst for improving economic competitiveness,² sparking innovation, and promoting knowledge production and dissemination within society, especially among youth.³ Research indicates that the more a country invests in higher education and the quality of its outcomes, the greater progress it achieves in developing a knowledge-based economy. Countries therefore seek both to increase the capacity of the higher education sector and to enhance the quality of its operations and outputs, with a view to stimulating development,⁴ and improving the welfare and wellbeing of individuals.⁵ This may be achieved by shifting towards student- and development-oriented programs,⁶ offering more specialized training and promoting lifelong learning.⁷

Despite broad agreement on the vital role of higher education, only a very limited body of literature exists that presents an objective assessment of this sector in the Arab region, while statistical and analytical data is often outdated or missing. Hence, there is a need for reliable evidence to inform decision making on how best to develop this sector and optimize its structures and processes. This requires additional, updated, and reliable information on higher education.

A culture of self-evaluation plays a central role in the success of higher education institutions in developed countries. This culture is not only weak in the Arab region, but there is also a major deficiency in the mechanisms that track and evaluate the outputs of higher education institutions.

In spite of the establishment of national accreditation bodies in several Arab countries, as well as the Arab Network for Quality Assurance in Higher Education⁸, there is no periodical publication or database that provides information and analysis of the state of higher education in the region. Consequently, Arab countries have no alternative but to adopt the tools and analyses of international organizations.

International organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Organisation for Economic Co-operation and Development (OECD) recommend monitoring and evaluation of higher education institutions as a means of improving the quality of the sector.⁹

Several countries have established initiatives to monitor the quality of higher education institutions. These programs are either country-specific, such as in La Agencia Nacional de Evaluación de la Calidad y Acreditación (ANECA) in Spain¹⁰, or of a wider scope such as the global network of research universities, Universitas 21, launched in Melbourne and providing an annual ranking of national higher education systems across 50 countries based on a system of 25 indicators.¹¹

In the United States, the Voluntary System of Accountability (VSA) is a similar program managed jointly by the American Association of State Colleges and Universities (AACSU) and the National Association of State Universities and Land-Grant Colleges (NASULGC).¹² The VSA seeks to evaluate learning outcomes, and allows comparison between public colleges and universities in terms of student performance, life on campus, faculty-to-student ratio and other criteria.¹³

Such initiatives reflect an increasing awareness of the importance of monitoring higher education, but existing university rankings have significant drawbacks. Firstly, as indicated by UNESCO they tend to use leading universities as a benchmark for evaluating others.¹⁴ Secondly, whilst available rankings may provide information on leading universities in a specific country in comparison to others, they do not reflect the quality of the broader higher education system or country-specific challenges.¹⁵ This applies to some of the world's most famous university rankings – such as the Shanghai Jiao Tong University's Academic Ranking of World Universities (Shanghai Ranking), Quacquarelli Symonds' QS World University Rankings, the Times Higher Education World University Rankings and the Webometrics Ranking of World Universities. As a result, policymakers tend to overlook

local specificities in their attempts to improve the performance of national universities in international rankings.¹⁶

In response to this, UNESCO's *Position Paper on Education Post-2015* discusses how higher education institutions can adapt to emerging challenges by developing a scorecard that balances the achievement of global goals and individual countries' ambitions.¹⁷ The paper adds that this approach necessitates an assessment of the knowledge, skills and competencies required at the individual level, as well as a reconsideration of educational processes, policies and reforms at the system level.

In this context, the OECD published a feasibility study on developing international standards for measuring the knowledge and abilities of undergraduate students (The OECD Initiative for an Assessment of Higher Education Learning Outcomes [AHELO]). The study focuses on the development of indicators that take into consideration country-specific contexts while also enabling comparison between countries. It recognizes that the majority of international university rankings rely on the university's reputation and performance in research, without sufficient consideration of factors such as quality of teaching and learning, social diversity, and institution-specific goals (where applicable).¹⁸

The Higher Education Index takes all these into account. It was first released in 2015, reflecting both local contexts and global standards.

The index does not benchmark Arab countries against each other, nor against other countries that have already developed more advanced higher education sectors. Instead, it provides a general overview of the higher education sector in each Arab country individually, stressing their respective strengths and weaknesses.

Creating an Arab index for higher education contributes to describing the current status of higher education and it serves as a reference tool for researchers and decision makers to make more informed decisions and develop relevant corrective measures. This would enable setting realistic objectives, reflecting countries' actual needs and priorities.

Formulation process and initial structure of the index

To develop the main pillars for the Higher Education Index, a systematic review of the conceptual foundations of currently available indices in the higher education and knowledge sectors was conducted. These include the Knowledge Economy Index (KEI) issued by the World Bank, the Global Competitiveness Index (GCI)¹⁹ and the Global Innovation Index (GII)²⁰, in addition to the above-mentioned UNESCO and OECD reports.

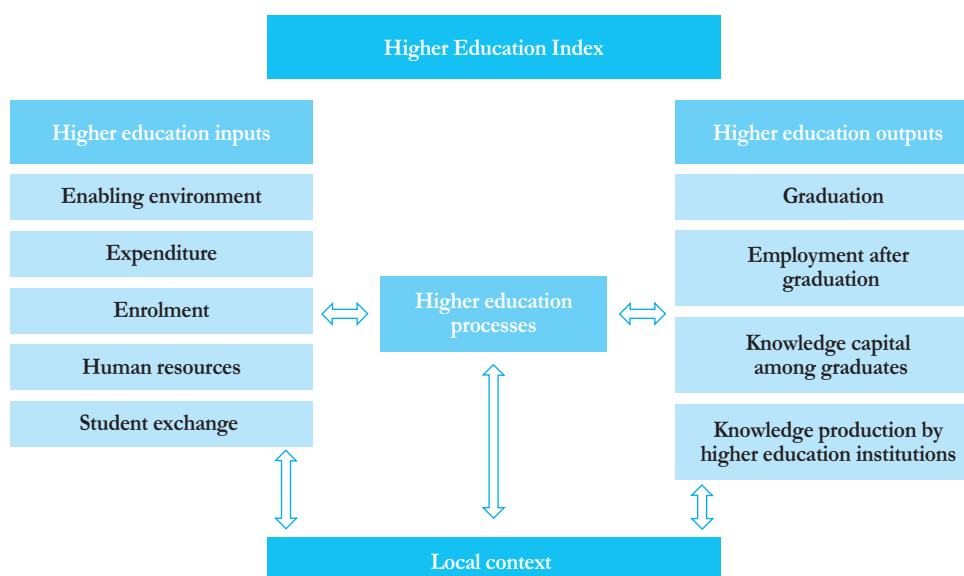
Each organization, institution or researcher may have a different perspective on building an index. For example, the GII includes tertiary education as a sub-pillar under the human capital and research pillar within the innovation sub-index; it considers knowledge through its relation to technology, which is considered an output of innovation.²¹

In a study published in 2011, UNESCO identifies three complimentary pillars of higher education indices: education, research and management capacity. The study also identifies several aspects that should be considered under these pillars, including: access, internal efficiency, relevance and external efficiency, quality of education, professionalization of higher education, capacity for research and innovation, equity, costs and expenditures, and strategic and operational management capacity.²² This division is similar to what was presented earlier in 2010, also by UNESCO, on key indicators for tertiary education, where indicators were grouped into four major categories: input indicators, access/participation indicators, output indicators and other indicators.²³

The approach adopted by the AKI Higher Education Index is to focus on knowledge as both an output of higher education institutions, and a tool for economic and human development. The index also takes into consideration systems theory, as it approaches the higher education sector by examining its inputs, processes, outputs as well as the broader enabling environment. The index considers effectiveness as the extent to which higher education institutions help graduates acquire the knowledge, skills and

Figure 11:

The structure of the 2015 Higher Education Index*



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

values required to positively integrate in society and contribute to its development. Effectiveness is also measured through the number and quality of research and publications produced, and the wider processes of knowledge production, development and dissemination.

The AKI Higher Education Index also follows the recommendations of international institutions in this field by incorporating specific themes such as gender equity, private sector contribution, differences between various disciplines of study, and flow of students.²⁴

The Higher Education Index was built in line with scientific and academic index-development methodologies. After an extensive literature review, the first index was developed in 2015, comprising three pillars and nine sub-pillars, consisting of indicators based on international reports and other new indicators which the research team considered important in the specific context of the Arab region.

As shown in Figure 11, the three pillars of the Higher Education Index in 2015 were: *higher education inputs*, *processes* and *outputs*.

The *higher education inputs* pillar is comprised of five sub-pillars: *enabling environment*, *expenditure*, *enrolment*, *human resources* and *student exchange*.

The *higher education outputs* pillar is comprised of four sub-pillars: *graduation*, *employment after graduation*, *knowledge capital among graduates*, and *knowledge production by higher education institutions*. A third pillar called *higher education processes*, with no sub-pillars, enables the interaction between the inputs and outputs.

Finally, these three main pillars influence and are influenced by the specificities of the local context.

Revisions

The initial 2015 version of the index went through a revision by the core team based on the feedback after its release. These were further reviewed by a select group of education experts. Reviewers confirmed the validity of the pillars, sub-pillars, and the corresponding variables and weights, in addition to the suggested computational methods.

As detailed later in this chapter, this revision has not affected the selection of pillars and sub-pillars but has rather entailed some secondary adjustments in the constituent variables and the distribution of weights.

The revision of the Higher Education Index was conducted with three objectives:

- 1) Validating the structure of the index with its three pillars, nine sub-pillars and constituent variables.
- 2) Addressing some challenges that emerged following the launch of the Higher Education Index in 2015. These include lack of data in two sub-pillars, namely *enabling environment* and *knowledge production by higher education institutions*. The *knowledge capital among graduates* sub-pillar also lacked data, as information on only four countries was available and was extracted from the Arab Knowledge Report 2014.²⁵
- 3) Reviewing the relative weights of each pillar, sub-pillar and variable.

Revisions applied to the main structure

No changes were made to the structure of the index, neither at the level of the three pillars (*higher education inputs, processes and outputs*) nor for the corresponding sub-pillars.

Furthermore, despite lack of data on *knowledge capital among graduates* and *knowledge production by higher education institutions* across the Arab region, these two sub-pillars were not removed for the time being, given the important weight they have within the index and also in the hope that more data will become available in the coming years.

In terms of relative weights, no changes were made to the three pillars. The *higher education inputs* pillar still maintains its weight at 0.3 of the total value of the index, the *higher education processes* pillar remains at 0.1 and the *higher education outputs* carries the highest weight (0.6) given its direct relation to development. This line of reasoning is consistent with studies and research conducted on indicators related to higher education such as the Universitas 21 rankings.²⁶

On the other hand, the relative weights of the two sub-pillars *expenditure* and *student exchange* under the *higher education inputs* pillar were revised. The *expenditure* sub-pillar's relative weight was increased from 1/6 to 1/3 to reflect the importance of expenditure in higher education, in keeping with international trends. Accordingly, the relative weight of the *student exchange* sub-pillar was reduced from 1/3 to 1/6,

in light of the limited evidence available on the nature of its impact on higher education.

The relative weights of the other sub-pillars under the *higher education inputs* pillar remained unchanged at 1/6.

As for the relative weight of the *higher education outputs* pillar, it had been previously divided among only three of the four sub-pillars in last year's AKI, as no data had been available for the sub-pillar *knowledge production by higher education institutions*. This year, however, it will be divided among all four, as the sub-pillar has been revised to include new variables with available data. Thus the relative weight of the *graduation* sub-pillar is now 1/9, 2/9 was accorded to *employment after graduation*, amounting to one third of the pillar's total relative weight; while the sub-pillars *knowledge capital among graduates* and *knowledge production by higher education institutions* were both accorded a relative weight of 1/3 each. Table A3 of the Annex shows a detailed description of the overall distribution of weights.

Revisions applied to the variables

In the 2015 AKI Higher Education Index, the *enabling environment* sub-pillar included six variables. Data was available for two variables: *political stability and absence of violence/terrorism* and *government effectiveness*. The remaining four, namely *financial stability, administrative stability, academic freedom* and *academic integrity*, had no corresponding data. The variable *administrative stability of higher education institutions* was thus replaced by two new variables – *regulatory quality* and *rule of law* – which measure a country's overall organizational stability and commitment to law implementation. Two new variables were also added: *foundations of wellbeing* and *percentage of adults that have at least completed upper secondary education*. Both variables are important given their connection to the social and economic environments of students in higher education institutions. The *enabling environment* sub-pillar is therefore now composed of nine variables, of which data was available for six.

The *expenditure* sub-pillar originally comprised seven variables, with data available for five. One variable was added in 2016: *expenditure on tertiary*

Table 3:

Changes applied to variables in the 2015 Higher Education Index

Variable	Modification
Higher education inputs pillar	
Regulatory quality	Added
Rule of law	Added
Foundations of wellbeing	Added
Educational attainment: at least completed upper secondary (ISCED 3 or higher), population 25+ years, both sexes (%)	Added
Expenditure on tertiary as % of government expenditure on education (%)	Added
Enrolment in tertiary education, ISCED 6 & 7 programmes, both sexes (number)	Replaced *
Gross enrolment ratio, tertiary, gender parity index (GPI)	Added
Percentage of students in tertiary education who are female (%)	Added
Extent of staff training	Added
Researchers (FTE) – higher education %	Added
Researchers FTE higher education ICSED 8/ Researchers FTE higher education	Added
% change in students studying at the undergraduate level in the US (2013/2014 and 2014/2015)	Added
% change in students studying at the graduate level in the US (2013/2014 and 2014/2015)	Added
Proportion of students studying in Arab countries from the total number of students studying abroad	Replaced *
Higher education processes pillar	
Quality of the education system	Added
Quality of math and science education	Added
Quality of scientific research institutions	Added
QS world ranking of the country's leading university	Added
School life expectancy, tertiary, both sexes (years)	Added
Internet access in schools	Added
Availability of specialized training services	Added
Higher education outputs pillar	
Proportion of graduates in ISCED 6 and 7 to the number of inhabitants	Replaced*
Labor force with tertiary education, male (% of male labor force)	Added
Unemployment of graduates of tertiary education, male (%)	Replaced*
Unemployment of graduates of tertiary education, female (%)	Replaced*
SJR ranking of the best scientific journal in the country	Added
Availability of scientists and engineers	Added
University-industry collaboration in R&D	Added
H Index	Added
Citable documents	Added
PCT patents, applications/million population	Added

* The variable has been replaced with another one. For more information, refer to Table A3 in the Annex.

education as a percentage of government expenditure on education.

The *enrolment* sub-pillar also comprised seven variables in the 2015 index, all of which had

corresponding data. Two variables were added this year – *percentage of female students in tertiary education* and *gross enrolment ratio of females in tertiary education compared to males (gender parity index)* – to reflect female access to higher education.

The *human resources* sub-pillar covered six variables, two of which had available data. The research team added three variables related to the quality of human resources in higher education institutions: *extent of staff training*, *percentage of researchers among full-time employees in the higher education sector* and *percentage of PhD holders among full-time researchers in the higher education sector*. As such, the *human resources* sub-pillar is now composed of nine variables, with data available for five.

The *student exchange* sub-pillar included three variables in 2015, with data available for two. Two variables were added to reflect the annual change of undergraduate and graduate students in the United States.

Given the difficulty of measuring processes of higher education and the quality of teaching and learning, the *higher education processes* pillar originally contained data for only one out of thirteen variables. Seven variables were added this year for a better assessment: *quality of the education system*, *quality of math and science education*, *quality of scientific research institutions*, *QS world ranking of the country's leading university*, *school life expectancy for tertiary education for both sexes*, *Internet access in schools*, and *availability of specialized training services*. Therefore, eight variables currently contain data under the *higher education processes* pillar.

The *graduation* sub-pillar this year maintains the same four variables as the previous year with no changes.

The *employment after graduation* sub-pillar previously covered six variables with data available for four. The variable *labor force with tertiary education for males as a percentage of the male labor force* was added. The two variables *unemployment with tertiary education for males and females* were replaced with *unemployment with tertiary education for males as a percentage of the male labor force* and *unemployment with tertiary education for females as a percentage of the female labor force*.

The *knowledge capital among graduates* sub-pillar remained unchanged in the 2016 revisions as it still includes data for ten variables in addition to one variable with missing values: *acceptance of the values of social peace, respect of difference and coexistence among students*.

As for the *knowledge production by higher education institutions* sub-pillar, no data was available for its corresponding variables in the 2015 Higher Education Index. Six variables with data were added this year: *PCT patents applications per million population*, *citable documents*, *H Index (author-level citation impact)*, *university–industry collaboration in R&D*, *availability of scientists and engineers*, and *SJR ranking of the best scientific journal in the country*. Although some of these variables are not limited to research in higher education institutions, they can still be used as alternatives in light of the limited availability of recent and reliable data.

The total relative weight of each sub-pillar was consequently equally redistributed among its updated number of variables in this year's revised version.

Table 3 lists the changes made to the 2015 Higher Education Index at the level of variables.

Revised Structure (2016 version)

The 2016 Higher Education Index maintains the same structure as the previous year with no changes made to its pillars and sub-pillars. Figure 11 represents the index's unchanged configuration.

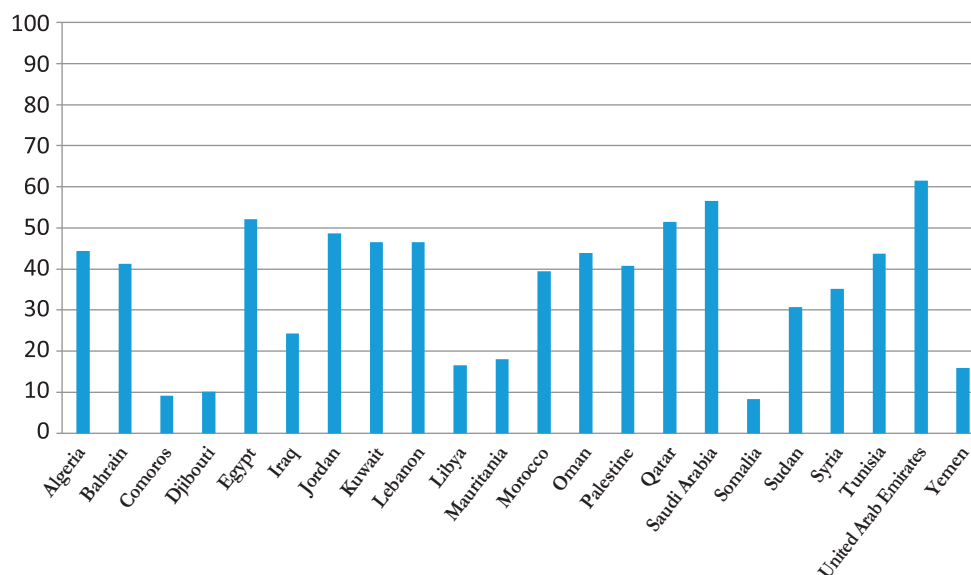
Results

The results of the AKI Higher Education Index reveal wide disparity between Arab states, with scores varying between 8.39 (Somalia) and 61.44 (United Arab Emirates). This disparity does not necessarily reflect a lack of interest in this sector, but it rather suggests that efforts in this sector must be better coordinated and properly directed towards producing knowledge and achieving development.

None of the Arab countries scored more than 65. In fact, only one country (United Arab Emirates) exceeded 60, with three other countries scoring above 50: Saudi Arabia (56.54), Egypt (52.04) and Qatar (51.4). The low scores achieved by most Arab countries indicate two things. First, they are a true reflection of the status of higher education in Arab countries in comparison

Figure 12:

Results of Arab countries on the Higher Education Index

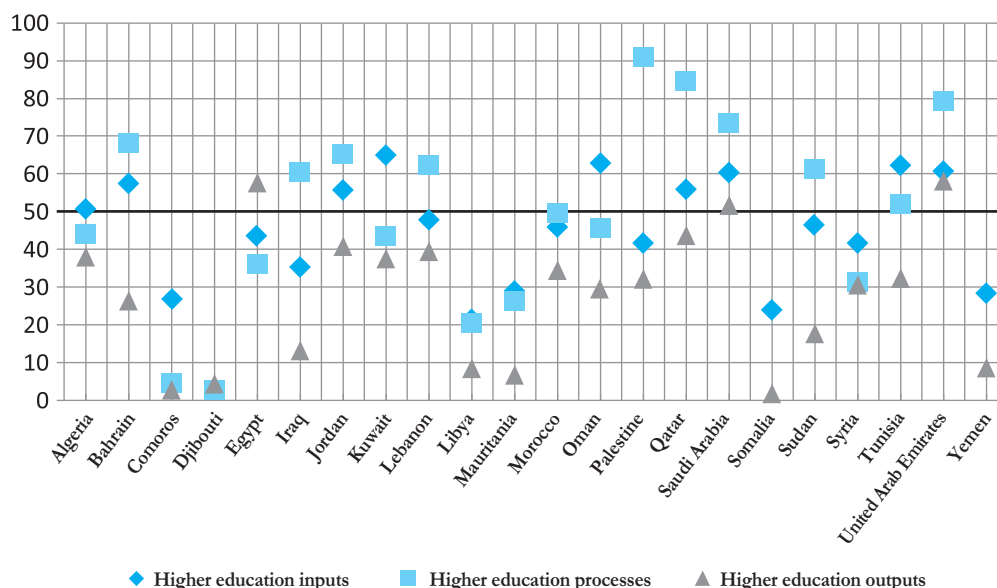


to other advanced educational systems, given that the relative weight of the *higher education outputs* – including knowledge production and contribution to development – represents 60 percent of the index. Secondly, irrespective of the disparity in scores, all countries in the Arab region, including those with top rankings, need to do more to develop their educational systems in order to draw level with the average quality of systems around the world.

With regard to the results of the main pillars of the index, there is a strong correlation between them. The highest correlation was between the *inputs* and *outputs* pillars (0.721). Scores on the *processes* pillar were relatively higher. All Arab countries with general high rankings scored higher on this pillar, with second highest scores recorded under the *inputs* pillar. Countries with low rankings had their highest scores on the *inputs* pillar, followed by the *processes*

Figure 13:

Results of Arab countries on the main pillars of the Higher Education Index



pillar. Even though they do not indicate a causal relation between inputs and outputs, these trends confirm two things: a minimum level of inputs is required for an educational system to function; the availability of human resources and processes that are capable of acting on those inputs is vital for determining the performance level of such a system, both quantitatively and qualitatively.

The results of the *inputs* pillar were consistent with those of the composite index. Higher values for the *enabling environment* sub-pillar in some countries – mostly the Gulf states – resulted in higher scores on the *inputs* pillar. Conversely, lower values for the *enabling environment* sub-pillar in countries such as Libya, Somalia, Syria, and Yemen led to lower values on the *inputs* pillar. It should be noted that data on *expenditure* was available for only 10 countries and showed a very wide disparity (85.28 in Kuwait and 2.83 in Comoros).

The constituting sub-pillars of the *processes* pillar had high values in general. Most Arab countries (with the exception of Comoros, Djibouti, Lebanon, Somalia, and Syria) have national bodies tasked with ensuring the quality of the higher education sector. This is very important but is not enough to explain the disparity in results. Some Arab countries have such bodies but achieved low scores on all variables. The values of the variables for science and mathematics teaching, quality of scientific research institutions and access to Internet at universities ranged from medium to upper medium in most countries.

In terms of the *outputs* pillar, only nine countries scored above 33, while seven countries scored less than 20. One of the reasons which could explain these low values is that data for the *knowledge capital among graduates* sub-pillar was available for only four countries, while this sub-pillar has a relative weight of 1/3 of the

outputs pillar. In addition, results of the *knowledge production by higher education institutions* sub-pillar were low despite the availability of data for its six variables in many Arab countries.

The results of the Higher Education Index highlight the important role of enabling environments in developing this sector. Second, the index gave a larger relative weight to the outputs of this sector, including students' knowledge, skills, and values as well as research, inventions, and other knowledge products to which researchers and knowledge workers in this sector contribute. The results have shown that this area requires more attention from higher education authorities, as data related to internationally registered patents, quotable scientific research papers, and university–industry partnerships were low in many Arab countries.

Finally, the index provides researchers and policymakers with a good opportunity to evaluate the higher education system and identify its strengths and weaknesses. Given the scarcity of data and analysis about the status of this sector in the Arab region, the index also aims to build a reliable database for public use. Through this information, researchers, and decision-makers should conduct their own analysis in their respective countries and design plans and programmes to improve this sector in a way that could contribute meaningfully to human development.

As such, the index focuses on the important role of this sector not from the perspective of human capital theory, which is based on providing the labour market with the required graduates; rather, it approaches the sector from a much deeper perspective that is based on providing graduates with contemporary knowledge, skills, and values so that they contribute to the development of their communities.

Endnotes

- ¹ The World Bank defines higher (tertiary) education as “all post-secondary education, including but not limited to universities. In recent years a diverse and growing set of public and private tertiary institutions in every country – colleges, technical training institutes, community colleges, nursing schools, research laboratories, centres of excellence, distance learning centres, and many more – form a network of institutions that prepare students for application of knowledge at an advanced level.” (World Bank, 2015). For the purposes of constructing the current index, higher education will only be considered in terms of public and private higher education institutions offering BA/BS stage programmes and what follows from Level 6 for the first university degree, Level 7 for the Master’s degree, and Level 8 for the Doctoral degree, according to UNESCO’s International Standard Classification of Education (ISCED).
- ² World Economic Forum, 2015.
- ³ Wildavsky, 2010.
- ⁴ Lane and Johnstone, 2012.
- ⁵ Shaffer and Wright, 2010.
- ⁶ Thomson, 2008.
- ⁷ Ibid.
- ⁸ UNESCO, 2014a.
- ⁹ See: <http://www.anqhac.org/?lang=en>
- ¹⁰ See: <http://www.aneca.es>
- ¹¹ See: <http://www.universitas21.com>
- ¹² Liu, 2009.
- ¹³ See: <http://www.voluntarysystem.org>
- ¹⁴ UNESCO, 2013.
- ¹⁵ Ibid.
- ¹⁶ El-Hefnawy et al., 2014.
- ¹⁷ UNESCO, 2014a.
- ¹⁸ OECD, 2010.
- ¹⁹ World Economic Forum, 2013.
- ²⁰ Cornell University et al., 2014.
- ²¹ Ibid.
- ²² Martin and Sauvageot, 2011.
- ²³ Labe, 2010.
- ²⁴ UNESCO Institute for Statistics, 2014b.
- ²⁵ UNDP and MBRF, 2014.
- ²⁶ Universitas 21, 2015.



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 phones² 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.

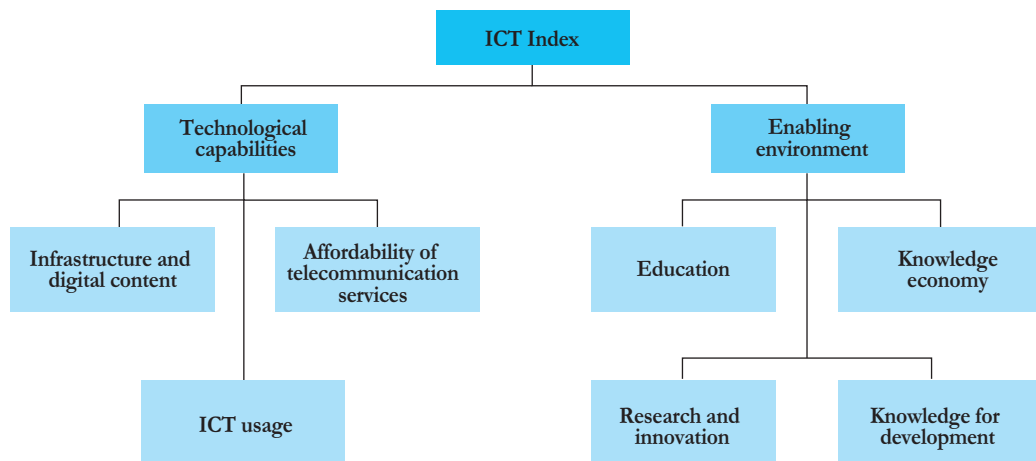
Formulation process and initial structure of the index

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

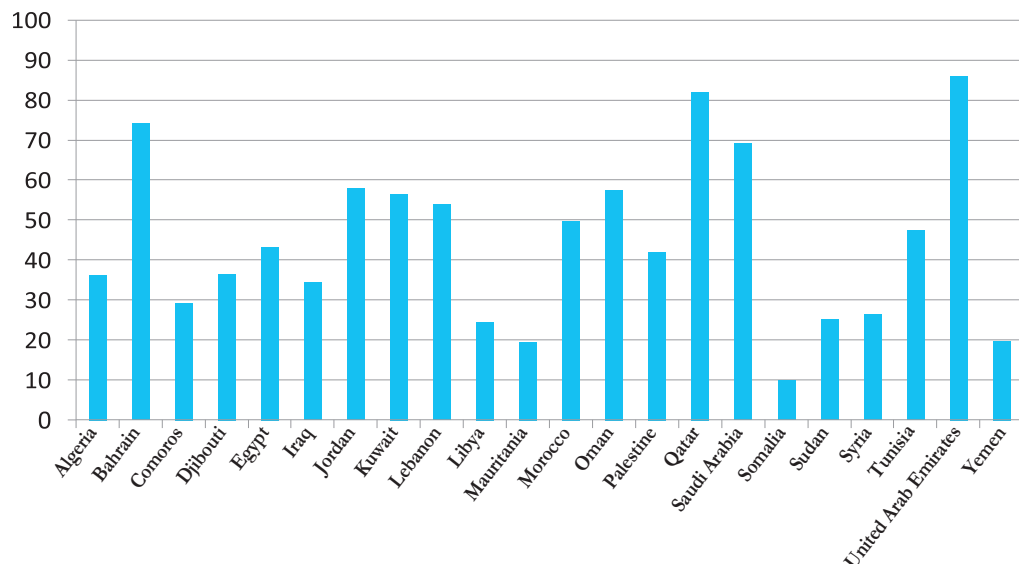
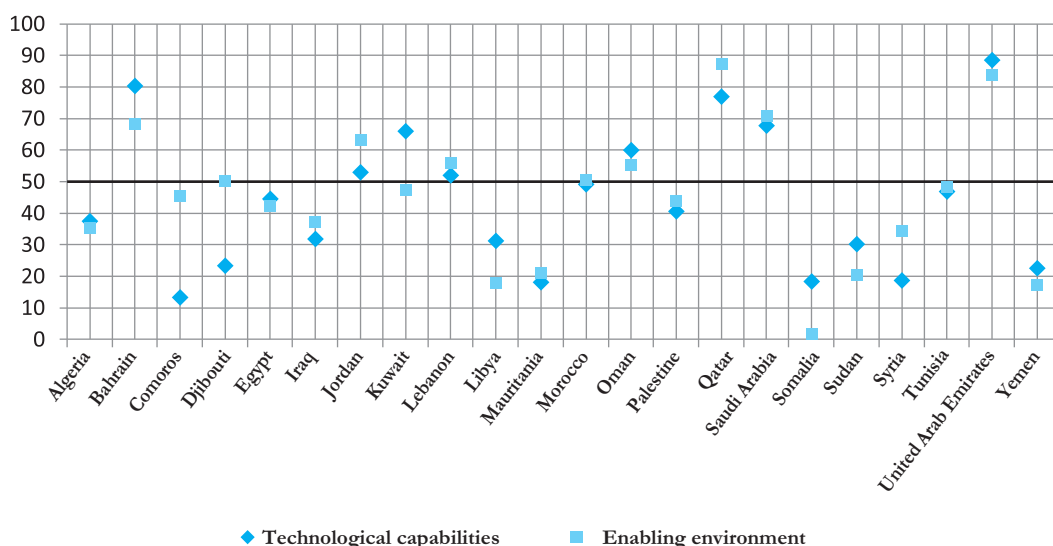


Figure 16:

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.

The image features a central blue square containing the text "Economy Index" in white. The square is surrounded by a pattern of grey arrows pointing upwards and to the right, creating a sense of growth and progress. The background is white, and the overall design is clean and modern.

Economy Index

Introduction

During the pre-industrial era, land and labour were the main resources of wealth; with the onset of the industrial era they were replaced by capital and labour. In today's post-industrial era, the main factor of production has shifted to knowledge, whereby its production, distribution, and use have become the key stimulants for growth. This has been accompanied by a shift from manual labour to knowledge-based labour. Knowledge has therefore become a new form of capital, consisting of ideas, experiences, and practices.¹

The value of knowledge as a new economic resource lies in its distribution and integration into production systems that contribute to increasing the competitiveness of human capital. Knowledge capital today is therefore considered to be more important than financial capital and can be considered as the fifth factor of production, adding to labour, land, capital and entrepreneurship.

The application of knowledge, especially through the technology that it stimulates, in development and improvement of the quality of goods throughout all stages of production and across all sectors has had a positive impact on economies, resulting in increased gross domestic product (GDP), job creation, and adoption of innovative methods. This in turn has improved productivity in human and financial resource management, and business administration as in the case of the digital revolution, which has reshaped business operations and relations with other local and international sectors, resulting in increased profits and capital.

Mohamed Diab notes that the concept of knowledge underwent its greatest transformation during the scientific and technological revolution that occurred in the final quarter of the twentieth century. According to Diab, this set in motion major transformations in the field of information and communications that saw the latter become a new strategic resource to complement natural resources in the dynamics of an economy, giving rise to what is generally known as the 'knowledge economy' or the 'knowledge-based economy'.²

The Economy Index is presented here as a tool to better understand the relationship between knowledge and economy and facilitate efforts to monitor various elements of a knowledge based-economy to better inform related policies in different sectors.

Formulation process and initial structure of the index

The Economy Index was developed following extensive review of economic literature, discussions within the AKI team, and consultations with experts and stakeholders.³ The index constituents were thus compiled in two interconnected levels. The first level is comprised of three main pillars: *organizational performance and human resources*; *competitiveness and creative development*; and *economy-related ICTs*; the second level is derived from the first and encompasses the sub-pillars of the index.

The first pillar, *organizational performance and human resources*, constitutes the backbone of the Economy Index, and is therefore assigned the highest weight among the pillars (50%). The other two pillars, namely *competitiveness and creative development* and *economy-related ICTs* are assigned relative weights of 30% and 20%, respectively.

All sub-pillars were assigned equal relative weights, regardless of the main pillar they fall under, as a means to avoid potential bias.

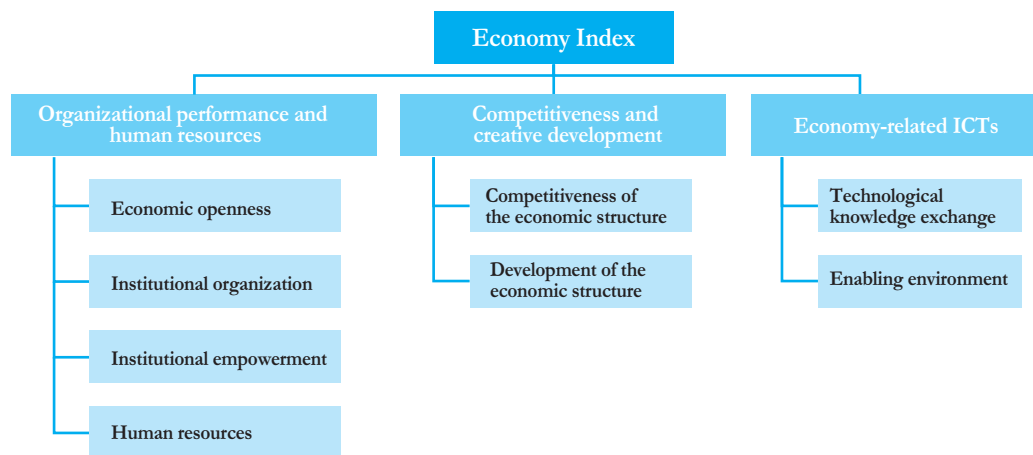
Figure 17 shows the structure of the 2015 Economy Index.

The first pillar, *organizational performance and human resources*, contains three sub-pillars that are directly related to economy, and a fourth sub-pillar, *human resources*, which represents the relationship between economy and education.

The second pillar, *competitiveness and creative development*, focuses on processes and procedures related to business development and execution. These processes serve as the main incentive for developing economic structures based on knowledge that can be acquired through facilitating procedures for foreign direct investment. Such investment results in increasing a country's exposure to new knowledge, global

Figure 17:

The structure of the 2015 Economy Index*



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

standards and its ability to attract the finest skills and expertise available in the world market, especially at the level of production and production enhancement. This is reflected in the variables *starting a business, procedures* (number of procedures to start a business), *starting a business, time* (number of days to start a business), and *foreign direct investment, net inflows*.

The third and final pillar, *economy-related ICTs*, highlights the role of ICT in connecting economy to knowledge channels worldwide. The corresponding sub-pillars demonstrate a qualitative overlap between economy and ICT sectors, two of the six sectoral indices that make up the Arab Knowledge Index.

It is worth noting that the Economy Index takes into consideration the specific characteristics of each country, especially in the sub-pillars *enabling environment, human resources, development of the economic structure, technological knowledge exchange, institutional organization* and *institutional empowerment*. The index builds on the individual economic infrastructure and superstructure of each country, whether in terms of institution-building, legal frameworks, global communication, or local competitiveness.

Revisions

Taking into account the feedback from experts and readers, the AKI core team held several meetings to discuss and improve the

conceptual foundations and pillars of the 2015 version of the index, and to enhance the connectivity between the Economy Index and the five other indices covering pre-university education; technical vocational education and training; higher education; information and communications technology; and research, development and innovation.

Revisions applied to the main structure

Based on the reviews and discussions, no revisions were made to the main structure of the index (pillars and sub-pillars).

Revisions applied to the variables

Most of the changes were applied at the level of variables related to the *organizational performance and human resources* pillar and the relative weights were redistributed accordingly. This was due to the special focus attributed to this pillar given its essential role in reflecting an economy's ability to generate, attract, accumulate, and utilize knowledge.

The added variables are: *high-technology exports as a percentage of manufactured exports* (economic openness sub-pillar); *Corruption Perceptions Index* (institutional organization sub-pillar); *World Press Freedom Index* and *percentage of bank deposits to GDP* (institutional empowerment sub-pillar); and *percentage of gross enrolment ratio in tertiary education for both sexes* and *percentage of graduates from tertiary education graduating in science, engineering, construction and manufacturing for*

both sexes (human resources sub-pillar). Every time a variable was added, the total relative weight of the sub-pillar was again divided equally among all its variables.

The *high-technology exports (% of manufactured exports)* variable reflects an understanding that exports are generally among the most important indicators of knowledge exchange and localization among countries, and can indicate the level of knowledge accumulation by the exporter. Each country introduces, through its exports, elements that serve as inputs for the recipient country to create their own products ready for export—which may be regarded as the ‘added value of exchange.’ Exports with high-technology components are a good example of knowledge exchange among countries. Consequently, an increase in the percentage of high-technology exports as a percentage of manufactured goods constitutes a positive element in the exchange of knowledge.

The *Corruption Perceptions Index* variable is based on the index issued by Transparency International on an annual basis. It is considered an important indicator for evaluating a country’s proper use of economic resources, foreign investment and the equal distribution of income. These three aspects are fundamental constituents of knowledge-based economies. The flow of foreign investment facilitates the transfer of knowledge from one place to another. The proper use of economic resources reflects the quality and efficiency of legal and organizational frameworks, especially in prohibiting resource monopolies including the transfer and localization of knowledge related to economy. Finally, equal distribution of income implies that more people have access to information and knowledge and are able to develop their capabilities in a just, transparent, and impartial environment.

The addition of the *World Press Freedom Index* variable might seem controversial, but it is in itself a component of the superstructure used to transfer knowledge to economies without barriers. Censorship might prevent knowledge and information from reaching all members of society. Freedom of press is also an important element in countering corruption, and helps attract foreign investment as it reflects the existence of a framework for guiding governance,

enhancing transparency and integrity, and of an environment tolerant of criticism.

The *bank deposits to GDP (%)* variable reflects the banking system’s capacity to achieve growth and development based on its ability to attract and utilize deposits. The state of the banking system is considered an important part of a country’s economic development course. This variable also reflects the relative level of development of a nation and enables a year-to-year evaluation of achieved economic development.

From an economic point of view, the *gross enrolment ratio, tertiary, both sexes (%)* variable reflects the level of accumulated knowledge, as well as the positive contribution that higher education offers to economic productivity, particularly in terms of developing the human element; such development is achieved using the abilities, skills, and information endowed by higher education including language skills, computer skills, research and analytical skills and critical thinking skills, etc.

The inclusion of the variable, *percentage of graduates from tertiary education graduating from science, engineering, construction and manufacturing, both sexes (%)*, reflects the assumption that graduates in these disciplines are among those best qualified to advance the development, localization, production and distribution of knowledge.

Regarding the second pillar, *competitiveness and creative development*, one variable was added to the *development of the economic structure* sub-pillar: *science and engineering articles in all fields* combined to reflect quantitative measure of scientific research and development. Scientific publications, especially in the field of technology, reflect an economy’s real research and development capacities; they also reflect local competitive capabilities, and local incentives to develop a country’s competitive and creative capacities. Such incentives are the main stimulants of knowledge production, localization and exchange between countries. The total relative weight of the sub-pillar (0.5) was redistributed equally among all six variables.

For the third and final pillar of the Economy Index, *economy-related ICTs*, the *Government Online Services Index* variable was added to the

Table 5:**Changes applied to variables in the 2015 Economy Index[†]**

Variable	Modification
Organizational performance and human resources pillar	
High-technology exports (% of manufactured exports)	Added
Corruption Perceptions Index	Added
World Press Freedom Index	Added
Bank deposits to GDP (%)	Added
Percentage of graduates from tertiary education graduating from science, engineering, construction, and manufacturing, both sexes (%)	Added
Gross enrolment ratio tertiary, both sexes (%)	Added
Competitiveness and creative development pillar	
Science and engineering articles in all fields combined	Added
Economy-related ICTs pillar	
Government Online Services Index	Added

[†] The names of the pillars have been updated to include changes resulting from the 2016 revisions.

enabling environment sub-pillar. It illustrates the country's ability to employ information and communications technologies to support knowledge transfer and economic development by offering public services through digital means and at a suitable cost. These time-, effort- and resource-saving initiatives feed into increased competence, efficiency and productivity, and enhance the country's attractiveness for investment.

Table 5 summarizes all the changes made to the variables of the 2015 Economy Index.

Revised structure (2016 version)

No changes were made to the main structure of the 2015 Economy Index. Accordingly, Figure 17 reflects the current configuration of the index as well.

Results

The results of the AKI Economy Index ranged between 83.1 (United Arab Emirates) and 15.09 (Somalia). This shows a wide disparity between Arab countries, with some making swift advances towards becoming globally competitive while others - mostly those suffering from crises or conflicts - experiencing economic collapse. With

the highest score achieved, the United Arab Emirates stands out among all other countries, including those with high rankings.

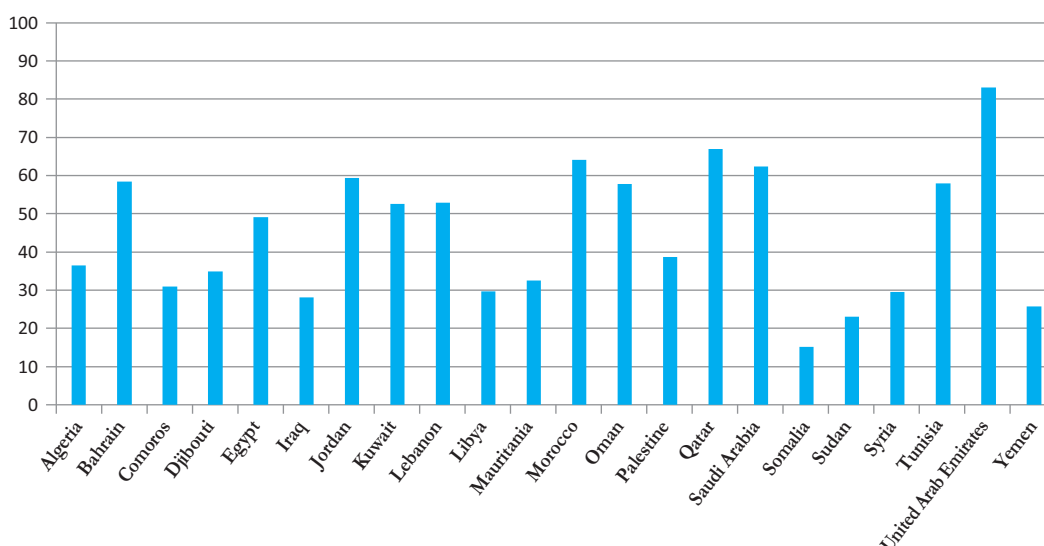
Regarding the main pillars of the Economy Index, the results show that apart from the United Arab Emirates, which ranked high on the *economy-related ICTs* pillar, most countries with high scores performed best on the *competitiveness and creative development* pillar, followed by the *organizational performance and human resources* pillar. Correlation coefficient analysis showed very strong positive correlation (0.819) between these two pillars. Correlation coefficient between the *organizational performance and human resources* pillar and the *economy-related ICTs* pillar was 0.547.

The results of the sub-pillars show some common trends in the economies of most Arab countries. With the exception of countries that are politically unstable, most Arab countries scored above 50 in terms of *institutional organization* and *institutional empowerment*. This suggests that these two sub-pillars are functioning well in most Arab economies that are not experiencing political and social instability, including in the areas of *regulatory quality*, *rule of law*, *soundness of banks*, *laws relating to ICTs* and *government effectiveness*.

It is worth mentioning that the GCC countries scored highly on all the sub-pillars of the

Figure 18:

Results of Arab countries on the Economy Index



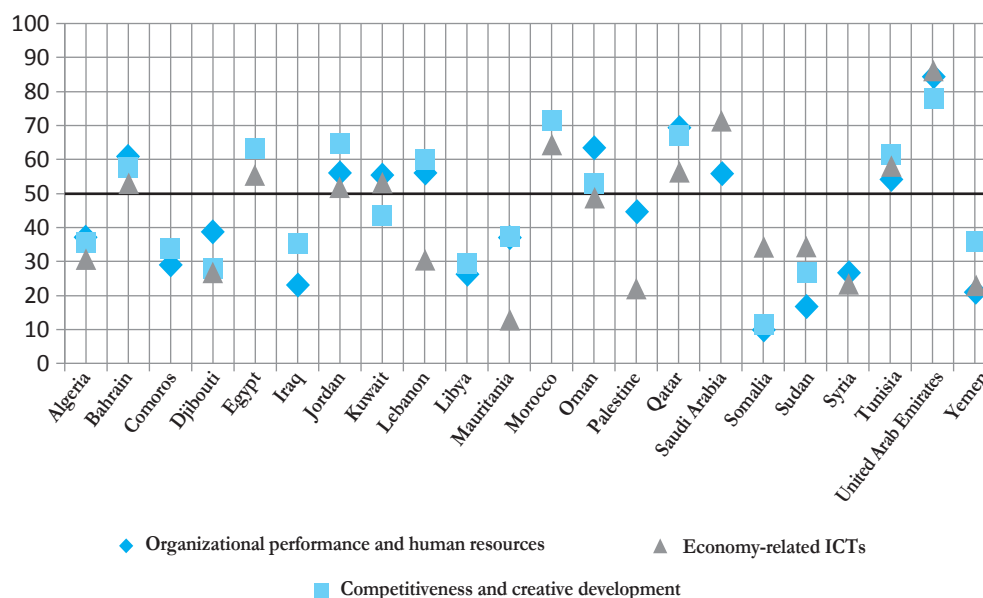
organizational performance and human resources pillar. Most Arab economies, with the exception of the United Arab Emirates and Oman, did not do well on the economic openness sub-pillar, which suggests that Arab economies are not largely involved in international trade.

The results also indicate an urgent need to focus on developing human resources in the Arab region, as the vast majority of Arab countries received low scores on the human resources sub-pillar.

As for the competitiveness and creative development pillar, the results were balanced among most countries that are not facing political or social instability problems. This indicates that Arab countries are keen to develop their economic structures and improve their competitiveness by simplifying the procedures required to start a business, computerizing some of these procedures, and attracting foreign capital. Scores were remarkably varied in terms of the development of the economic structure, especially in relation to variables evaluating the value added of

Figure 19:

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



manufacturing (as a % of GDP), e-government services, venture capital availability, and expenditure on R&D. This highlights the need for greater efforts to develop the economic structure around all of these sub-pillars in a balanced manner.

Looking at the sub-pillars of the *economy-related ICTs* pillar, there is wide variation between the results of Arab countries, with only few excelling in this area (Morocco, Saudi Arabia and the United Arab Emirates). This suggests that Arab countries are making little effort to develop an ICT infrastructure that supports their economies (*enabling environment* sub-pillar). Furthermore, they are not making any tangible progress in terms of *technological knowledge exchange*. In both areas, the United Arab Emirates was a unique case of excellence, scoring much higher than the rest of the Arab countries. This can be explained by the country's interest in advanced technology, smart government, and innovation. The United Arab Emirates's success story could encourage other Arab countries to

adopt similar approaches in order to improve their rankings. This highlights the important role of technological capital today in strengthening the economy, putting the country on the world economic map, being connected with the tools and channels of international trade and foreign investment, and creating capital.

The data provided by the AKI 2016 Economy Index may help decision makers devise policies to improve the economic environment, strengthen links between components of the local economy, and meet the requirements of the global economy. Although this analysis does not seek to rank countries, the results show that some Arab countries have come a long way in developing their economies through reliance on their accumulated knowledge, and learning from other countries' practices. Given the similarities across the Arab region, while taking into account national specificities, there is scope to enhance cooperation and joint action among Arab countries and to benefit from regional successful experiences.

Endnotes

- ¹ Diab, 2009 (in Arabic).
- ² Ibid.
- ³ UNDP and MBRF, 2015.

The background features a pattern of grey arrows pointing upwards and to the right, creating a sense of growth and progress. A prominent blue square is centered on the page, containing the title text. The text is white and uses a serif font.

Research,
Development and
Innovation Index

Introduction

In the twenty-first century, distinct knowledge gaps still separate developed and developing countries, manifested by disparities in research, development, and innovation, as well as in progress towards achieving knowledge economies and societies. International organizations and research institutions show that this knowledge gap is widening, therefore hindering efforts to achieve sustainable human development.¹

Research and development (R&D) is among the most important drivers of a country's transition to a modern society with a knowledge economy. Notwithstanding its significant role in knowledge production, dissemination, and application, R&D should be accompanied by a complementary shift towards innovation in order to further accelerate a country's progression towards achieving sustainable development.

Countries and regions that aspire to keep pace in the knowledge era must adopt effective policies in research, development and innovation (RDI) based on reliable indicators to identify progress achieved.

The AKI therefore offers a composite index for RDI to support countries in the Arab region in monitoring their efforts and results in this regard. It builds on relevant global practices and examples while taking into account the Arab region's specific institutional, economic and social contexts.

The index makes use of the concepts and definitions provided by the Organisation for Economic Co-operation and Development (OECD) and adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) among other international organizations, whereby R&D is defined as creative work undertaken systematically in order to increase accumulated knowledge – including knowledge of people, culture, and society – and the use of this knowledge to devise new applications.² It adopts the principle of a full research and innovation cycle, aiming to measure "scientific research stages that begin with basic and

applied research and end in the development of a product, a productivity process or a new method in the context of innovative activities."³

Research and development are divided into three broad categories: basic research; applied research; and experimental development. Innovation is the introduction of a new product or a significant improvement to an existing one, whether at the level of the product itself or in terms of methods of production, marketing or organization.^{4,5}

R&D activities contribute to improving performance, reinforcing the knowledge base, and expanding its applications, as they also provide inputs for effecting progress in innovation; yet, the success of RDI systems cannot be achieved in the absence of an appropriate economic, social, and political environment, and suitably supportive ICT and non-ICT infrastructures.

Formulation process and initial structure of the index

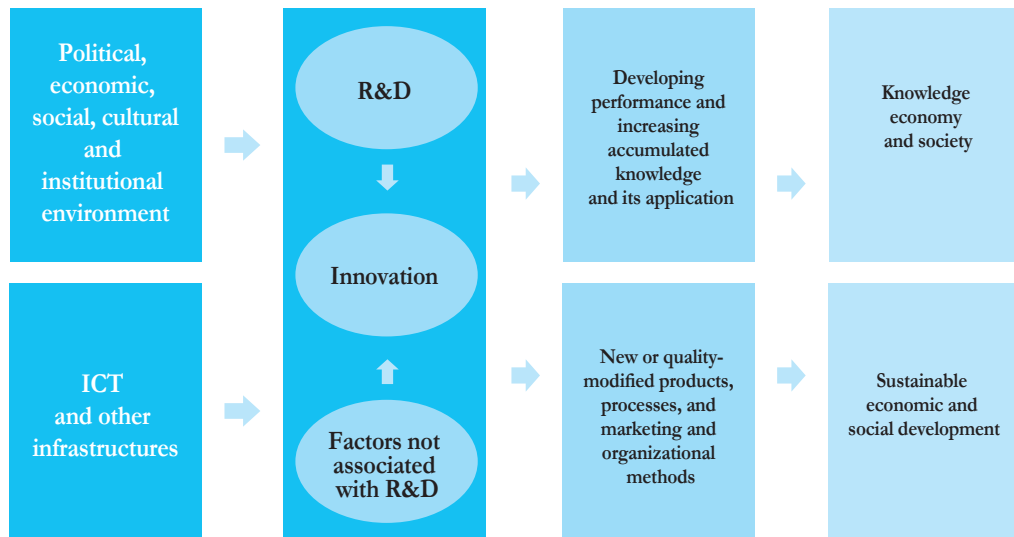
The process of selecting the pillars and variables of the composite RDI Index entailed a series of preparatory phases. Relevant databases and reports were screened to identify currently-adopted indicators (inventory and description phase) that were consequently analysed to determine their type, conceptual–technical approaches, and determinants (analysis and critiquing phase).

Previous studies have sought to measure innovation and R&D separately, taking into consideration their individual contributions to achieving knowledge-based societies. This separation, however, ignores the fact that research and development are among the key inputs of the innovation process.

The AKI therefore adopts a unique approach that formulates a composite index combining these two components in one integrated framework to support Arab knowledge production. This composite index offers the added advantage of helping to avoid any potential repetition or statistical overlap among the measured indicators. It is also designed in a way that takes

Figure 20:

Methodological framework of the RDI Index



into account political, economic, and social variables, as well as appropriate ICT and non-ICT infrastructures.

To validate the RDI Index, individual consultations were organized and a workshop was held with Arab researchers and experts in the fields of research, development and innovation.

Revisions

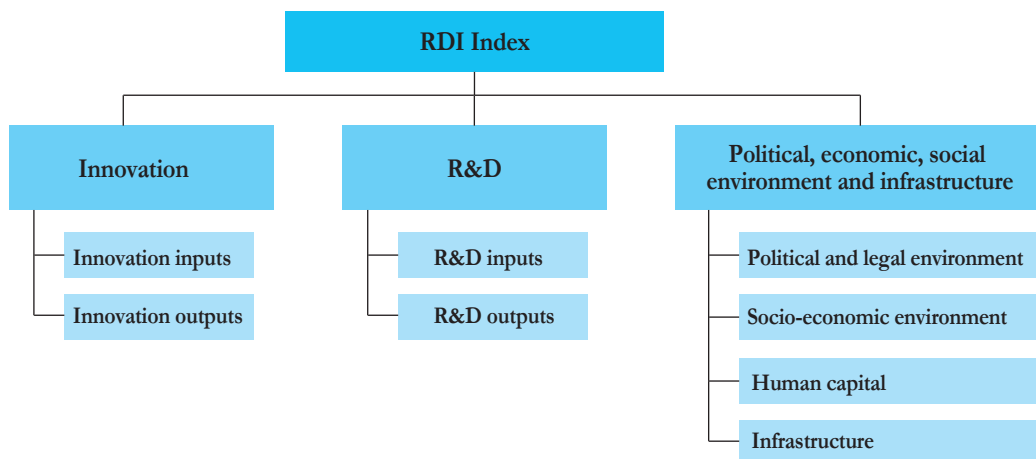
The 2015 RDI Index was reviewed in two respects: the variables related to *R&D inputs* and *outputs* were fined-tuned to capture available

data. Second, the *innovation* pillar was adjusted, taking into account the technological and non-technological elements of innovation in industry and in the services sector. This pillar was supplemented with variables that measure both the enabling environment and infrastructure, and outputs in terms of creative products. The review included the following steps:

- 1) Studying regional and international tools that measure RDI in conjunction with the enabling environment to better reflect the specificities of the Arab Region in the index. Inputs and outputs of the index have also been updated based on the review.

Figure 21:

The structure of the 2015 RDI Index



- 2) Ensuring the availability of data and verifying the conceptual framework, methodological approach, and estimation methods of the index.
- 3) Reviewing the relationship between R&D and innovative production, especially considering that R&D may serve as a main input for innovation, as described above. However, since innovation may also occur outside the R&D system, the index now includes variables for measuring the inputs and outputs of innovation that are external to the goods and services production processes.
- 4) Reviewing the relative weights of the pillars, sub-pillars and variables to ensure they reflect the objective and methodology of the index as well as experts' feedback.

The 2015 RDI Index was based on the vision adopted by the UNESCO and the Oslo Manual developed by the OECD, which maintains that innovation primarily occurs in the production processes of goods and services, as it is then divided into technological innovation (products and production methods that are new or

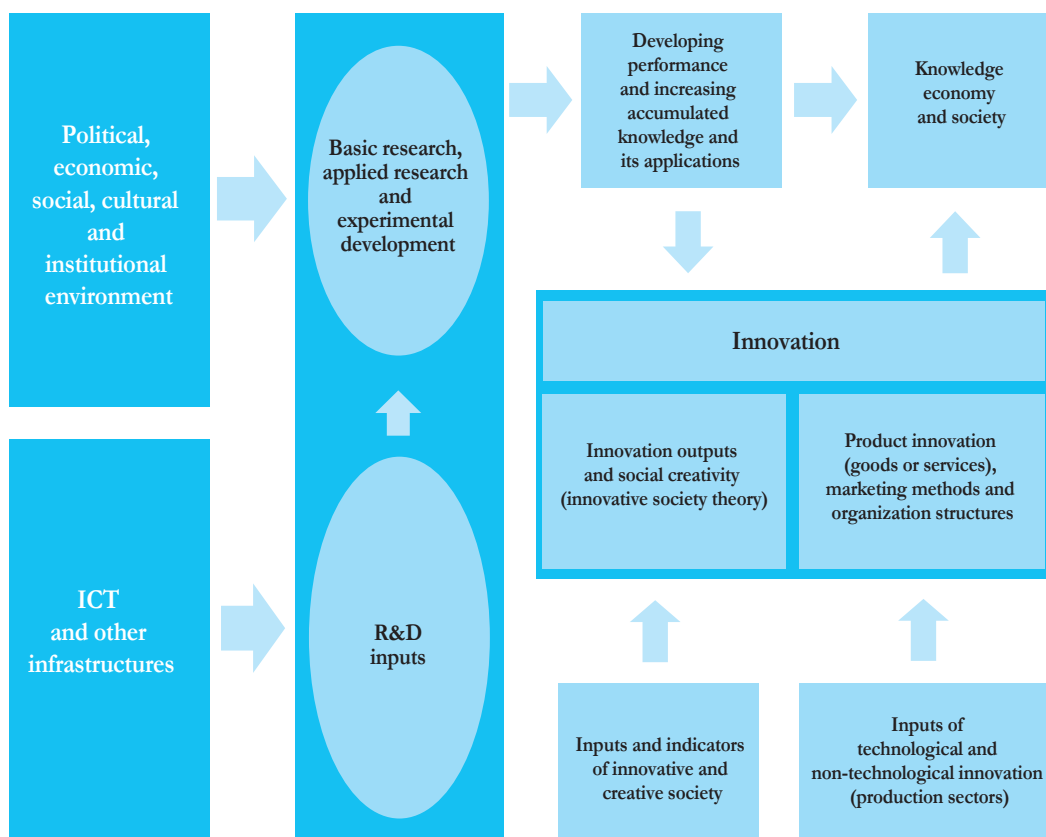
of enhanced quality), and non-technological innovation (new marketing and organization methods).⁶ Despite the validity and accuracy of this methodology, several analytical studies have shown that many innovated products and methods are developed outside national R&D systems in societies characterized by modern technological features. As such, a country's potential in innovation is based on building a creative society capable of introducing change and novelty in addition to developing new products and production processes.⁷ This line of thought is consistent to a large extent with that of the Global Innovation Index, the European Union Innovation Index and the Asian Creative Productivity Index.

The above-mentioned review led to a revision of the methodological framework of the RDI, marked in particular by recognition of the following:

- 1) The contribution of basic research, applied research, and experimental development to improving performance and increasing

Figure 22:

The revised methodological framework of the RDI Index



accumulated knowledge, in terms of both theory and practice, as well as to supporting innovation (within the overall framework of R&D).

- 2) The need to incorporate variables measuring technological and non-technological innovation, as well as others representative of the characteristics of a creative society under the innovation sub-pillars.
- 3) The contribution of the RDI system to building the foundations of a knowledge economy and society and in supporting efforts for attaining sustainable development.
- 4) The dependence of a country's success in RDI on the availability of conducive economic, social, political, cultural and institutional environments, in addition to the existence of a suitable infrastructure.

Based on the conceptual and methodological foundations above, the general structure of the AKI 2015 (R&D, innovation and political, economic and social environment and infrastructure as the three main pillars) was retained, with changes applied to the *innovation* pillar and to the *R&D outputs* sub-pillar as well as the addition of some variables.

Revisions applied to the main structure

Regarding the *research and development* pillar, a new component *institutional framework of scientific research* was added to the *R&D outputs* sub-pillar to better reflect the quality of scientific research institutions and the collaboration between universities and industries in R&D.

Secondly, the *innovation* pillar was modified to comprise two new sub-pillars. The first sub-pillar, *innovation in production*, refers to technological innovation (products and processes) and non-technological innovation (marketing and organizational methods). The second sub-pillar, *social innovation*, includes variables used to measure a society's capacity for innovation and creative production.

Each of the sub-pillars is comprised of two components – *inputs* and *outputs* – that in turn are comprised of several sub-components.

Theoretically, the *inputs* component under the *innovation in production* sub-pillar is composed of

a sub-component related to *innovation activities*, in addition to a second sub-component related to *information sources and institutional cooperation* and a third sub-component related to *financial support*. The *outputs* component, on the other hand, is divided into *technological* and *non-technological innovation* sub-components defined by variables representing innovative products, production and marketing methods, in addition to the general influence of innovation on the system of production and the factors hindering innovation in the production process.

On a practical level, the absence of data related to these two components culminated in a failed statistical analysis, which consequently led to the total disablement of the *innovation in production* sub-pillar.

The inputs of the *social innovation* sub-pillar are defined by: the knowledge base and competition rules that characterize the commodity and services markets; private and public sector business environments that are favourable to innovation; and by other factors such as total spending on computer software and exports in cultural and creative services. The outputs of this sub-pillar comprise the *social impact of innovation*, *knowledge dissemination*, and *creative outputs in the fields of culture, media, and entertainment* sub-components.

The relative weights distributed under the *R&D outputs* sub-pillar were modified after the addition of the component representing the *quality of the R&D institutional framework*. The two components, *scientific publishing* and *patents*, were assigned a relative weight of 35 percent each. The *institutional framework of scientific research* component was allocated a relative weight of 20 percent. Whereas the fourth component, *balance of payments for ICT products*, was reduced to a relative weight of 10 percent.

As for the *innovation* pillar, theoretically speaking, its relative weight (30 percent of the RDI Index total relative weight) is meant to be equally distributed between its two sub-pillars: *innovation in production* and *social innovation*. However, due to the lack of data in relation to *innovation in production* in the Arab countries at this stage, the *social innovation* sub-pillar will be solely allocated the total relative weight of the *innovation* pillar.

Table 6:**Changes applied to variables in the 2015 RDI Index[†]**

Variable	Modification
Research and development pillar	
GERD by type of activity (basic research, applied research, experimental development)	Replaced*
GERD by source of funds(%)	Replaced*
Educational attainment: at least master's or equivalent (SCED 7 or higher), population 25+ years, both sexes	Added
Quality of scientific research institutions	Added
University-industry collaboration in R&D	Added
PCT patents, applications/million population	Added
Innovation pillar	
DTF score for getting credit (0-100)	Added
DTF score for protecting minority investors (0-100)	Added
Stocks traded, total value (% of GDP)	Added
Tariff rate, applied, weighted mean, all products (%)	Added
Trade (% of GDP)	Added
Intensity of local competition	Added
GERD financed by abroad (%)	Added
State of cluster development	Added
High-tech net imports (% of total trade)	Added
ICT services imports (% of total trade)	Added
Foreign direct investment, net inflows (% of GDP)	Added
Number of trademark applications issued to residents by the national office (per billion PPP\$ GDP)	Replaced*
ICT services exports (% total trade)	Added
Intellectual property protection	Added
Enabling environment and infrastructure pillar	
Employment in knowledge-intensive services (% of workforce)	Moved**
Domestic credit to private sector (% of GDP)	Moved**
GERD financed by business enterprises as a percent of GDP	Moved**
Expenditure on education as % of total government expenditure (%)	Replaced*

* The variable has been replaced with another one. For more information, refer Table A6 in the Annex.

** The variable has been moved to another pillar in the index. For more information, refer to Table A6 in the Annex.

[†] The names of the pillars have been updated to include changes resulting from the 2016 revisions.

The relative weights of the *inputs* and *outputs* within social innovation were assigned in accordance with the objective of the index and based on consultations carried out with innovation experts.

Table A6 in the Annex shows all details on the redistribution of weights for both pillars.

Revisions applied to the variables

New variables were incorporated in the *research and development* pillar. A variable, *GERD performed by government as a percentage of GDP* was added under the *R&D inputs* sub-pillar, given the importance of governments' support for this sector in Arab countries. Another variable,

educational attainment of at least master's or equivalent for population of 25 years and above, was added under the same sub-pillar to stress the role of human resources in improving R&D. Three variables were added to reflect the institutional and organizational framework of research under the R&D outputs: These include *quality of scientific research institutions, university-industry collaboration in R&D, and applications for PCT patents.*

The *innovation* pillar underwent a significant structural revision this year. A list of new variables were added to the inputs of its *social innovation* sub-pillar. These include: *domestic credit to private sector as a percentage of GDP, DTF score for getting credit, DTF score for protecting minority investors, total value of stocks traded, tariff rate applied on all products, trade as a percentage of GDP, intensity of local competition, knowledge-intensive jobs as percentage of workforce, GERD financed by abroad, state of cluster development, high-tech net imports as a percentage of total trade, ICT services imports as a percentage of total trade, net inflows of foreign direct investment as a percentage of GDP, and finally GERD performed by business enterprise as a percentage of GDP.*

The *outputs* of the *social innovation* sub-pillar include the following new variables: *annual percentage of GDP per capita growth, medium and high-tech MVA share in total manufacturing, ICT services exports as a percentage of total trade, and intellectual property protection.*

Three variables in the 2015 Index were divided into ten new ones. The new variables are: *GERD for basic research, GERD for applied research, GERD for experimental development, GERD financed by business enterprise, GERD financed by government, GERD financed by higher education, GERD financed by private non-profit, GERD financed by not specified source, expenditure on tertiary education as percentage of government expenditure on education, and government expenditure on tertiary education as percentage of GDP.*

The changes made to the variables of the 2015 AKI RDI Index are displayed in Table 6.

Revised structure (2016 version)

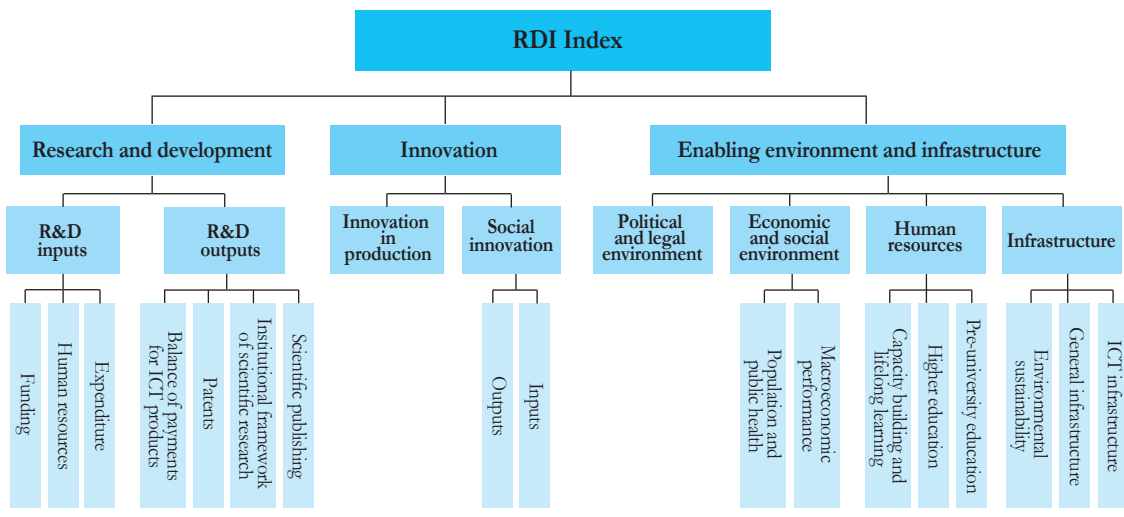
Figure 23 represents the structure of the RDI Index 2016.

Results

The results of the RDI Index reveal a general low performance by the Arab countries in this sector. Out of 22 countries, only seven (Bahrain, Kuwait, Lebanon, Qatar, Saudi Arabia, Tunisia and the United Arab Emirates) scored 50 and above. The highest score was that of the United Arab Emirates (68.53). For the remaining countries, the scores varied under 50, with Comoros, Iraq, Libya, and Somalia scoring the lowest.

Figure 23:

The revised structure of the RDI Index



Results on the pillars of the RDI Index show progress in 13 countries on the *enabling environment and infrastructure* pillar, with scores ranging from 19.76 to 71.16, followed by the *innovation* pillar, with scores in the range of 14.28–72.28, and the *research and development* pillar, with scores between 14.25 and 64.49. Qatar, Saudi Arabia and the United Arab Emirates were the only three countries that scored above 50 on all three pillars. Apart from these, five countries (Bahrain, Jordan, Lebanon, Morocco and Tunisia) scored above 50 on two pillars: *innovation* and *enabling environment and infrastructure*.

The results of the sub-pillars show some general trends with interesting exceptions. In general, the United Arab Emirates and Qatar achieved high scores on all sub-pillars except for that relating to *human resources*.

Figure 25 shows the results of Arab countries on the main pillars of the RDI Index.

- With regard to the two *research and development* sub-pillars, only five countries (Egypt, State of Palestine, Qatar, Tunisia and the United Arab Emirates) scored 50 and above on the *R&D inputs* sub-pillar. Likewise, only five countries (Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) scored 50 and above on the *R&D outputs* sub-pillar. Comparing scores on both sub-pillars shows that for most countries where

data was available for both, scores were higher on the outputs sub-pillar, with varied gaps between the two (reaching up to 63.67 points in the case of Saudi Arabia). Still, Egypt, Jordan, Morocco, State of Palestine and Tunisia scored higher on the inputs sub-pillar, with gaps ranging from 13.16 to 38.24 points. Correlation analysis revealed the absence of any statistically significant positive correlation between *R&D inputs* and *R&D outputs*, which indicates that the R&D system is not functioning well.

- Regarding the *innovation* pillar, which ideally consists of two sub-pillars (*innovation in production* and *social innovation*), no results could be calculated for the first sub-pillar due to lack of data. For the social innovation sub-pillar, nine countries (including most notably the United Arab Emirates and Saudi Arabia) scored 50 and above.
- In terms of the four sub-pillars of the *enabling environment and infrastructure* pillar, scores were relatively better on the *human resources* sub-pillar, with 13 countries scoring 50 and above. The six GCC states, Jordan, Morocco and Tunisia scored above 50 on all four sub-pillars. Correlation analysis indicated positive correlation with varying significance and the correlation coefficient ranged from 0.447 (between the *human resources* sub-pillar and the *economic and social environment* sub-pillar) to 0.885 (between the *economic and social environment* sub-pillar and

Figure 24:

Results of Arab countries on the RDI Index

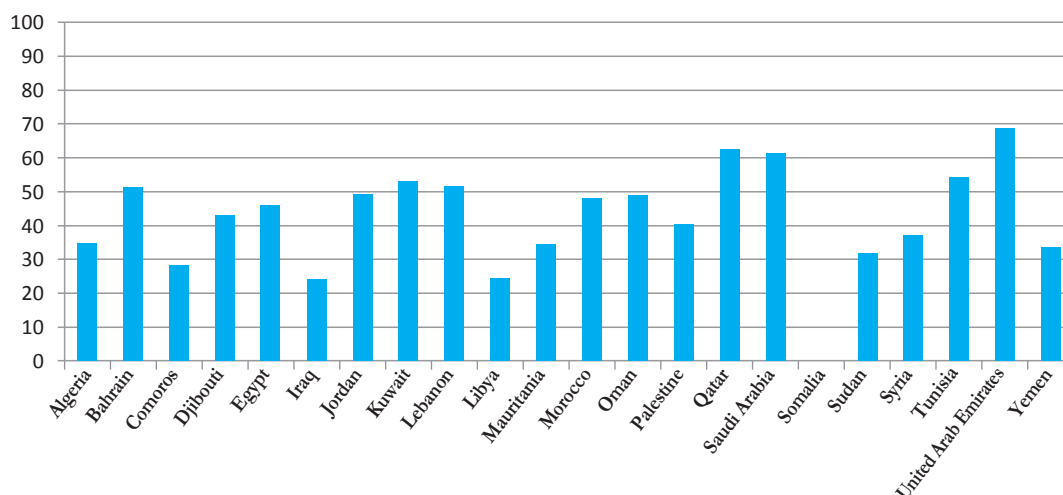
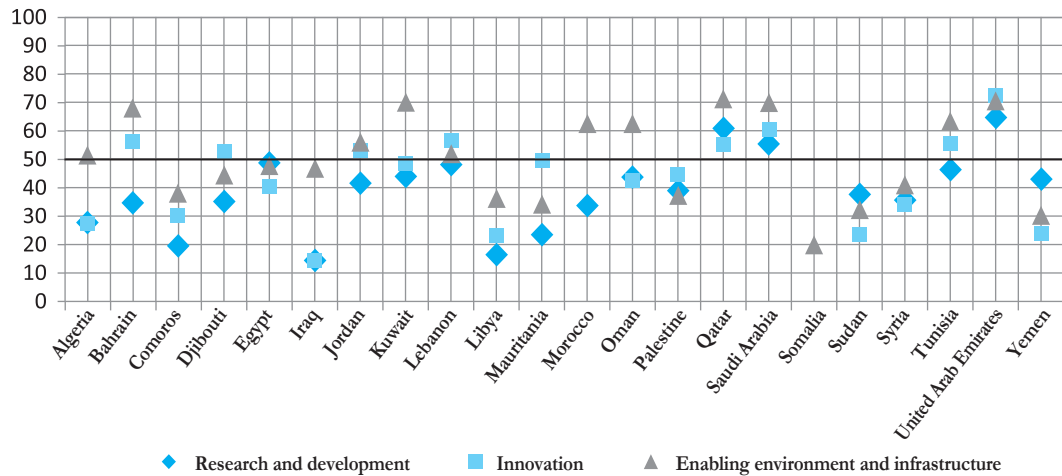


Figure 25:

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



the *enabling environment and infrastructure* sub-pillar).

Overall, these results indicate that the performance of Arab countries in terms of RDI is still far below global levels. In addition, there is lack of researchers in the region compared to more advanced regions. This suggests that Arab states need to exert more efforts to provide the necessary financial support to enhance human capabilities and improve the various components of the RDI sector.

This overall low performance should not obscure the successes in the region, particularly in certain GCC countries which have begun to compete for top global positions. Furthermore, one cannot discuss the overall performance of the Arab region without considering that a group of Arab countries are currently experiencing unstable political, economic, social and security conditions which inevitably affect their research output and innovation capability.

Endnotes

- ¹ Hargreaves and Shaw, 2006.
- ² OECD, 2015.
- ³ UNDP and MBRF 2015.
- ⁴ Cornell University et al., 2015.
- ⁵ OECD, 2005.
- ⁶ UNDP and MBRF, 2015.
- ⁷ Khorshid, 2015 (in Arabic).



Statistical
Methodology

The structure of the AKI 2016 reflects the same format of the AKI 2015 with its six composite indices: Pre-University Education; Technical Vocational Education and Training (TVET); Higher Education; Economy; Information and Communications Technology (ICT); and Research, Development and Innovation (RDI). As outlined in the previous chapters, some changes, such as adding/removing variables and updating data, have been made to better measure the state of knowledge systems in the region. The scope of the statistical analysis was expanded to: ensure consistency; select variables; determine weights; discover outliers, severe skewness and severe kurtosis; and ensure data adequacy for the accurate calculation of each index. The following sections provide a detailed review of the statistical steps taken in building the AKI 2016.

Variable selection

The constituent variables of the six indices of the AKI 2016 are similar to those of the 2015 edition; some new variables were introduced while others were removed, with most changes being made to the TVET Index and the RDI Index.

To ensure the consistency of the selected variables and their classification into the various pillars and sub-pillars, the principal components analysis and Cronbach's alpha coefficients were employed. In most cases, the explained variance ratio exceeded 50 percent¹ and Cronbach's alpha coefficient exceeded 0.7.²

Furthermore, the results of the correlation analysis confirmed the validity of the selection and classification of the variables. The correlation matrix for normalized variables was analysed to ensure they follow the same trend as the composite index, and confirmed the need to include variables that have high correlation coefficients (above 0.9) with the other variables.

Data used

The 432 variables incorporated into the AKI 2016 were obtained from external sources including United Nations Educational, Scientific

and Cultural Organization (UNESCO) and other United Nations agencies; the World Bank; the International Telecommunication Union (ITU); the European Union (EU); the Organisation for Economic Co-operation and Development (OECD) and others.³

The team reviewed the data more than once to ensure no errors had occurred during data entry. Consequently, data was processed on the assumption that it was error-free. In the cases of variables that were linked to other factors – such as population or GDP – results were recalculated after adjusting for the effect of the size.

For the sake of transparency, simplicity and the possibility of replicating the results, no attempts were made to estimate missing values. The use of the arithmetic mean in computing the index is equivalent to estimating each of the missing values of the variable by the mean value. As usual in such cases, the missing values were not entered into the composite indices, which were calculated using the available data for each country.⁴

Data quality

The data employed in building the six sectoral indices should meet certain statistical criteria. In particular, data should be free from outliers, severe skewness and severe kurtosis, which might lead to biased index values. Therefore, the team had to ensure these criteria were met before calculating each index. In cases where such criteria were not met, data was prepared properly to avoid bias. The following section will explain the methods used to identify and treat outliers, severe skewness and severe kurtosis.

Outliers

The value of a variable is considered an outlier if it falls outside the range of the data fence, i.e. an interval with lower and upper bounds calculated based on data location measures (first and third quartiles) and data dispersion measures (interquartile range) as follows:

$$\begin{aligned} \text{Lower bound} &= \text{first quartile} - 1.5 * \text{interquartile range} \\ \text{Upper bound} &= \text{third quartile} + 1.5 * \text{interquartile range} \end{aligned}$$

Outliers are treated by replacing them with the highest value lying within the range of the data fence in the case of high values, and the lowest value within the range of data fence in case of low values.

Skewness and Kurtosis

According to international literature, a variable has severe skewness if its absolute skewness coefficient is above 2. An absolute kurtosis coefficient above 3.5 indicates that the variable has severe kurtosis. Variables that are characterized by severe skewness and/or severe kurtosis require statistical treatment before they may be used for calculating the six sectoral indices. The logarithm transformation is among the well-known transformations used in this respect.

By applying the rules for identifying outliers, severe skewness and/or severe kurtosis in the data of the AKI 2016 variables, the team found 66 variables displaying such phenomena. Table 7 shows the distribution of these variables across the six AKI indices.

The maximum number of outliers for any variable was 2, and the treatment of outliers resolved the problem of severe skewness and/or severe kurtosis in all cases without the need for transformation.

Normalization

The rescaling or “maximum–minimum” method was used for normalization, in which the maximum and minimum indicate the largest

and smallest of the available variable values. The values of variables were normalized in the range of 1–100, in which the higher values indicated better results. The normalization criterion depends on whether the variable is good (i.e. has a positive relation with the composite index) or bad (i.e. has a negative relation with the composite index).

The good variables were normalized using the following formula:

$$\text{Normalised variable value of the country} = 99 \times \left(\frac{\text{raw variable value of the country} - \text{raw minimum value of the variable across countries}}{\text{raw maximum value of the variable across countries} - \text{raw minimum value of the variable across countries}} \right) + 1$$

In the case of the bad variables (i.e. those with an inversely correlated relation) this formula is adjusted as follows:

$$\text{Normalised variable value of the country} = 99 \times \left(\frac{\text{raw maximum value of the variable across countries} - \text{raw variable value of the country}}{\text{raw maximum value of the variable across countries} - \text{raw minimum value of the variable across countries}} \right) + 1$$

Weights

In general, the AKI 2016 adopted the same methods for estimating weights as the 2015 edition, which range from equal weighting and budget allocation to the factor analysis method. However, some of the weights were modified as a result of changes to the overall structure of the sectoral index due to the addition and/or deletion of variables.

The weights were also statistically estimated for each variable using factor analysis by: first, using the values of one factor for each individual

Table 7:

Frequency distribution of variables with outliers, severe skewness and/or severe kurtosis

Index	Number of variables with outliers, severe skewness and/or severe kurtosis
Economy	10
Higher Education	15
ICT	8
Pre-University Education	12
RDI	17
TVET	4

variable proposed to measure the relevant index; and second, using the values of three factors – rather than one – for the suggested individual variables in order to propose several alternative weights to help researchers determine the ultimate weights of the various variables.

Sectoral index calculation

The AKI 2016 used the most recent and credible data for each of the 22 Arab countries. It applied a series of successive aggregations, starting with the more detailed-level variables and ending with the overall sectoral index.

Owing to the failure to obtain data for all the main pillars for each country, and in light of the

desire to maintain an adequate level of accuracy, the sectoral indices were calculated only in cases where data was available for at least two of the main pillars. This applies to all six AKI indices and for all countries. In cases where data for variables was not available for at least three countries, the results of the sub-pillars were not presented.

The arithmetic aggregation formula was used to calculate each composite index of the AKI. Each composite index (CI) is calculated by aggregating its main pillars (SI_j) as follows:

$$CI = \sum_{j=1}^n w_j \times SI_j$$

Endnotes

- ¹ Hair et al., 2015.
- ² Tavakol and Dennick, 2011.
- ³ For more information about the data sources of the AKI, refer to the Annex.
- ⁴ Cornell University et al., 2015.

The background features a pattern of grey arrows pointing in various directions, some overlapping. A prominent blue square is centered on the page, containing the word 'References' in white text. The overall aesthetic is clean and modern, suggesting a focus on direction and progress.

References

References in Arabic

Al-Assaf, G. (2016). *Survey on Components of the AKI Economy Index 2015*. Unpublished background paper for the 2016 Arab Knowledge Index. Arab Knowledge Project. United Nations Development Programme and Mohammed Bin Rashid Al Maktoum Foundation.

Al-Sunbil, A. (2002). *Education in the Arab World on Verge of the Twenty-first Century*. Alexandria: Al-Maktab al-Gami'i al-Hadith (Modern University Office).

Arab Labor Organization (2010). *Arab Strategy for TVET*. Arab Labor Conference No. 1424, 37th Edition. Al-Manama, Bahrain, 6-13 March 2010.

Arab Labor Organization (2008). *Summary of the First Arab Labor Organization Report on Employment and Unemployment in Arab Countries*. Available from: http://alolabor.org/wp-content/uploads/2015/01/Report_Operation_And_Unemployment_Nu_01_Summary.pdf

Arab Monetary Fund (2015). *Joint Arab Economic Report 2015*. Abu Dhabi. Retrieved on November 3, 2016 from: www.amf.org.ae/ar/jointrep

Diab, M. (2009). *Knowledge Economy: A New Quality Era in Economic Development*. Al-Methaq Institute for Training, Studies and Research. February 2, 2009. Retrieved on August 23, 2016 from: <http://www.almethaq.info/news/article1395.htm>

International Labour Organization (2014). *2013 Annual Report*. ILO Cairo. Available from: http://www.ilo.org/wcmsp5/groups/public/@africa/@ro-addis_ababa/@sro-cairo/documents/publication/wcms_332270.pdf

Khalaf, F.H. (2007). *Knowledge Economy*. Amman: Jadara International Books.

Khorshid, M. (2015). *Measuring Research, Development and Innovation Indicators for the Arab Countries*. Unpublished background paper for the 2015 Arab Knowledge Index. Arab Knowledge Project. United Nations Development Programme and Mohammed Bin Rashid Al Maktoum Foundation.

Ministry of Higher Education and Scientific Research of Egypt (2008). *Science and Technology Indicators*, no. 1.

Mrayati, M. (2010). *Knowledge Economy: Arabization of Information Technology Training*. Available from: www.kantakji.com/media/5576/1012.pdf

Qindeel Printing and Publishing (2015). *Economy and Knowledge in a Changing World (compilation)*. Dubai: Qindeel Printing and Publishing

Saleh, K. (2014). *Indicators for Measuring Human Welfare: An Attempt for an Arab Model*. Amman: Arab Institute for Training & Research in Statistics (AITRS). Available from: http://www.aitrs.org/EchoBusV3.0/SystemAssets/Documents/Rafah_Stady.pdf

References in English

Atkinson, R. C., and W. A. Blanpied (2008). Research Universities: Core of the US Science and Technology System. *Technology in Society*, vol. 30. Available from: http://rca.ucsd.edu/speeches/TIS_ResearchUniversitiesCoreoftheUSscienceandtechnologysystem1.pdf

Bassanini, A., S. Scarpetta and I. Visco (2000). *Knowledge, Technology and Economic Growth: Recent Evidence from OECD Countries*. Organisation for Economic Co-operation and Development. Economics Department Working Papers No. 25 and No. 32. Available from: <https://www.oecd.org/eco/growth/1885659.pdf>

Cornell University, INSEAD and the World Intellectual Property Organization (2016). *The Global Innovation Index 2016: Winning with Global Innovation*. Ithaca, Fontainebleau and Geneva. Available from: www.wipo.org

int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf

Cornell University, INSEAD and the World Intellectual Property Organization (2015). *The Global Innovation Index 2015: Effective Innovation Policies for Development*. Ithaca, Fontainebleau and Geneva. Available from: <https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf>

Cornell University, INSEAD and the World Intellectual Property Organization (2014). *The Global Innovation Index 2014: The Human Factor in Innovation*. Ithaca, Fontainebleau and Geneva. Available from: <https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2014-v5.pdf>

Cornell University, INSEAD and the World Intellectual Property Organization (2013). *The Global Innovation Index 2013: The Local Dynamics of Innovation*. Ithaca, Fontainebleau and Geneva. Available from: www.wipo.int/edocs/pubdocs/en/economics/gii/gii_2013.pdf

Deutsche Gesellschaft für Internationale Zusammenarbeit (2013). *Through Competence-Based to Employment-Oriented Education and Training: A Guide for TVET Practitioners*. Available from: https://www.giz.de/akademie/de/downloads/Employment-Oriented_Education_and_Training.pdf

Deutsche Gesellschaft für Internationale Zusammenarbeit (2012). *Selecting and Structuring Vocational Training Contents*. Available from: https://www.giz.de/akademie/de/downloads/Lehrbrief_12__Selecting_and_Structuring_Vocational_Training_Contents.pdf

Deutsche Gesellschaft für Internationale Zusammenarbeit (2009). *Key Aspects of the Economics of Technical and Vocational Education and Training (TVET): Lessons Learned and Gaps to be Filled*. Available from: <https://www.giz.de/fachexpertise/downloads/Fachexpertise/giz2009-en-key-aspects-of-tvet.pdf>

Drucker, P. (1969). *The Age of Discontinuity: Guidelines to our Changing Society*. Oxford: Butterworth Heineman.

Economist Intelligence Unit (2014). *Creative Productivity Index: Analysing Creativity and Innovation in Asia*. For the Asian Development Bank. Available from: https://www.adb.org/sites/default/files/publication/59586/creative-productivity-index_0.pdf

El-Hefnawy, M., A. El-Bastawissy and M. Kadry (2014). Benchmarking the Higher Education Institutions in Egypt using Composite Index Model. *International Journal of Advanced Computer Science and Applications*. Special Issue on Extended Papers from Science and Information Conference.

Enterprise Surveys (n.d.). Economy Snapshots. World Bank. Retrieved from: <https://www.enterprisesurveys.org/Data/>

European Training Foundation (2015a). *The Challenge of Youth Employability in Arab Mediterranean Countries: The Role of Active Labour Market Programmes*. Luxembourg: Publications Office of the European Union. Available from: [http://www.etf.europa.eu/webatt.nsf/0/4C4059A5BA350653C1257E5200453377/\\$file/Youth%20employability%20AMCs.pdf](http://www.etf.europa.eu/webatt.nsf/0/4C4059A5BA350653C1257E5200453377/$file/Youth%20employability%20AMCs.pdf)

European Training Foundation (2015b). *Young People not in Employment, Education or Training: An Overview in ETF Partner Countries*. Torino. Available from: [http://www.etf.europa.eu/webatt.nsf/0/BFEEBA10DD412271C1257EED0035457E/\\$file/NEETS.pdf](http://www.etf.europa.eu/webatt.nsf/0/BFEEBA10DD412271C1257EED0035457E/$file/NEETS.pdf)

European Training Foundation (2010). *Torino Process: Egypt, 2010*. Available from: [http://www.etf.europa.eu/webatt.nsf/0/CEB1D1635813993DC12578C4004A6684/\\$file/Torino%20Process%20-%20Egypt.pdf](http://www.etf.europa.eu/webatt.nsf/0/CEB1D1635813993DC12578C4004A6684/$file/Torino%20Process%20-%20Egypt.pdf)

European Training Foundation (n.d.). Publications by Country. Retrieved from: http://www.etf.europa.eu/web.nsf/pages/Publications_by_country

Groeneveld, R.A., and G. Meeden (1984). Measuring Skewness and Kurtosis. *The Statistician*, vol. 33, No. 4.

Hair, J., R. Anderson, R. Tatham and W. Black (2010). *Multivariate Data Analysis*. 7th ed. Upper Saddle River, NJ: Prentice-Hall International.

Hargreaves, A., and P. Shaw (2006). *Knowledge and Skill Development in Developing and Transitional Economies*.

- Boston College and University of Victoria. Available from: http://siteresources.worldbank.org/EDUCATION/Resources/278200-1126210664195/1636971-1126210694253/DFID_WB_KS_FinalReport_7-31-06.pdf
- Hollanders, H., and N. Es-Sadki (2014). *Innovation Union Scoreboard 2014: The Innovation Union's Performance Scoreboard for Research and Innovation*. European Innovation Scoreboards 2013–2014 Project. European Commission and Maastricht Economic and Social Research Institute on Innovation and Technology (U-MERIT). Retrieved on October 31, 2016 from: <http://ec.europa.eu/DocsRoom/documents/6993/attachments/1/translations/en/renditions/native>
- International Labour Organization (2015). *Global Employment Trends for Youth 2015: Scaling Up Investments in Decent Jobs for Youth*. Geneva. Available from: http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_412015.pdf
- International Telecommunication Union (2016). *World Telecommunication/ICT Indicators Database online*. Available from: <http://www.itu.int/pub/D-IND-WTID.OL>
- International Telecommunication Union (2015a). *Measuring the Information Society Report 2015*. Geneva. Available from: <http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf>
- International Telecommunication Union (2015b). *New Edition of ITU's Flagship Global ICT Regulatory Report: Trends in Telecommunication Reform 2015 tracks increasingly complex ICT ecosystem of traditional and new-generation players*. Press release. Retrieved on November 9, 2016 from: http://www.itu.int/net/pressoffice/press_releases/2015/31.aspx#.WCgww6-7qUI
- Inyagu, E. (2014). Challenges Facing Technical and Vocational Education in Nigeria. *Journal of Educational Policy and Entrepreneurial Research (JEPER)*, vol. 1, No. 1. Retrieved on November 3, 2016 from: <http://jeper.org/index.php/JEPER/article/viewFile/5/5>
- Korany, B., et al. (2014) *Arab Human Development in the Twenty-first Century: The Priorities of Empowerment*. Beirut: Centre for Arab Unity Studies.
- Labe, O. (2010). *Key Indicators on Tertiary Education: Calculation and Interpretation*. Presentation at the UIS Workshop on Education Statistics, Windhoek, 17–21 October. Available from: <http://www.uis.unesco.org/StatisticalCapacityBuilding/Workshop%20Documents/Education%20workshop%20dox/2010%20Windhoek%20-Regional%20Workshop%20on%20Education%20Statistics%20for%20South%20and%20Eastern%20Africa/Key%20Higher%20ED%20indicators.pdf>
- Lane, J., and B. Johnstone (2012). *Universities and Colleges as Economic Drivers: Measuring Higher Education's Role in Economic Development*. Albany, NY: State University of New York Press.
- Liu, O. L. (2009). Measuring Learning Outcomes in Higher Education. *R&D Connections*, No. 10. Available from: https://www.ets.org/Media/Research/pdf/RD_Connections10.pdf
- Martin, M., and C. Sauvageot (2011). *Constructing an Indicator System or Scorecard for Higher Education: A Practical Guide*. UNESCO and International Institute for Educational Planning. Paris: International Institute for Educational Planning. Available from: <http://www.uis.unesco.org/Library/Documents/constructing-indicator-system-scorecard-higher-education-2011-en.pdf>
- Ministry of Education of Finland (2008). *Education and Research Development Plan 2007–2012*. Helsinki: Helsinki University Print Bookstore. Available from: <http://www.minedu.fi/export/sites/default/OPM/Julkaisut/2008/lititeet/opm11.pdf>
- Organisation for Economic Co-operation and Development (2015). *Frascati Manual 2015 Edition: Guidelines for Collecting and Reporting Data on Research and Experimental Development*. Paris. Available from: <http://dx.doi.org/10.1787/9789264239012-en>
- Organisation for Economic Co-operation and Development (2014). *PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know*. Paris. Available from: <https://www.oecd.org/pisa/>

keyfindings/pisa-2012-results-overview.pdf

Organisation for Economic Co-operation and Development (2013). *OECD Science, Technology and Industry Scoreboard 2013: Innovation for Growth*. Paris. Available from: <http://www.oecd.org/sti/scoreboard-2013.pdf>

Organisation for Economic Co-operation and Development (2010). *Assessment of Higher Education Learning Outcomes*. Feasibility Study Report, vol. 2. Available from: <http://www.oecd.org/education/skills-beyond-school/AHELOFSReportVolume2.pdf>

Organisation for Economic Co-operation and Development (2008a). *Compendium of Patents Statistics 2008*. Paris. Available from: <https://www.oecd.org/sti/inno/37569377.pdf>

Organisation for Economic Co-operation and Development (2008b). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. Paris.

Organisation for Economic Co-operation and Development (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. 3rd ed. Paris: OECD Publishing and Eurostat. Available from:

<http://www.oecd-ilibrary.org/docserver/download/9205111e.pdf?expires=1478753861&id=id&accname=guest&checksum=BFE434F94AFE5E376C34F94030E310E9>

Organisation for Economic Co-operation and Development (2004). *Innovation in the Knowledge Economy: Implications for Education and Learning*. Centre for Education Research and Innovation. Paris. Available from: <http://ocw.metu.edu.tr/file.php/118/Week11/oecd2.pdf>

Organisation for Economic Co-operation and Development (OECD) (2002). *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*. Paris. Available from: http://www.tubitak.gov.tr/tubitak_content_files/BTYPD/kilavuzlar/Frascati.pdf

Paunov, C. (2013). *Innovation and Inclusive Development: A Discussion of the Main Policy Issues*. OECD Science, Technology and Industry Working Papers 2013/01. Paris: OECD Publishing. Retrieved on November 7, 2016 from: [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/DOC\(2013\)1&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/DOC(2013)1&docLanguage=En)

Power, C. (2015). *The Power of Education: Education for All, Development, Globalisation and UNESCO*. London: Springer.

Saltelli, A., M. Ratto, T. Andres, F. Campolongo, J. Cariboni, D. Gatelli, M. Saisana, and S. Tarantola (2008). *Global Sensitivity Analysis: The Primer*. Chichester: John Wiley & Sons.

Shaffer, D., and D. Wright (2010). *A New Paradigm for Economic Development: How Higher Education Institutions are Working to Revitalize their Regional and State Economies*. Albany, NY: Rockefeller Institute of Government. Available from: http://www.rockinst.org/pdf/education/2010-03-18-A_New_Paradigm.pdf

Statista (2016). *Number of smartphone users worldwide from 2014 to 2020 (in millions)*. Retrieved on November 10, 2016 from: <https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/>

Statistical, Economic and Social Research and Training Centre for Islamic Countries (2016). Basic Social and Economic Indicators (BASEIND) Database. Retrieved from: <http://www.sesric.org/baseind-step1.php>

Tavakol, M., and R. Dennick (2011). Making Sense of Cronbach's Alpha. *International Journal of Medical Education*, vol. 2.

The Software Alliance (2016). *Seizing Opportunity Through License Compliance: BSA Global Software Survey*. Washington, D.C. Available from: http://www.globalstudy.bsa.org/2016/downloads/studies/BSA_GSS_US.pdf

The Software Alliance (2014). *The Compliance Gap: BSA Global Software Survey*. June 2014. Washington, D.C. Available from: http://globalstudy.bsa.org/2013/downloads/studies/2013GlobalSurvey_Study_en.pdf

Thomson, A. (2008). *Exploring the Relationship between Higher Education and Development: A Review and Report*.

- Brighton: Guerrand-Hermès Foundation for Peace. Available from: http://www.ghfp.org/Portals/ghfp/publications/thomson_hei_role_dev.pdf
- United Nations (2016a). *Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators*. Economic and Social Council. Statistical Commission, forty-seventh session. Available from: <http://unstats.un.org/unsd/statcom/47th-session/documents/2016-2-IAEG-SDGs-E.pdf>
- United Nations (2016b). *UN urges action on sustainable development to create pathways for global 'transformation'*. UN News Centre. April 21. Retrieved on November 8, 2016 from: <http://www.un.org/apps/news/story.asp?NewsID=53744#.WAsiuy197IU>
- United Nations (2015a). Economic and Social Council Summary Record of the 43rd Meeting. Retrieved on November 8, 2016 from: http://www.un.org/ga/search/view_doc.asp?symbol=E/2015/SR.43
- United Nations (2015b). Resolution Adopted by the General Assembly on 25 September 2015. *Transforming our world: the 2030 Agenda for Sustainable Development*. (A/RES/70/1). Available from: http://unctad.org/meetings/en/SessionalDocuments/ares70d1_en.pdf
- United Nations (2014). UN E-Government Surveys. Retrieved on July 25, 2016 from: http://www.unpan.org/egovkb/global_reports/08report.htm
- United Nations (2006). *Convention on the Rights of Persons with Disabilities and Optional Protocol*. Available from: <http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf>
- United Nations Children's Fund (2016a). *Early Childhood Development*. Retrieved from: <http://data.unicef.org/index555d.html?section=topics&suptopicid=42>
- United Nations Children's Fund (2016b). *Multiple Indicator Cluster Surveys (MICS)*. Retrieved from: <http://mics.unicef.org/surveys>
- United Nations Children's Fund (2015a). *Conflict drives 13 million children out of school in the Middle East and North Africa*. Media Centre. September 3. Retrieved on November 1, 2016 from: https://www.unicef.org/mena/media_10557.html
- United Nations Children's Fund (2015b). *Education under Fire: How Conflict in the Middle East is Depriving Children of their Schooling*. Amman: UNICEF Regional Office for Middle East and North Africa. Available from: http://www.unicef.org/mena/Education_Under_Fire_.pdf
- United Nations Department of Economic and Social Affairs (2016). Division for Public Administration and Development Management. United Nations Public Administration Country Studies. Data Center. Retrieved from: <https://publicadministration.un.org/egovkb/en-us/Data-Center>
- United Nations Development Programme (2009). *Arab Human Development Report 2009: Challenges to Human Security in the Arab Countries*. New York. Available from: <http://www.arab-hdr.org/publications/other/ahdr/ahdr2009e.pdf>
- United Nations Development Programme (2003). *Arab Human Development Report 2003: Building a Knowledge Society*. New York. Available from: <http://www.arab-hdr.org/publications/other/ahdr/ahdr2003e.pdf>
- United Nations Development Programme (1990). *Human Development Report 1990*. New York: Oxford University Press. Available from: http://hdr.undp.org/sites/default/files/reports/219/hdr_1990_en_complete_nostats.pdf
- United Nations Development Programme and Mohammed Bin Rashid Al Maktoum Foundation (2015). *Arab Knowledge Index 2015*. Dubai: Al Ghurair Printing and Publishing. Available from: http://www.knowledge4all.com/uploads/files/AKI2015/PDFEn/AKI2015_Full_En.pdf
- United Nations Development Programme and Mohammed Bin Rashid Al Maktoum Foundation (2014). *Arab Knowledge Report 2014: Youth and Localisation of Knowledge*. Dubai: Al Ghurair Printing and Publishing. Available from: www.undp.org/content/dam/rbas/report/UNDP-GENERAL-REPORT-ENG.pdf

United Nations Development Programme and Mohammed Bin Rashid Al Maktoum Foundation (2012). *Arab Knowledge Report 2010/2011: Preparing Future Generations for the Knowledge Society*. Dubai: Al Ghurair Printing and Publishing. Available from: http://www.knowledge4all.com/uploads/files/AKR2011/en/AKR2011_Full_En.pdf

United Nations Development Programme and Mohammed Bin Rashid Al Maktoum Foundation (2009). *Arab Knowledge Report 2009: Towards Productive Intercommunication for Knowledge*. Dubai: Al Ghurair Printing and Publishing. Available from: http://www.knowledge4all.com/uploads/files/AKR2009/en/AKR2009_Full_En.pdf

United Nations Economic and Social Commission for Western Asia (1997). *Science and Technology Indicators: Basic Concepts, Definitions and Prospects for Development*. New York: United Nations.

United Nations Educational, Scientific and Cultural Organization (2016a). *Draft Strategy for Technical and Vocational Education and Training (2016–2021)*. Available from: <http://unesdoc.unesco.org/images/0024/002438/243804e.pdf>

United Nations Educational, Scientific and Cultural Organization (2016b). *Global Education First Initiative*. Retrieved on October 26, 2016 from: <http://www.unesco.org/new/en/education/global-education-first-initiative-gefi/>

United Nations Educational, Scientific and Cultural Organization (2016c). *Technical Vocational Education and Training*. Retrieved on November 3, 2016 from: <http://www.unesco.org/new/en/education/themes/education-building-blocks/technical-vocational-education-and-training-tvet/>

United Nations Educational, Scientific and Cultural Organization (2015a). *EFA Global Monitoring Report. Education for All 2000–2015: Achievements and Challenges*. Available from: <http://unesdoc.unesco.org/images/0023/002322/232205e.pdf>

United Nations Educational, Scientific and Cultural Organization (2015b). *Incheon Declaration: Education 2030: Towards Inclusive and Equitable Quality Education and Lifelong Learning for All*. Available from: <http://unesdoc.unesco.org/images/0023/002338/233813M.pdf>

United Nations Educational, Scientific and Cultural Organization (2015c). *Rethinking Education: Towards a Global Common Good?* Paris. Available from: <http://unesdoc.unesco.org/images/0023/002325/232555e.pdf>

United Nations Educational, Scientific and Cultural Organization (2014a). *Position Paper on Education Post-2015*. Available from: <http://unesdoc.unesco.org/images/0022/002273/227336E.pdf>

United Nations Educational, Scientific and Cultural Organization (2014b). *Sustainable Development Begins with Education: How Education Can Contribute to the Proposed Post-2015 Goals*. Education for All Global Monitoring Report. Paris. Available from: <http://unesdoc.unesco.org/images/0023/002305/230508e.pdf>

United Nations Educational, Scientific and Cultural Organization (2013). *Rankings and Accountability in Higher Education: Uses and Misuses*. Paris: P.T.M. Marope, P.J. Wells, and E. Haselkon, eds.

United Nations Educational, Scientific and Cultural Organization (2012a). *Education First*. September 26. Retrieved from: http://portal.unesco.org/geography/en/ev.php-URL_ID=15971&URL_DO=DO_TOPIC&URL_SECTION=201.html

United Nations Educational, Scientific and Cultural Organization (2012b). *Shanghai Consensus: Recommendations of the Third International Congress on Technical and Vocational Education and Training 'Transforming TVET: Building skills for work and life', Shanghai, People's Republic of China, 14 to 16 May 2012*. Available from: <http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/concensus-en.pdf>

United Nations Educational, Scientific and Cultural Organization (2010). *UNESCO Science Report 2010: The Current Status of Science around the World*. Paris. Available from: <http://unesdoc.unesco.org/images/0018/001899/189958e.pdf>

United Nations Educational, Scientific and Cultural Organization (2009). *Guide to Measuring Information*

and *Communication Technologies (ICT) in Education*. Technical Paper No. 2. Montreal: Institute for Statistics. Available from: <http://unesdoc.unesco.org/images/0018/001865/186547e.pdf>

United Nations Educational, Scientific and Cultural Organization (1998). *Higher Education in the Twenty-First Century: Vision and Action*. World Conference on Higher Education. Paris. Retrieved on November 8, 2016 from: <http://www.unesco.org/education/educprog/wche/principal/ket-e.html>

United Nations Educational, Scientific and Cultural Organization, Institute for Statistics (2016). Data Centre. Retrieved from: <http://data.uis.unesco.org/>

United Nations Educational, Scientific and Cultural Organization, Institute for Statistics (2015). *Technical Advisory Group Proposal: Thematic Indicators to Monitor the Post-2015 Education Agenda*. Available from: <http://www.uis.unesco.org/Education/Documents/tag-proposed-thematic-indicators-post2015-education-agenda.pdf>

United Nations Educational, Scientific and Cultural Organization, Institute for Statistics (2014a). *Higher Education*. Retrieved on October 31, 2016 from: <http://www.uis.unesco.org/Education/Pages/tertiary-education.aspx>

United Nations Educational, Scientific and Cultural Organization, Institute for Statistics (2014b). *Towards Indicators for a Post-2015 Education Framework: Post-2015 Education Indicators Technical Advisory Group of the EFA Steering Committee*. Montreal. Available from: <http://www.uis.unesco.org/Education/Documents/towards-indicators-for-post-2015-education-framework.pdf>

United Nations Educational, Scientific and Cultural Organization, Institute for Statistics (2011). *International Standard Classification of Education (ISCED) 2011*. Montreal. Available from: <http://www.uis.unesco.org/Education/Documents/isced-2011-en.pdf>

United Nations Educational, Scientific and Cultural Organization, Institute for Statistics (2010). *Measuring R&D: Challenges Faced by Developing Countries*. Technical Paper No. 5. Montreal. Available from: <http://www.uis.unesco.org/Library/Documents/tech%205-eng.pdf>

United Nations Educational, Scientific and Cultural Organization, Institute for Statistics (2009). *Guide to Measuring Information and Communication Technologies (ICT) in Education*. Technical Paper No. 2. Montreal. Available from: <http://unesdoc.unesco.org/images/0018/001865/186547e.pdf>

United Nations Educational, Scientific and Cultural Organization, International Centre for Technical and Vocational Education and Training, (2016a). *Update on Activities and Achievements of the European Training Foundation (ETF): Activities and Achievements of ETF*. Retrieved on November 3, 2016 from: [http://www.unevoc.unesco.org/print.php?q=Update+on+Activities+and+Achievements+of+the+European+Training+Foundation+\(ETF\)](http://www.unevoc.unesco.org/print.php?q=Update+on+Activities+and+Achievements+of+the+European+Training+Foundation+(ETF))

United Nations Educational, Scientific and Cultural Organization, International Centre for Technical and Vocational Education and Training (2016b). *Who we are*. September 20. Retrieved on November 5, 2016 from: <http://www.unevoc.unesco.org/go.php?q=aboutus>

United Nations Educational, Scientific and Cultural Organization, International Centre for Technical and Vocational Education and Training (2014a). *Revising the 2001: Revised Recommendations Concerning Technical and Vocational Education*. Available from: www.unevoc.org/fileadmin/up/e-forum_synthesis_report_revised_recommendation_2014.pdf

United Nations Educational, Scientific and Cultural Organization, International Centre for Technical and Vocational Education and Training (2014b). *Vocational Pedagogy: What it is, why it matters and how to put it into practice*. Report of the UNESCO–UNEVOC Virtual Conference, 12–26 May 2014. Available from: <http://unesdoc.unesco.org/images/0023/002303/230349e.pdf>

United Nations Educational, Scientific and Cultural Organization, International Centre for Technical and Vocational Education and Training (2013a). *Entrepreneurship Education in the Arab States. Component II: Synthesis Report*. Available from: http://www.unevoc.unesco.org/fileadmin/user_upload/docs/EPE_

Regional_Synthesis_Report_Component_II__EN_.pdf

United Nations Educational, Scientific and Cultural Organization, International Centre for Technical and Vocational Education and Training (2013b). *Workshop on Policies and Practices on TVET Teachers and Instructors in the Arab Region*. Paris. Retrieved on November 5, 2016 from: <http://www.unevoc.unesco.org/go.php?q=UNESCO-UNEVOC%20participates%20in%20workshop%20on%20%E2%80%9CPolicies%20and%20Practices%20on%20TVET%20Teachers%20and%20Instructors%20in%20the%20Arab%20Region%E2%80%9D>

United Nations Educational, Scientific and Cultural Organization, International Centre for Technical and Vocational Education and Training (n.d.). World TVET Database. Retrieved from: <http://www.unevoc.unesco.org/go.php?q=World+TVET+Database>

Universitas 21 (2015). *U21 Ranking of National Higher Education Systems 2015*. Melbourne Institute of Applied Economic and Social Research and Universitas 21. Retrieved on October 31, 2016 from: <http://www.universitas21.com/RelatedFile/Download/772>

Wildavsky, B. (2010). *The Great Brain Race: How Global Universities are Reshaping the World*. Princeton, NJ: Princeton University Press.

Wilkins, K. (2011). *Higher Education Reform in the Arab World*. SABAN Center, Brookings Institution. Available from: http://www.brookings.edu/wp-content/uploads/2016/06/08_education_reform_wilkins.pdf

World Bank (2016a). *Doing Business 2016: Measuring Regulatory Quality and Efficiency*. Washington, D.C. Available from: <http://www.doingbusiness.org/~media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB16-Full-Report.pdf>

World Bank (2016b). *SABER Systems Approach for Better Education Results*. Retrieved from: <http://saber.worldbank.org/index.cfm>

World Bank (2016c). World Development Indicators. Retrieved from: <http://data.worldbank.org/data-catalog/world-development-indicators>

World Bank (2016d). Worldwide Governance Indicators. Retrieved from: <http://databank.worldbank.org/data/reports.aspx?source=worldwide-governance-indicators&preview=on>

World Bank (2015). *Tertiary Education: Overview*. Retrieved on October 3, 2016 from: <http://www.worldbank.org/en/topic/tertiaryeducation/overview#1>

World Bank (2014a). *Doing Business 2015: Going Beyond Efficiency*. Washington, D.C. Available from: <http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB15-Full-Report.pdf>

World Bank (2014b). *World Bank Support to Education: A Systems Approach to Achieve Learning for All*. April 28. Retrieved on October 21 from: <http://www.worldbank.org/en/results/2014/04/28/world-bank-support-to-education-a-systems-approach-to-achieve-learning-for-all>

World Bank (2013). *Jobs for Shared Prosperity: Time for Action in the Middle East and North Africa*. Washington, D.C. Available from: <http://documents.worldbank.org/curated/en/540401468051871415/pdf/724690v40Full00Prosperity0full0book.pdf>

World Bank (2012). *World Bank Knowledge Economy Index*. Knoema. Retrieved from: <https://knoema.com/WBKEI2013/knowledge-economy-index-world-bank-2012>

World Bank (2011). *Learning for All: Investing in People's Knowledge and Skills to Promote Development*. World Bank Group Education Strategy 2020. Washington, D.C. Available from: http://siteresources.worldbank.org/EDUCATION/Resources/ESSU/Education_Strategy_4_12_2011.pdf

World Bank (2008). *K4D: Knowledge for Development*. The World Bank Institute's Program on Building Knowledge Economies. Washington, D.C. Available from: <http://siteresources.worldbank.org/KFDLP/>

Resources/461197-1199907090464/k4d_bookletjune2008.pdf

World Bank (2007). *Building Knowledge Economies: Advanced Strategies for Development*. World Bank Institute Development Studies. Washington, D.C. Available from: <http://siteresources.worldbank.org/KFDLP/Resources/461197-1199907090464/BuildingKEbook.pdf>

World Bank (1999). *World Development Report: Knowledge for Development*. Washington, D.C.: Oxford University Press. Available from: <http://documents.worldbank.org/curated/en/729771468328524815/pdf/184450WDR00PUBLIC00ENGLISH01998099.pdf>

World Bank and PricewaterhouseCoopers, (2015). *Paying Taxes 2016: The Global Picture*. Washington, D.C.: The World Bank. Available from: <https://www.pwc.com/gx/en/paying-taxes-2016/paying-taxes-2016.pdf>

World Commission on Environment and Development (1987). *Our Common Future*. Oxford: Oxford University Press. Available from: <http://www.un-documents.net/our-common-future.pdf>

World Economic Forum (2015). *The Global Competitiveness Report 2015–2016*. Geneva. Available from: www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

World Economic Forum (2014). *The Global Competitiveness Report 2014–2015*. Geneva. Available from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

World Economic Forum (2013). *The Global Competitiveness Report 2013–2014*. Geneva. Available from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf

World Economic Forum, INSEAD and Cornell University (2016). *The Global Information Technology Report 2016: Innovating in the Digital Economy*. Geneva. Available from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf

World Economic Forum, INSEAD and Cornell University (2015). *The Global Information Technology Report 2015: ICTs for Inclusive Growth*. Insight Report. Geneva. Available from: http://www3.weforum.org/docs/WEF_GITR2015.pdf

World Economic Forum, INSEAD and Cornell University (2012). *The Global Information Technology Report 2012: Living in a Hyperconnected World*. Insight Report. Geneva. Available from: http://www3.weforum.org/docs/Global_IT_Report_2012.pdf

World Health Organization (2015a). Global Health Observatory Data Repository. Retrieved from: <http://apps.who.int/gho/data/view.main>

World Health Organization (2015b). *World Health Statistics 2015: Part I, Health-related Millennium Development Goals*. Retrieved on September 2, 2016 from: http://www.who.int/gho/publications/world_health_statistics/EN_WHS2015_Part1.pdf?ua=1

World Health Organization (n.d.). World Health Statistics. Retrieved on November 20, 2016 from: http://www.who.int/gho/publications/world_health_statistics/en/

Zhao, H. (2015). *ICTs for Sustainable Development*. ITU Blog. Retrieved on September 26, 2016 from: <https://itu4u.wordpress.com/2015/09/23/leading-the-field-icts-for-sustainable-development/>



Annex

Table A1:

Pre-University Education Index: Variables and Weights

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Knowledge Capital (0.4)	Enrolment and Completion (0.5)			Gross intake ratio to the last grade of primary education, both sexes (%)	1/7	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=160
				Gross graduation ratio from primary education, both sexes (%)	1/7	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=161
				Gross graduation ratio from lower secondary education, both sexes (%)	1/7	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=161
				Effective transition rate from primary to lower secondary general education, both sexes (%)	1/7	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=159
				Gross intake ratio to the last grade of lower secondary general education, both sexes (%)	1/7	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=160
				Cumulative drop-out rate to the last grade of primary education, both sexes (%)	1/7	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=156
				Cumulative drop-out rate to the last grade of lower secondary general education, both sexes (%)	1/7	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=157
	Outcomes (0.5)	Basic Skills (0.333)	Literacy Skills (0.333)	Youth literacy rate, population 15-24 years, both sexes (%)	0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166
				Mean score of 15-year-old students in reading literacy	0.5	Organisation for Economic Co-operation and Development (OECD). (2014). PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know. Retrieved from: https://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf
			Mathematics Skills (0.333)	4th Grade achievement in mathematics	1/3	Mullis, I.V.S., Martin, M.O., Foy, P., and Arora, A. (2012). TIMSS 2011 International Results in Mathematics. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College; Amsterdam: International Association for the Evaluation of Educational Achievement (IEA) Secretariat. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Mathematics_FullBook.pdf
				8th Grade achievement in mathematics	1/3	Mullis, I.V.S., Martin, M.O., Foy, P., and Arora, A. (2012). TIMSS 2011 International Results in Mathematics. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College; Amsterdam: International Association for the Evaluation of Educational Achievement (IEA) Secretariat. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Mathematics_FullBook.pdf
				Mean score of 15-year-old students in mathematics literacy	1/3	Organisation for Economic Co-operation and Development (OECD). (2014). PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know. Retrieved from: https://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source		
Knowledge Capital (0.4)	Outcomes (0.5)	Basic Skills (0.333)	Scientific Skills (0.333)	4th Grade achievement in science	1/3	Mullis, I.V.S., Martin, M.O., Foy, P., and Arora, A. (2012). TIMSS 2011 International Results in Mathematics. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College; Amsterdam: International Association for the Evaluation of Educational Achievement (IEA) Secretariat. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Mathematics_FullBook.pdf		
				8th Grade achievement in science	1/3	Mullis, I.V.S., Martin, M.O., Foy, P., and Arora, A. (2012). TIMSS 2011 International Results in Mathematics. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College; Amsterdam: International Association for the Evaluation of Educational Achievement (IEA) Secretariat. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Mathematics_FullBook.pdf		
				Mean score of 15-year-old students in science literacy	1/3	Organisation for Economic Co-operation and Development (OECD). (2014). PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know. Retrieved from: https://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf		
		Lifelong Learning Skills (0.333)	Problem Solving (0.25)	Skillfulness of students in problem solving	1	United Nations Development Programme (UNDP) and Mohammed bin Rashid Al Maktoum Foundation. (2012). Arab Knowledge Report 2010-2011: Preparing Future Generations for the Knowledge Society. Dubai: Al Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2011/en/AKR2011_Full_En.pdf		
				Communication (0.25)	Skillfulness of students in Arabic written communication	1	United Nations Development Programme (UNDP) and Mohammed bin Rashid Al Maktoum Foundation. (2012). Arab Knowledge Report 2010-2011: Preparing Future Generations for the Knowledge Society. Dubai: Al Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2011/en/AKR2011_Full_En.pdf	
					Research and Analysis (0.25)	Skillfulness of students in information retrieval and analysis	1	United Nations Development Programme (UNDP) and Mohammed bin Rashid Al Maktoum Foundation. (2012). Arab Knowledge Report 2010-2011: Preparing Future Generations for the Knowledge Society. Dubai: Al Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2011/en/AKR2011_Full_En.pdf
						Technological Skills (0.25)	Skillfulness of students in using technology	1
		Values and Trends (0.333)		Q7. If politicians were predominantly women, do you believe the world would in general be a better place, a worse place or no different?	1/3	Gallup International. (2013). End of Year Survey 2013: Country Results. Retrieved September 6, 2016, from: http://www.wingia.com/en/services/end_of_year_survey_2013/country_results/7/37/		
				Q7b. To what extent do you agree or disagree with each of the following statement: Democracy may have problems but it is the best system of government.	1/3	Gallup International. (2013). End of Year Survey 2013: Country Results. Retrieved September 6, 2016, from: http://www.wingia.com/en/services/end_of_year_survey_2013/country_results/7/37/		
				Q11. Overall, do you think globalization is a good thing, bad thing, or neither good nor bad?	1/3	Gallup International. (2013). End of Year Survey 2013: Country Results. Retrieved September 6, 2016, from: http://www.wingia.com/en/services/end_of_year_survey_2013/country_results/7/37/		

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Enabling Environment (0.3)	Family Environment (0.333)	Home Educational Resources (0.333)		Question: Number of study supports in the home: Own room and Internet connection	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: Home educational resources (Index)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
		Parental Level of Education (0.333)		Question: Highest level of education of parents	1	Team Index Calculations based on data from: TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
		Parental Involvement at Home (0.333)		Question: How often do your parents ask what you learned in school?	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: How often do your parents make sure that you set aside time for your homework?	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
	Early Childhood Education (0.333)	Enrolment (0.5)		Gross enrolment ratio, pre-primary, both sexes (%)	0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/?queryid=142
				Attendance in early childhood development (36-59 months)	0.5	UNICEF Data & Analytics. (2016). State of the World's Children Report 2016. Retrieved September 6, 2016, from: https://public.tableau.com/views/UNICEFSOWC2016/StateoftheWorldsChildren?:embed=y&:display_count=yes&:showTabs=y&:toolbar=no&:showVizHome=no
		Outcomes (0.5)		Early Child Development Index	1	UNICEF. (2016). Multiple Indicator Cluster Surveys (MICS) 2016. Retrieved August 31, 2016, from: http://mics.unicef.org/surveys
	School Environment (0.333)	Parental Involvement at School (0.2)		Question: How would you characterize parental involvement in school activities within your school? (Opinion of school)	1/6	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: How would you characterize parental support for student achievement within your school? (Opinion of school)	1/6	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: How would you characterize parental support for student achievement within your school? (Opinion of mathematics teachers)	1/6	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: How would you characterize parental involvement in school activities within your school? (Opinion of mathematics teachers)	1/6	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source	
Enabling Environment (0.3)	School Environment (0.333)	Parental Involvement at School (0.2)		Question: How would you characterize parental support for student achievement within your school? (Opinion of science teachers)	1/6	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: How would you characterize parental involvement in school activities within your school? (Opinion of science teachers)	1/6	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
		Classroom Environment (0.2)	Learning Time (0.25)		Teaching hours	1/7	ALECSO: Arab Educational Observatory. (2013). Data and Indicators of the Arab Educational Observatory. Tunisia: Arab Organization for Culture and Science. Retrieved September 6, 2016, from: http://www.alecso.org/marsad/site/?page_id=321&lang=ar
					Question: What is the total instructional time (hours), excluding breaks, in a typical day?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement
					Question: To what degree is absenteeism a problem among teachers in your school?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
					Question: To what degree is arriving late or leaving early a problem among teachers in your school?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
					Question: To what degree is classroom disturbance a problem among <eighth-grade> students in your school?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
					Question: How difficult was it to fill <eighth-grade> teaching vacancies for this school year for science?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
					Question: How difficult was it to fill <eighth-grade> teaching vacancies for this school year for mathematics?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
			Educational Settings (0.25)		Question: Teacher working conditions (Index) (Opinion of mathematics teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
					Question: Teacher working conditions (Index) (Opinion of science teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Enabling Environment (0.3)	School Environment (0.333)	Classroom Environment (0.2)	Pedagogical Relation (0.25)	Question: Thinking about your current school, indicate the extent to which you agree or disagree that the students are respectful of the teachers. (Opinion of mathematics teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: Thinking about your current school, indicate the extent to which you agree or disagree that the students are respectful of the teachers. (Opinion of science teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
			Number of Students in the Classroom (0.25)	Pupil-teacher ratio in primary education (headcount basis)	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=180
				Pupil-teacher ratio in lower secondary education (headcount basis)	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=180
				Pupil-teacher ratio in upper secondary education (headcount basis)	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=180
			Educational Framework (0.2)	Preparation for the Profession (0.25)	Percentage of teachers in pre-primary education who are trained, both sexes (%)	0.25
		Percentage of teachers in primary education who are trained, both sexes (%)			0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx
		Percentage of teachers in lower secondary education who are trained, both sexes (%)			0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx
		Percentage of teachers in upper secondary education who are trained, both sexes (%)			0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/index.aspx
		Collaborative Work (0.25)		Question: Collaborate to improve teaching (Index) (Opinion of science teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: Collaborate to improve teaching (Index) (Opinion of mathematics teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Enabling Environment (0.3)	School Environment (0.333)	Educational Framework (0.2)	Professional Satisfaction (0.25)	Question: Teacher career satisfaction (Index) (Opinion of mathematics teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: Teacher career satisfaction (Index) (Opinion of science teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
			Relation with the Family (0.25)	Question: How often do you meet or talk individually with the student's parents to discuss his/her learning progress? (Opinion of mathematics teachers)	0.25	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: How often do you send home a progress report on the student's learning? (Opinion of mathematics teachers)	0.25	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: How often do you meet or talk individually with the student's parents to discuss his/her learning progress? (Opinion of science teachers)	0.25	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
				Question: How often do you send home a progress report on the student's learning? (Opinion of science teachers)	0.25	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
		Use of Education Technology (0.2)	Technological Infrastructure (0.5)	Internet access in schools	1/3	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
				Educational institutions with computer-assisted instruction (CAI)	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/
				Educational institutions with computer laboratories	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source	
Enabling Environment (0.3)	School Environment (0.333)	Use of Education Technology (0.2)	Use of CAI Technologies (0.5)	Strategies to promote integration of ICT in education	0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/	
				Curriculum includes recommendations for ICT-assisted instruction to form part of subject delivery in mathematics, natural sciences, social sciences, reading, writing, and literature and second language	0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 5, 2016, from: http://data.uis.unesco.org/	
		School Leadership (0.2)	Security and Organization (0.333)	Question: School discipline and safety (Index)	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: Safe and orderly school (Index) (Opinion of mathematics teachers)	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: Safe and orderly school (Index) (Opinion of science teachers)	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: To what degree is physical injury to teachers or staff a problem among <eighth-grade> students in your school?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: To what degree is physical injury to other students a problem among <eighth-grade> students in your school?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: Students bullied at school (Index)	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: During this year, how often were you hit or hurt by other student(s) at school?	1/7	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Cooperation with the family (0.333)	Question: How often does your school organize workshops or seminars for parents on learning or pedagogical issues?	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.
					Question: How often does your school discuss parents' concerns or wishes about the school's organization?	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source	
Enabling Environment (0.3)	School Environment (0.333)	School Leadership (0.2)	Academic Success (0.333)	Question: School emphasis on academic success - teacher reports (Index) (Opinion of mathematics teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
				Question: School emphasis on academic success - teacher reports (Index) (Opinion of science teachers)	0.5	TIMSS & PIRLS International Study Center. (2013). TIMSS 2011 International Database. Boston: IEA International Association for the Evaluation of Educational Achievement.	
Development Context (0.3)	Expenditure on Education (0.2)			Government expenditure per primary student as % of GDP per capita (%)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016 from: http://data.uis.unesco.org/index.aspx?queryid=189	
				Government expenditure per secondary student as % of GDP per capita (%)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016 from: http://data.uis.unesco.org/index.aspx?queryid=189	
				Government expenditure in educational institutions as % of GDP (%)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=182	
				Expenditure on education as % of total government expenditure (%)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=183	
	Cultural Context (0.2)				Educational attainment: at least completed primary (ISCED 1 or higher), population 25+ years, both sexes (%)	0.2	UNESCO Institute for Statistics. (2015)Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/ .
					Educational attainment: at least completed lower secondary (ISCED 2 or higher), population 25+ years, both sexes (%)	0.2	UNESCO Institute for Statistics. (2015). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/
					Educational attainment: at least completed upper-secondary (ISCED 3 or higher), population 25+ years, both sexes (%)	0.2	UNESCO Institute for Statistics. (2015). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/
					Enrolment in tertiary education per 100,000 inhabitants, both sexes	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=131
					Adult literacy rate, population 15+ years, both sexes (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source	
Development Context (0.3)	Health Context (0.2)			Access to improved sanitation facilities (% of population)	1/6	WHO/ UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation. (2016). Data and Estimates. Retrieved September 6, 2016, from: http://www.wssinfo.org/data-estimates/tables/	
				Total health expenditure (% of GDP)	1/6	World Health Organization. (2016). Global Health Observatory Data Repository. Retrieved September 6, 2016, from: http://apps.who.int/gho/data/node.imr.WHS7_143?lang=en	
				Life expectancy at birth, both sexes (years)	1/6	World Health Organization. (2016). Global Health Observatory Data Repository. Retrieved September 6, 2016, from: http://apps.who.int/gho/data/node.main.688?lang=en	
				Total density per 100000 population: hospitals	1/6	World Health Organization. (2016). Global Health Observatory Data Repository. Retrieved September 6, 2016, from: http://apps.who.int/gho/data/view.main.30000	
				Average of 13 international health regulations core capacity scores	1/6	World Health Organization. (2016). World Health Statistics 2016 Data Visualizations Dashboard. Retrieved September 6, 2016, from: http://apps.who.int/gho/data/view.sdq.3-d-d-data-ctry?lang=en	
				Skilled health professional's density (Per 10000 population)	1/6	World Health Organization. (2016). Global Health Observatory Data. Retrieved September 6, 2016, from: http://www.who.int/gho/publications/world_health_statistics/2016/whs2016_AnnexA_HealthWorkforce.pdf	
	Political Context (0.2)				Political stability and absence of violence/terrorism	0.25	World Bank. (2015). World Governance Indicators. Retrieved September 5, 2016, from: http://info.worldbank.org/governance/wgi/index.aspx#home
					Corruption Perceptions Index	0.25	Transparency International. (2015). Corruption Perceptions Index 2015. Retrieved September 5, 2016, from: http://www.transparency.org/cpi2015#results-table
					Transparency of government policymaking	0.25	World Economic Forum. (2015). The Global Competitiveness Report 2015 – 2016. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf For Libya and Yemen: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
					Country well-being (Percent thriving in 3+ elements)	0.25	Gallup Healthways Well-Being Index. (2014). State of Global Well-Being: 2014 Country Well-Being Rankings. Retrieved from: http://info.healthways.com/hubs/Well-Being_Index/2014_Data/Gallup-Healthways_State_of_Global_Well-Being_2014_Country_Rankings.pdf?t=1471642049488
	Social Context (0.2)	Gender Parity (0.333)	Education (0.25)		Gross enrolment ratio, pre-primary, gender parity index (GPI)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .
					Gross enrolment ratio, primary, gender parity index (GPI)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .
					Gross enrolment ratio, lower secondary, gender parity index (GPI)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Development Context (0.3)	Social Context (0.2)	Gender Parity (0.3333)	Education (0.25)	Gross enrolment ratio, upper secondary, gender parity index (GPI)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .
				Gross graduation ratio from primary education, gender parity index (GPI)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/ .
				Gross graduation ratio from lower secondary education, gender parity index (GPI)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 6, 2016, from: http://data.uis.unesco.org/ .
			Literacy (0.25)	Youth literacy rate, population 15-24 years, gender parity index (GPI)	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 8, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166
				Literacy rate, population 25-64 years, gender parity index (GPI)	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 8, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166
				Elderly literacy rate, population 65+ years, gender parity index (GPI)	1/3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 8, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166
			Employment (0.25)	Difference between rates of unemployment for females and males (rates as a percentage of respective male and female labour force)	1	Index Team Calculations based on data from: International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 8, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx
			Civic Participation (0.25)	Difference between the percentage of women and the percentage of men in parliament (%)	1	Index Team Calculations based on data from: Inter-Parliamentary Union. (2016). PARLINE Database on National Parliaments. Retrieved September 5, 2016, from: http://www.ipu.org/wmn-e/classif.html
			Income Distribution (0.333)	Multidimensional Poverty Index	0.5	United Nations Development Programme (UNDP). (2015). Human Development Report: Work for Human Development. Retrieved from: http://hdr.undp.org/sites/default/files/2015_human_development_report_1.pdf
				Poverty headcount ratio at national poverty lines (% of population)	0.5	World Bank. (2016). World Development Indicators. Retrieved September 5, 2016, from: http://data.worldbank.org/indicator/SI.POV.NAHC .

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Development Context (0.3)	Social Context (0.2)	Regional Parity (0.333)		Net attendance rates in primary education (%), urban vs rural (net difference)	0.2	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2015). Data Centre. Retrieved August 31, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=284
				Poverty gap at national poverty lines (%), urban vs rural (net difference)	0.2	Index Team Calculations based on data from: World Bank. (2015). World Bank Open Data. Retrieved August 31, 2016, from: http://data.worldbank.org/indicator/SI.POV.URGP
				Improved sanitation facilities (%), urban vs rural (net difference)	0.2	Index Team Calculations based on data from: WHO/ UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation. (2016). Data and Estimates. Retrieved September 13, 2016, from: http://www.wssinfo.org/data-estimates/tables/
				Improved water source (%), urban vs rural (net difference)	0.2	Index Team Calculations based on data from: WHO/ UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation. (2016). Data and Estimates. Retrieved September 13, 2016, from: http://www.wssinfo.org/data-estimates/tables/
				Composite Coverage Index (%), urban vs rural (net difference)	0.2	Index Team Calculations based on data from: WHO. (2015). RMNCH Interventions Combined, Composite Coverage Index. Retrieved September 13, 2016 from: http://gamapsrver.who.int/gho/interactive_charts/health_equity/inequalities_residence/Map_Place%20oP%20residence.html

Table A2:

Technical Vocational Education and Training Index: Variables and Weights

Pillar	Sub-Pillar	Variable	Weight	Source	
Education and Training (0.2)	Enrolment (0.5)	Percentage of students in secondary education enrolled in vocational programmes, both sexes (%)	0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=135 .	
		Percentage of students in secondary vocational education who are female (%)	0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=140 .	
	Relation with the Labour Market (0.5)	Inadequately educated workforce	1/7	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf	
		Extent of training for TVET students	1/7	ETF. (سنوات مختلفة). Fondation Européenne pour la formation. Retrieved August 25, 2016, from: http://www.etf.europa.eu/ UNESCO.UNEVOC. (سنوات مختلفة). قاعدة البيانات العالمية حول التعليم والتدريب التقني والمهني. Retrieved August 25, 2016 from: http://www.unevoc.unesco.org/	
		Availability of specialized training services	1/7	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf	
		Percent of firms offering formal training	1/7	World Bank. (2016). Enterprises Surveys. Retrieved September 14, 2016, from: http://www.enterprisesurveys.org/data	
		TVET involvement in entrepreneurship	1/7	ETF. (سنوات مختلفة). Fondation Européenne pour la formation. Retrieved August 25, 2016 from: http://www.etf.europa.eu/ UNESCO.UNEVOC. (سنوات مختلفة). قاعدة البيانات العالمية حول التعليم والتدريب التقني والمهني. Retrieved August 25, 2016 from: http://www.unevoc.unesco.org/	
		Participation of TVET authorities in the organising body for the TVET examinations	1/7	ETF. (سنوات مختلفة). Fondation Européenne pour la formation. Retrieved August 25, 2016 from: http://www.etf.europa.eu/ UNESCO.UNEVOC. (سنوات مختلفة). قاعدة البيانات العالمية حول التعليم والتدريب التقني والمهني. Retrieved August 25, 2016 from: http://www.unevoc.unesco.org/	
		Participation of TVET authorities in the committees responsible for setting the TVET curricula	1/7	ETF. (سنوات مختلفة). Fondation Européenne pour la formation. Retrieved August 25, 2016 from: http://www.etf.europa.eu/ UNESCO.UNEVOC. (سنوات مختلفة). قاعدة البيانات العالمية حول التعليم والتدريب التقني والمهني. Retrieved August 25, 2016 from: http://www.unevoc.unesco.org/	
	Organizational Framework (0.5)	Economic Policies (0.5)	Total investment (% of GDP)	0.25	International monetary fund. (2016). Data and Statistics. Retrieved September 15, 2016, from: http://www.imf.org/external/pubs/ft/weo/2016/02/weodata/index.aspx
			Tax incentives for young businesses	0.25	UNESCO. UNEVOC. Entrepreneurship Education in the Arab States. (2013). Retrieved August 25, 2016, from: http://www.unevoc.unesco.org
Starting a business, procedures (number)			0.25	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/-/media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf	
Ease of doing business			0.25	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/-/media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf	

Pillar	Sub-Pillar	Variable	Weight	Source
Organizational Framework (0.5)	Labour Market Features (0.5)	High-skilled employment share (25-54 age group)	1/14	World Economic Forum. (2016). The Human Capital Report 2016. Geneva: World Economic Forum. Retrieved September 26, 2016, from: http://reports.weforum.org/human-capital-report-2016/?doing_wp_cron=1474892898.4192020893096923828125
		Poor work ethic in national labor force	1/14	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Labor force with less than primary education (% of total labor force)	1/14	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 26, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
		Total tax rate, % of commercial profits	1/14	World Bank and PwC. (2016). Paying Taxes 2016: The Global Picture. Washington DC: The World Bank. Retrieved from: https://www.pwc.com/gx/en/paying-taxes-2016/paying-taxes-2016.pdf
		Ratio of minimum wage as a share of value added per worker	1/14	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf .
		Disputes rate per 1000 workers	1/14	جامعة الدول العربية ، المنظمة العربية للشغل 2013. (2013). «التقرير العربي الأول، حول سوق العمل». Retrieved August 23, 2016 from: http://alolabor.org/wp
		Mean weekly hours actually worked per employed person	1/14	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 14, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx
		Pay and productivity	1/14	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Female participation in the labor force, ratio to men (15+)	1/14	Team Index Calculations Based on: International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved October 3, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm01.xlsx
		Labor force not contributing to social security (percent)	1/14	World Bank. (2013). Jobs for Shared Prosperity: Time for Action in the Middle East and North Africa. Retrieved from: https://openknowledge.worldbank.org/handle/10986/13284 .
Labor market efficiency	1/14	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf		

Pillar	Sub-Pillar	Variable	Weight	Source
Organizational Framework (0.5)	Labour Market Features (0.5)	Restrictive labor regulations	1/14	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Labor regulations	1/14	World Bank. (2016). Enterprises Surveys. Retrieved September 14, 2016, from: http://www.enterprisesurveys.org/Custom-Query .
		Availability of a government authority to regulate labour supply and demand	1/14	Fondation Européenne pour la formation. Retrieved August 25, 2016, from: http://www.etf.europa.eu/
Development Context (0.3)	Education (0.333)	Government expenditure per primary and secondary student as % of GDP per capita (%)	0.125	Index Team Calculation: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 26, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=189 .
		Government expenditure on education as % of GDP (%)	0.125	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=181 .
		Higher education and training	0.125	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Adult literacy rate, population 15+ years, both sexes (%)	0.125	Team Index Calculation based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166 .
		Gross enrolment ratio, primary, gender parity index (GPI)	0.125	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .
		Rate of out-of-school children of primary school age, both sexes (%)	0.125	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=121 .
		Net enrolment rate, secondary, both sexes (%)	0.125	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=144 .
		Net enrolment rate, primary, both sexes (%)	0.125	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 14, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=144 .

Pillar	Sub-Pillar	Variable	Weight	Source
Development Context (0.3)	Demography (0.333)	Employment in agriculture, both sexes (%)	0.5	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 14, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx
		Population growth rate (%) (Average annual)	0.5	United Nations, Department of Economic and Social Affairs, Population Division. (2015). World Population Prospects: The 2015 Revision. Retrieved September 15, 2016, from: https://esa.un.org/unpd/wpp/Download/Standard/Population/ .
	State of Development (0.333)	AKI 2015 Economy Index	0.2	United Nations Development Programme (UNDP) and Mohammed bin Rashid Al Maktoum Foundation. (2014). Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014/en/AKR2014_Full_En.pdf .
		Youth unemployment rate (%), 15-24 age group	0.2	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 14, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
		Unemployment rate (%), (15+)	0.2	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 14, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
		Human Development Index (HDI)	0.2	United Nations Development Programme (UNDP). (2016). Human Development Report 2015, Work for Human Development, Retrieved from: http://hdr.undp.org/sites/default/files/2015_human_development_report.pdf .
		GDP per capita (Current US\$)	0.2	World Bank. (2016). World Development Indicators. Retrieved September 9, 2016, from: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD .

Table A3:

Higher Education Index: Variables and Weights

Pillar	Sub-Pillar	Variable	Weight	Source
Higher Education Inputs (0.3)	Enabling Environment (0.167)	Political stability and absence of violence/terrorism	1/6	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home .
		Government effectiveness	1/6	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home .
		Regulatory quality	1/6	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home .
		Rule of law	1/6	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home .
		Foundations of wellbeing	1/6	Social Progress Imperative. (2016). 2016 Social Progress Index. Retrieved September 7, 2016, from: http://www.socialprogressimperative.org/global-index/#data_table/countries/com1/dim1,com1,dim2,dim3 .
		Educational attainment: At least completed upper secondary (ISCED 3 or higher), population 25+ years, both sexes (%)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=168 .
	Expenditure (0.333)	Government expenditure on tertiary education as % of GDP (%)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=181 .
		Expenditure on tertiary as % of total government expenditure (%)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=183 .
		Expenditure on tertiary as % of government expenditure on education (%)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=184 .
		Government expenditure per tertiary student (constant PPP\$)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=191 .
		All staff compensation as % of total expenditure in tertiary public institutions (%)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=186 .
		Capital expenditure as % of total expenditure in tertiary public institutions (%)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=188 .
	Enrolment (0.167)	Percentage of all students in tertiary education enrolled in ISCED 6, both sexes (%)	1/9	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=134 .
		Percentage of all students in tertiary education enrolled in ISCED 7, both sexes (%)	1/9	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=134 .
		Percentage of all students in tertiary education enrolled in ISCED 8, both sexes (%)	1/9	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=134 .
		Gross enrolment ratio, tertiary, female (%)	1/9	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .
		Gross enrolment ratio, tertiary, male (%)	1/9	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .

Pillar	Sub-Pillar	Variable	Weight	Source
Higher Education Inputs (0.3)	Enrolment (0.167)	Gross enrolment ratio, tertiary, gender parity index (GPI)	1/9	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .
		Percentage of students in tertiary education who are female (%)	1/9	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 8, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=139 .
		Difference between enrolment rates in scientific vs non-scientific programmes	1/9	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 8, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=137 .
		Percentage of enrolment in tertiary education in private institutions (%)	1/9	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 8, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=136 .
	Human Resources (0.167)	Pupil-teacher ratio in tertiary education (headcount basis)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=180 .
		Percentage of teachers in tertiary education who are female (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=178 .
		Extent of staff training	0.2	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Researchers (FTE) - higher education %	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=65 .
	Researchers FTE higher education ICSED 8 / Researchers FTE higher education	0.2	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=65 and http://data.uis.unesco.org/index.aspx?queryid=66 .	
	Student Exchange (0.167)	Net flow of internationally mobile students (inbound - outbound), both sexes (number)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=243 .
		Gross outbound enrolment ratio to North America and Western Europe, both sexes (%)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=175 .
		% Change in students studying at the undergraduate level in the US (2013/2014 and 2014/2015)	0.25	Institute of International Education. (2016). "International Scholar Totals by Place of Origin, 2013/14 - 2014/15." Open Doors Report on International Educational Exchange. Retrieved September 8, 2016, from: http://www.iie.org/Research-and-Publications/Open-Doors/Data/International-Students/By-Academic-Level-and-Place-of-Origin/2014-15 .
		% Change in students studying at the graduate level in the US (2013/2014 and 2014/2015)	0.25	Institute of International Education. (2016). "International Scholar Totals by Place of Origin, 2013/14 - 2014/15." Open Doors Report on International Educational Exchange. Retrieved September 8, 2016, from: http://www.iie.org/Research-and-Publications/Open-Doors/Data/International-Students/By-Academic-Level-and-Place-of-Origin/2014-15 .

Higher Education Processes
(0.1)

Pillar	Variables	Weight	Source
Higher Education Processes (0.1)	Establishment of a national authority for quality assurance in the higher education sector	0.125	The source for each national information is cited; there is also this 2009 publication: http://unesdoc.unesco.org/images/0018/001892/189272a.pdf
	Quality of the education system	0.125	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
	Quality of math and science education	0.125	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
	Quality of scientific research institutions	0.125	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
	QS world ranking of the country's leading university	0.125	QS World University Rankings. (2016). University Rankings 2016/17. Retrieved September 9, 2016, from: http://www.topuniversities.com/university-rankings/world-university-rankings/2016 .
	School life expectancy, tertiary, both sexes (years)	0.125	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=147 .
	Internet access in schools	0.125	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
	Availability of specialized training services	0.125	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .

Pillar	Sub-Pillar	Variable	Weight	Source
Higher Education Outputs (0.6)	Graduation (0.111)	Graduates from ISCED 6 programmes in tertiary education, both sexes (number)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=162 .
		Graduates from ISCED 7 programmes in tertiary education, both sexes (number)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=162 .
		Graduates from ISCED 8 programmes in tertiary education, both sexes (number)	0.25	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=162 .
		Difference between completion rates for scientific vs. non-scientific programmes (%)	0.25	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 8, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=162 .
	Employment After Graduation (0.222)	Labor force with tertiary education, both sexes (% of total) (15+)	0.2	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 8, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
		Labor force with tertiary education, male (% of male labor force) (15+)	0.2	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 8, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
		Labor force with tertiary education, female (% of female labor force) (15+)	0.2	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 8, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
		Unemployment with tertiary education, male (% of total unemployment, male) (15+)	0.2	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 8, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
		Unemployment with tertiary education, female (% of total unemployment, female) (15+)	0.2	International Labor Organization (ILO). (2015). Key Indicators of the Labor Market (KILM), 9th Edition. Retrieved September 8, 2016, from: http://www.ilo.org/legacy/english/global-reports/kilm2015/kilm14.xlsx .
	Knowledge Capital Among Graduates (0.333)	Skillfulness of students in problem solving	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Skillfulness of students in Arabic written communication	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Skillfulness of students in foreign language(s)	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Skillfulness of students in information retrieval and analysis	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Skillfulness of students in using technology	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf

Pillar	Sub-Pillar	Variable	Weight	Source
Higher Education Outputs (0.6)	Knowledge Capital Among Graduates (0.333)	Cultural effectiveness among tertiary education students	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Societal effectiveness among tertiary education students	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Economic effectiveness among tertiary education students	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Students recognition for the values of citizenship and belonging	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
		Students recognition for the values of openness and global communication	0.1	UNDP & Mohammed Bin Rashid al Maktoum Foundation. (2014). The Arab Knowledge Report 2014: Youth and Localisation of Knowledge. Dubai: Al-Ghurair. Retrieved from: http://www.knowledge4all.com/uploads/files/AKR2014UAE/ar/AKR2014_UAE_FuII_Ar.pdf
	Knowledge Production by Higher Education Institutions (0.333)	PCT patents, applications/million population	1/6	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Citable documents	1/6	SCImago and Country Rank. (2016). Scimago Journal & Country Rank. Retrieved September 7, 2016, from: http://www.scimagojr.com/countryrank.php?order=desc&year=2015 .
		H Index	1/6	SCImago and Country Rank. (2016). Scimago Journal & Country Rank. Retrieved September 7, 2016, from: http://www.scimagojr.com/countryrank.php?order=h&year=2015 .
		University-industry collaboration in R&D	1/6	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Availability of scientists and engineers	1/6	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
SJR ranking of the best scientific journal in the country	1/6	SCImago and Country Rank. (2016). Country Rankings. Retrieved September 7, 2016, from: http://www.scimagojr.com/journalrank.php		

Table A4:

Information and Communications Technology Index: Variables and Weights

Pillar	Sub-Pillar	Variable	Weight	Source
Technological Capabilities (0.5)	Infrastructure and Digital Content (0.34)	Electricity production, kWh/capita	0.235	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Percentage of the population covered by a mobile-cellular network	0.235	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		International internet bandwidth (Kbits/s) per internet user	0.265	Index Team Calculations based on data from: International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Secure internet servers (per 1 million people)	0.265	World Bank. (2016). World Development Indicators. Retrieved September 1, 2016 from: http://data.worldbank.org/indicator/IT.NET.SECR.P6
	Affordability of Telecommunication Services (0.16)	Mobile-cellular prepaid price of a one-minute local call (off-peak, on-net), in USD	0.375	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Fixed-broadband monthly subscription charge, in USD	0.375	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Internet and telephony sectors competition	0.25	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
	ICT Usage (0.5)	Fixed-telephone subscriptions per 100 inhabitants	0.06	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Mobile-cellular telephone subscriptions per 100 inhabitants	0.08	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Fixed-broadband subscriptions per 100 inhabitants	0.08	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Active mobile-broadband subscriptions per 100 inhabitants	0.08	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.

Pillar	Sub-Pillar	Variable	Weight	Source
Technological Capabilities (0.5)	ICT Usage (0.5)	Percentage of households with computer	0.06	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Percentage of households with Internet	0.08	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Percentage of individuals using the Internet	0.08	International Telecommunication Union (ITU). (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 1, 2016.
		Use of virtual social networks	0.06	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Firm-level technology absorption	0.06	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		ICT use for business-to-business transactions	0.06	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Business-to-consumer internet use	0.06	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Extent of staff training	0.06	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf

Pillar	Sub-Pillar	Variable	Weight	Source
Technological Capabilities (0.5)	ICT Usage (0.5)	Importance of ICTs to government vision of the future	0.06	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Government Online Service Index	0.06	United Nations Department of Economic and Social Affairs (UNDESA). (2016). Division for Public Administration and Development Management. United Nations Public Administration Country Studies (UNPACS) Data Center. Retrieved September 1, 2016, from: https://publicadministration.un.org/egovkb/en-us/Data-Center
		Government success in ICT promotion	0.06	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
Enabling Environment (0.5)	Education (0.26)	Quality of primary education	0.131	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Quality of math and science education	0.123	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Gross enrolment ratio, secondary, both sexes (%)	0.123	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 1, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142
		Adult literacy rate, population 15+ years, both sexes (%)	0.123	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 1, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166

Pillar	Sub-Pillar	Variable	Weight	Source
Enabling Environment (0.5)	Education (0.26)	Internet access in schools	0.123	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Percentage of students in secondary education enrolled in vocational programmes, both sexes (%)	0.123	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 1, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=135 .
		Gross enrolment ratio, tertiary, both sexes (%)	0.123	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 1, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142 .
		Quality of the education system	0.131	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
	Knowledge Economy (0.4)	Effectiveness of law-making bodies	0.07	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Laws relating to ICTs	0.07	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf

Pillar	Sub-Pillar	Variable	Weight	Source
Enabling Environment (0.5)	Knowledge Economy (0.4)	Judicial independence	0.07	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Efficiency of legal framework in settling disputes	0.07	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Intellectual property protection	0.08	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Unlicensed software installation rates	0.08	The Software Alliance (BSA). (2016). Seizing Opportunity Through License Compliance: BSA Global Software Survey. Washington: BSA Worldwide Headquarters. Retrieved from: globalstudy.bsa.org/2016/downloads/studies/BSA_GSS_US.pdf
		Enforcing contracts, procedures (number)	0.07	World Bank. (2015). Doing Business 2015: Going Beyond Efficiency. 12th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: www.doingbusiness.org/~media/GIABW/Doing%20Business/Documents/Annual-Reports/English/DB15-Full-Report.pdf
		Enforcing contracts, time (days)	0.07	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIABW/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf
		Availability of latest technologies	0.07	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Venture capital availability	0.07	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		Total tax rate (% of commercial profit)	0.07	World Bank and PwC. (2016). Paying Taxes 2016: The Global Picture. Washington DC: The World Bank. Retrieved from: https://www.pwc.com/gx/en/paying-taxes-2016/paying-taxes-2016.pdf

Pillar	Sub-Pillar	Variable	Weight	Source
Enabling Environment (0.5)	Knowledge Economy (0.4)	Starting a business, time (days)	0.07	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIABW/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf
		Starting a business, procedures (number)	0.07	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIABW/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf
		Intensity of local competition	0.07	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
	Research and Innovation (0.16)	Global Innovation Index	0.375	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf For Sudan: Cornell University, INSEAD, and WIPO. (2015). The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva: Cornell University, INSEAD, and WIPO. Retrieved from: https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf For Syria: Cornell University, INSEAD, and WIPO. (2013). The Global Innovation Index 2013: The Local Dynamics of Innovation. Geneva, Ithaca, and Fontainebleau: Cornell University, INSEAD, and WIPO. Retrieved from: www.wipo.int/edocs/pubdocs/en/economics/gii/gii_2013.pdf
		PCT patents, applications / million population	0.3125	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014-2015. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf . For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011-2012. Geneva: World Economic Forum. Retrieved from: www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf .
		ICT PCT patents, applications / million population	0.3125	World Economic Forum, INSEAD and Cornell University (2016). The Global Information Technology Report: Innovating in the Digital Economy. Geneva, Switzerland: World Economic Forum and INSEAD. http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva, Switzerland: World Economic Forum and INSEAD. www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum & INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf

Pillar	Sub-Pillar	Variable	Weight	Source
Enabling Environment (0.5)	Knowledge for Development (0.18)	Impact of ICT on business models	2/15	World Economic Forum, INSEAD and Cornell University (2016). The Global Information Technology Report: Innovating in the Digital Economy. Geneva, Switzerland: World Economic Forum and INSEAD. http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva, Switzerland: World Economic Forum and INSEAD. www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum & INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Impact of ICTs on organizational models	2/15	World Economic Forum, INSEAD and Cornell University (2016). The Global Information Technology Report: Innovating in the Digital Economy. Geneva, Switzerland: World Economic Forum and INSEAD. http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva, Switzerland: World Economic Forum and INSEAD. www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum & INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Knowledge-intensive jobs, percentage workforce	2/15	World Economic Forum, INSEAD, and Cornell University. (2016). The Global Information Technology Report: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Bahrain, Jordan, Kuwait, Oman, and Yemen: World Economic Forum, INSEAD, and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_Global_IT_Report_2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		Impact of ICTs on access to basic services	2/15	World Economic Forum, INSEAD, and Cornell University (2016). The Global Information Technology Report: Innovating in the Digital Economy. Geneva, Switzerland: World Economic Forum and INSEAD. http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD, and Cornell University (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva, Switzerland: World Economic Forum and INSEAD. www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		ICT use and government efficiency	2/15	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report: Innovating in the Digital Economy. Geneva, Switzerland: World Economic Forum and INSEAD. http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva, Switzerland: World Economic Forum and INSEAD. www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		E-Participation Index	2/15	United Nations Department of Economic and Social Affairs (UNDESA). (2016). Division for Public Administration and Development Management. United Nations Public Administration Country Studies (UNPACS) Data Center. Retrieved September 1, 2016, from: https://publicadministration.un.org/egovkb/en-us/Data-Center
		Healthy life expectancy at birth	0.2	World Health Organization (WHO). (2016). Global Health Observatory Data Repository. Retrieved September 1, 2016, from: http://apps.who.int/gho/data/view.main.HALEXv

Table A5:

Economy Index: Variables and Weights

Pillar	Sub-Pillar	Variable	Weight	Source
Organizational Performance and Human Resources (0.5)	Economic Openness (0.25)	Trade (% of GDP)	0.25	World Bank. (2016). World Development Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/NE.TRD.GNFS.ZS
		Gross fixed capital formation (% of GDP)	0.25	World Bank. (2016). World Development Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/NE.GDLFTOT.ZS
		Prevalence of non-tariff barriers	0.25	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		High-technology exports (% of manufactured exports)	0.25	World Bank. (2016). Trade Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS?view=chart
	Institutional Organization (0.25)	Soundness of banks	0.2	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Regulatory quality	0.2	World Bank. (2016). World Governance Indicators. Retrieved October 9, 2016, from: http://info.worldbank.org/governance/wgi/index.aspx#reports
		Rule of law	0.2	World Bank. (2016). World Governance Indicators. Retrieved October 9, 2016, from: http://info.worldbank.org/governance/wgi/index.aspx#reports .
		Corruption Perceptions Index	0.2	Transparency International. (2016). Corruption Perceptions Index 2015. Retrieved September 2, 2016, from: http://www.transparency.org/cpi2015#results-table
	Political stability and absence of violence/terrorism	0.2	World Bank. (2016). World Governance Indicators. Retrieved October 9, 2016, from: http://info.worldbank.org/governance/wgi/index.aspx#reports	
	Institutional Empowerment (0.25)	Government effectiveness	0.2	World Bank. (2016). World Governance Indicators. Retrieved October 9, 2016, from: http://info.worldbank.org/governance/wgi/index.aspx#reports .
		Laws relating to ICTs	0.2	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
		World Press Freedom Index	0.2	Reporters without Borders. (2016). World Press Freedom Index 2016. Retrieved September 4, 2016, from: https://rsf.org/sites/default/files/details-2016-world-press-freedom-index_2.csv
		Domestic credit to private sector (% of GDP)	0.2	World Bank. (2016). World Development Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS
		Bank deposits to GDP (%)	0.2	World Bank. (2016). Global Financial Development. Retrieved October 9, 2016, from: http://data.worldbank.org/data-catalog/global-financial-development .

Pillar	Sub-Pillar	Variable	Weight	Source
Organizational Performance and Human Resources (0.5)	Human Resources (0.25)	Total R&D personnel (HC) - Total	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 4, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=61
		Percentage of graduates from tertiary education graduating from science, engineering, construction, and manufacturing, both sexes (%)	1/6	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 30, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=163 .
		Extent of staff training	1/6	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Gross enrolment ratio, tertiary, both sexes (%)	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 2, 2016, from: http://data.uis.unesco.org/Index.aspx?queryid=142
		GDP per capita (current US\$)	1/6	World Bank. (2016). World Development Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
		Percentage of individuals using the internet	1/6	International Telecommunication Union (ITU) (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 4, 2016.
Competitiveness and Creative Development (0.3)	Competitiveness of the Economic Structure (0.5)	Starting a business, procedures (number)	1/6	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf .
		Starting a business, time (days)	1/6	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf .
		Enforcing contracts, procedures (number)	1/6	World Bank. (2015). Doing Business 2015: Going Beyond Efficiency. 12th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB15-Full-Report.pdf .
		Enforcing contracts, time (days)	1/6	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf .
		Foreign direct investment, net inflows (BoP, in current million US\$)	1/6	Index Team Calculations based on data from: World Bank. (2016). World Development Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD .
		Total tax rate (% of commercial profits)	1/6	World Bank and PwC. (2016). Paying Taxes 2016: The Global Picture. Washington DC: The World Bank. Retrieved from https://www.pwc.com/gx/en/paying-taxes-2016/paying-taxes-2016.pdf
	Development of the Economic Structure (0.5)	GERD as a percentage of GDP	1/6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 4, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=74 .
		Manufacturing, value added (% of GDP)	1/6	World Bank. (2016). World Development Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/NV.IND.MANF.ZS .
		E-Government Index	1/6	United Nations Department of Economic and Social Affairs (UNDESA). (2016). Division for Public Administration and Development Management. United Nations Public Administration Country Studies (UNPACS) Data Centre. Retrieved September 4, 2016, from: https://publicadministration.un.org/egovkb/en-us/Data-Center .

Pillar	Sub-Pillar	Variable	Weight	Source
Competitiveness and Creative Development (0.3)	Development of the Economic Structure (0.5)	Venture capital availability	1/6	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Intensity of local competition	1/6	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
		Science and engineering articles in all fields combined	1/6	National Science Foundation. (2016). Science & Engineering Indicators 2016. Retrieved September 5, 2016, from: https://www.nsf.gov/statistics/2016/nsb20161/#/downloads/report .
Economy-Related ICTs (0.2)	Technological Knowledge Exchange (0.5)	High-technology exports (current US\$)	1/3	World Bank. (2016). World Development Indicators. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/TX.VAL.TECH.CD
		Share of imported ICT goods as percentage of total goods imported.	1/3	United Nations Conference on Trade and Development (UNCTAD). (2016). ICT goods imports (% total goods imports). Retrieved September 4, 2016, from: http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx
		Investment in telecoms with private participation (in current million US\$)	1/3	Index Team Calculations based on data from: World Bank. (2016). Private Participation in Infrastructure Database. Retrieved October 9, 2016, from: http://data.worldbank.org/indicator/IE.PPI.TELE.CD
	Enabling Environment (0.5)	Mobile-cellular telephone subscriptions per 100 inhabitants	1/6	International Telecommunication Union (ITU) (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 4, 2016.
		Mobile-cellular prepaid price of a one-minute local call (off-peak, on-net), in USD	1/6	International Telecommunication Union (ITU) (2016). World Telecommunication/ICT Indicators Database online. Retrieved September 4, 2016.
		Impact of ICTs on access to basic services	1/6	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf

Pillar	Sub-Pillar	Variable	Weight	Source
Economy-Related ICTs (0.2)	Enabling Environment (0.5)	ICT use and government efficiency	1/6	<p>World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf</p> <p>For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf</p> <p>For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf</p>
		Government Online Services Index	1/6	United Nations Department of Economic and Social Affairs (UNDESA). (2016). Division for Public Administration and Development Management. United Nations Public Administration Country Studies (UNPACS) Data Center. Retrieved September 4, 2016, from: https://publicadministration.un.org/egovkb/en-us/Data-Center
		Government success in ICT promotion	1/6	<p>World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf</p> <p>For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf</p> <p>For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf</p>

Table A6:

Research, Development and Innovation Index: Variables and Weights

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source	
Research and Development (0.4)	R&D Inputs (0.5)	Expenditure (0.35)		GERD as a percentage of GDP	0.3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 4, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=74	
				GERD per researcher HC (in '000 PPP\$, constant prices - 2005)	0.3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 4, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=74	
				GERD -performed by government as a percentage of GDP	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=81	
				GERD -basic research (%)	1/15	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=79	
				GERD -applied research (%)	1/15	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=79	
				GERD -experimental development (%)	1/15	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=79	
			Human Resources (0.45)		Researchers per million inhabitants (HC)	0.6	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=64
				Technicians per million inhabitants (HC)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=70	
				Educational attainment: at least master's or equivalent (ISCED 7 or higher), population 25+ years, both sexes (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=168	
			Funding (0.2)		GERD - financed by Business enterprise (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=76
				GERD - financed by Government (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=76	
				GERD - financed by Higher education (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=76	
				GERD - financed by Private non-profit (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=76	
				GERD - financed by Not specified source (%)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=76	
			R&D Outputs (0.5)	Scientific Publishing (0.35)		Average documents per researcher	0.7
		Citations per document			0.3	SC imago Journal & Country Rank. (2016). SC imago Journal & Country Rank. Retrieved October 6, 2016, from: www.scimagojr.com/countryrank.php?year=2015&region=Middle%20East	

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source	
Research and Development (0.4)	R&D Outputs (0.5)	Institutional Framework of Scientific Research (0.2)		Quality of scientific research institutions	0.6	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf . For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf	
				University-industry collaboration in R&D	0.4	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf	
		Patents (0.35)		PCT patents, applications/million population	0.2	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf	
				Average number of patents granted annually (2013 - 2015)	0.6	Index Team Calculations based on data from: U.S. Patent and Trademark Office: Patent Technology Monitoring Team (PTMT). (2016). Patent Counts by Country, State, and Year - Utility Patents (December 2015). Alexandria, VA: U.S. Patent and Trademark Office. Retrieved August 24, 2016, from: www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_utl.htm	
				Ratio of the country's annual average of patents to the total Arab regional annual average of patents (2013 - 2015)	0.2	Index Team Calculations based on data from: U.S. Patent and Trademark Office: Patent Technology Monitoring Team (PTMT). (2016). Patent Counts by Country, State, and Year - Utility Patents (December 2015). Alexandria, VA: U.S. Patent and Trademark Office. Retrieved August 24, 2016, from: www.uspto.gov/web/offices/ac/ido/oeip/taf/cst_utl.htm	
			Balance of Payments for ICT Products (0.10)		Share of imported ICT goods as percentage of total goods imported	1	United Nations Conference on Trade and Development (UNCTAD). (2016). ICT goods imports (% total goods imports). Retrieved September 4, 2016, from: http://unctadstat.unctad.org/wds/TableView/tableView.aspx
		Innovation (0.3)	Social Innovation (1)	Inputs (0.4)	Markets, Services, and Competition (0.4)	Domestic credit to private sector (% of GDP)	0.25
DTF score for getting credit (0–100)	0.1					World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf	

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Innovation (0.3)	Social Innovation (1)	Inputs (0.4)	Markets, Services, and Competition (0.4)	DTF score for protecting minority investors (0–100)	0.2	World Bank. (2016). Doing Business 2016: Measuring Regulating Quality and Efficiency. 13th edition. Washington: International Bank for Reconstruction and Development / The World Bank. Retrieved from: http://www.doingbusiness.org/~media/GIAWB/Doing%20Business/Documents/Annual-Reports/English/DB16-Full-Report.pdf
				Stocks traded, total value (% of GDP)	0.15	World Bank. (2016). World Development Indicators. Retrieved October 10, 2016, from: http://data.worldbank.org/indicator/CM.MKT.TRAD.GD.ZS
				Tariff rate, applied, weighted mean, all products (%)	0.1	World Bank. (2016). World Development Indicators. Retrieved October 10, 2016, from: http://data.worldbank.org/indicator/TM.TAX.MRCH.WM.AR.ZS
				Trade (% of GDP)	0.1	World Bank. (2016). World Development Indicators. Retrieved October 10, 2016, from: http://data.worldbank.org/indicator/IE.PPI.TELE.CD
				Intensity of local competition	0.1	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf
			Business Environment (0.4)	Knowledge-intensive jobs, percentage workforce	0.4	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Bahrain, Jordan, Kuwait, Oman, and Yemen: World Economic Forum, INSEAD, & Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/WEF_Global_IT_Report_2015.pdf For Syria: World Economic Forum & INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/Global_IT_Report_2012.pdf
				GERD - financed by abroad (%)	0.15	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=76
				State of cluster development	0.15	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf
				High-tech net imports (% of total trade)	0.1	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Innovation (0.3)	Social Innovation (1)	Inputs (0.4)	Business Environment (0.4)	ICT services imports (% of total trade)	0.1	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf For Sudan: Cornell University, INSEAD, and WIPO. (2015). The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva: Cornell University, INSEAD, and WIPO. Retrieved from: https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf For Syria: Cornell University, INSEAD, and WIPO. (2013). The Global Innovation Index 2013: The Local Dynamics of Innovation. Geneva, Ithaca, and Fontainebleau: Cornell University, INSEAD, and WIPO. Retrieved from: www.wipo.int/edocs/pubdocs/en/economics/gii_2013.pdf
				Foreign direct investment, net inflows (% of GDP)	0.1	World Bank. (2016). World Development Indicators. Retrieved October 10, 2016, from: http://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS
			Other Creative Inputs (0.2)	GERD performed by business enterprise as a percentage of GDP	0.3	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=81
				Cultural and creative services exports (% of total trade)	0.4	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf
				Total computer software spending (% of GDP)	0.3	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf
			Outputs (0.6)	Social Impact of Innovation (0.2)	GDP per capita growth (annual %)	0.265
		New business density [number of newly registered corporations per 1,000 working-age people (15–64 age group)]			0.245	World Bank Group. (2016). Doing Business: Measuring Business Regulations. Retrieved October 6, 2016, from: www.doingbusiness.org/data/exploretopics/entrepreneurship
		Medium and high-tech MVA share in total manufacturing (percent)			0.245	United Nations Industrial Development Organization (UNIDO). (2015). Industrial Development Report 2016: The Role of Technology and Innovation in Inclusive and Sustainable Industrial Development. Vienna: UNIDO. Retrieved from: https://www.unido.org/fileadmin/user_media_upgrade/Resources/Publications/EBOOK_IDR2016_FULLREPORT.pdf
		ISO 9001 quality management systems—requirements: number of certificates issued (per billion PPPS GDP)			0.245	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf For Sudan: Cornell University, INSEAD, and WIPO. (2015). The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva: Cornell University, INSEAD, and WIPO. Retrieved from: https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf For Syria: Cornell University, INSEAD, and WIPO. (2013). The Global Innovation Index 2013: The Local Dynamics of Innovation. Geneva, Ithaca, and Fontainebleau: Cornell University, INSEAD, and WIPO. Retrieved from: www.wipo.int/edocs/pubdocs/en/economics/gii_2013.pdf

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Innovation (0.3)	Social Innovation (1)	Outputs (0.6)	Knowledge Penetration (0.2)	High-technology exports (% of manufactured exports)	0.35	World Bank. (2016). World Development Indicators. Retrieved October 7, 2016, from: http://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS?view=chart
				Foreign direct investment, net outflows (% of GDP)	0.325	World Bank. (2016). World Development Indicators. Retrieved October 6, 2016, from: http://data.worldbank.org/indicator/BM.KLT.DINV.WD.GD.ZS
				ICT services exports (% total trade)	0.325	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf For Sudan: Cornell University, INSEAD, and WIPO. (2015). The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva: Cornell University, INSEAD, and WIPO. Retrieved from: https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf For Syria: Cornell University, INSEAD, and WIPO. (2013). The Global Innovation Index 2013: The Local Dynamics of Innovation. Geneva, Ithaca, and Fontainebleau: Cornell University, INSEAD, and WIPO. Retrieved from: www.wipo.int/edocs/pubdocs/en/economics/gii/gii_2013.pdf
			Intangible Assets (0.15)	Difference between resident and total trademark application class count per 100 billion USD GDP (2011 PPPs)	0.36	Index Team Calculations based on data from: World Intellectual Property Organization. (2015). WIPO IP Statistics Data Center. Retrieved October 5, 2016, from: http://ipstats.wipo.int/ipstatv2/IpsStatsResultvalue
				Impact of ICTs on business models	0.32	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf
				Impact of ICTs on organizational models	0.32	World Economic Forum, INSEAD and Cornell University. (2016). The Global Information Technology Report 2016: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen: World Economic Forum, INSEAD and Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/WEF_GITR2015.pdf For Syria: World Economic Forum and INSEAD. (2012). The Global Information Technology Report 2012: Living in a Hyperconnected World. Geneva: World Economic Forum and INSEAD. Retrieved from: www3.weforum.org/docs/Global_IT_Report_2012.pdf

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source	
Innovation (0.3)	Social Innovation (1)	Outputs (0.6)	Creative Products and Services (0.15)	Number of national feature films produced (per million population 15–69 years old)	1/3	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf For Syria: Cornell University, INSEAD, and WIPO. (2013). The Global Innovation Index 2013: The Local Dynamics of Innovation. Geneva, Ithaca, and Fontainebleau: Cornell University, INSEAD, and WIPO. Retrieved from: www.wipo.int/edocs/pubdocs/en/economics/gii/gii_2013.pdf	
				Printing and publishing manufactures output (% of manufactures total output)	1/3	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf	
				Creative goods exports (% of total trade)	1/3	Cornell University, INSEAD, and WIPO. (2016). The Global Innovation Index 2016: Winning with Global Innovation. Ithaca, Fontainebleau, and Geneva: Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from: www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf For Sudan: : Cornell University, INSEAD, and WIPO. (2015). The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva: Cornell University, INSEAD, and WIPO. Retrieved from: https://www.globalinnovationindex.org/userfiles/file/reportpdf/GII-2015-v5.pdf For Syria: Cornell University, INSEAD, and WIPO. (2013). The Global Innovation Index 2013: The Local Dynamics of Innovation. Geneva, Ithaca, and Fontainebleau: Cornell University, INSEAD, and WIPO. Retrieved from: www.wipo.int/edocs/pubdocs/en/economics/gii/gii_2013.pdf	
			Intellectual Copyrights (0.3)	Intellectual property protection	1	World Economic Forum. (2016). The Global Competitiveness Report 2016 – 2017. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf For Libya: World Economic Forum. (2014). The Global Competitiveness Report 2014 – 2015. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf For Syria: World Economic Forum. (2011). The Global Competitiveness Report 2011 – 2012. Geneva: World Economic Forum. Retrieved from: http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf	
Enabling Environment and Infrastructure (0.3)	Political and Legal Environment (0.14)			Political stability and absence of violence/terrorism	0.25	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home	
				Government effectiveness	0.4	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home	
				Regulatory quality	0.2	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home	
				Rule of law	0.15	World Bank. (2016). World Governance Indicators. Retrieved October 10, 2016, from: http://info.worldbank.org/governance/wgi/#home	
	Economic and Social Environment (0.22)	Macroeconomic Performance (0.6)			Budget surplus or deficit (% OF GDP)	0.15	Central Intelligence Agency (CIA). (2016). The World Factbook. Retrieved October 10, 2016, from: https://www.cia.gov/library/publications/the-world-factbook/fields/2222.html
					Gross national savings (% of GDP)	0.25	International Monetary Fund (IMF). (2016). World Economic Forum Database, October 2016. Retrieved October 5, 2016, from: http://www.imf.org
					General government debt, total (% of GDP)	0.15	International Monetary Fund (IMF). (2016). World Economic Forum Database, October 2016. Retrieved October 5, 2016, from: http://www.imf.org
					GDP per capita (current US\$)	0.25	World Bank. (2016). World Development Indicators. Retrieved October 6, 2016, from: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
					General government structural balance (percent of GDP)	0.2	International Monetary Fund (IMF). (2016). World Economic Forum Database, October 2016. Retrieved October 5, 2016, from: http://www.imf.org

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Enabling Environment and Infrastructure (0.3)	Economic and Social Environment (0.22)	Population and Public Health (0.4)		Infant mortality rate (probability of dying between birth and age 1 per 1000 live births)	0.3	World Health Organization (WHO). (2016). Global Health Observatory Data Repository. Retrieved October 7, 2016, from: http://apps.who.int/gho/data/view.main.182
				Life expectancy at birth, both sexes (years)	0.28	WHO. (2016). Global Health Observatory Data Repository. Retrieved October 5, 2016, from: http://apps.who.int/gho/data/node.main.688
				Total health expenditure (% of GDP)	0.14	World Health Organization. (2016). Global Health Expenditure Database: National Health Indicators. Retrieved September 14, 2016, from: http://apps.who.int/nha/database/ViewData/Indicators/en
				Adult illiteracy rate, population 15+ years, both sexes (%)	0.28	Team Index Calculation based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=166
	Human Resources (0.32)	Pre-University Education (0.35)		Gross expenditure on pre-primary, primary and secondary education (% of GDP)	0.24	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 7, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=181
				Government expenditure per secondary student as % of GDP per capita (%)	0.26	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=189
				Pupil-teacher ratio in secondary education (headcount basis)	0.2	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=180
				Gross enrolment ratio, secondary, both sexes (%)	0.1	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 5, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=142
				Mean score of 15-year-old students in reading literacy	1/35	Organisation for Economic Co-operation and Development (OECD). (2014). PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know. Retrieved from: www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf
				4th Grade achievement in mathematics	1/35	Mullis, I.V.S., Martin, M.O., Foy, P., and Arora, A. (2012). TIMSS 2011 International Results in Mathematics. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College; Amsterdam: International Association for the Evaluation of Educational Achievement (IEA) Secretariat. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Mathematics_FullBook.pdf
				8th Grade achievement in mathematics	1/35	Mullis, I.V.S., Martin, M.O., Foy, P., and Arora, A. (2012). TIMSS 2011 International Results in Mathematics. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College; Amsterdam: International Association for the Evaluation of Educational Achievement (IEA) Secretariat. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Mathematics_FullBook.pdf
				Mean score of 15-year-old students in mathematics literacy	1/35	Organisation for Economic Co-operation and Development (OECD). (2014). PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know. Retrieved from: www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf
				4th Grade achievement in science	1/35	Mullis, I.V.S., Martin, M.O., Foy, P., & Arora, A. (2012). TIMSS 2011 International Results in Science. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Science_FullBook.pdf
				8th Grade achievement in science	1/35	Mullis, I.V.S., Martin, M.O., Foy, P., & Arora, A. (2012). TIMSS 2011 International Results in Science. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. Retrieved from: http://timssandpirls.bc.edu/timss2011/downloads/T11_IR_Science_FullBook.pdf
	Mean score of 15-year-old students in science literacy	1/35	Organisation for Economic Co-operation and Development (OECD). (2014). PISA 2012 Results in Focus: What 15-year-olds know and what they can do with what they know. Retrieved from: www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf			

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Enabling Environment and Infrastructure (0.3)	Human Resources (0.32)	Higher Education (0.45)	Enrolment (0.3)	Gross enrolment ratio, tertiary, both sexes (%)	1	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 2, 2016, from: http://data.uis.unesco.org/Index.aspx?queryid=142
			Engineering and Science Graduates (0.3)	Percentage of graduates from tertiary education graduating from science, engineering, construction, and manufacturing, both sexes (%)	1	Index Team Calculations based on data from: UNESCO Institute for Statistics. (2016). Data Centre. Retrieved September 30, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=163
			Government Spending (0.4)	Expenditure on tertiary as % of government expenditure on education (%)	0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=184
		Government expenditure on tertiary education as % of GDP (%)		0.5	UNESCO Institute for Statistics. (2016). Data Centre. Retrieved October 6, 2016, from: http://data.uis.unesco.org/index.aspx?queryid=181	
		Capacity Building and Lifelong Learning (0.2)	Percent of firms offering formal training	1	World Bank Group. (2016). Enterprise Surveys: What Businesses Experience. Retrieved October 5, 2016, from: www.enterprisesurveys.org/data/exploretopics/workforce	
	Infrastructure (0.32)	ICT Infrastructure (0.45)	IDI Access Sub-Index	0.333	International Telecommunication Union. (2015). Measuring the Information Society Report 2015. Geneva: International Telecommunication Union. Retrieved from: www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf For Palestine and Yemen: International Telecommunication Union. (2014). Measuring the Information Society Report 2014. Geneva: International Telecommunication Union. Retrieved from: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf For Comoros: International Telecommunication Union. (2013). Measuring the Information Society Report 2013. Geneva: International Telecommunication Union. Retrieved from: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2013/MIS2013_without_Annex_4.pdf	
			IDI Use Sub-Index	0.333	International Telecommunication Union. (2015). Measuring the Information Society Report 2015. Geneva: International Telecommunication Union. Retrieved from: http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf For Palestine and Yemen: International Telecommunication Union. (2014). Measuring the Information Society Report 2014. Geneva: International Telecommunication Union. Retrieved from: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf For Comoros: International Telecommunication Union. (2013). Measuring the Information Society Report 2013. Geneva: International Telecommunication Union. Retrieved from: https://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2013/MIS2013_without_Annex_4.pdf	
			E-Participation Index	0.334	United Nations Department of Economic and Social Affairs (UNDESA) (2016). Division for Public Administration and Development Management. United Nations Public Administration Country Studies (UNPACS) Data Center. Retrieved September 1, 2016, from https://publicadministration.un.org/egovkb/en-us/Data-Center	

Pillar	Sub-Pillar	Component	Sub-Component	Variable	Weight	Source
Enabling Environment and Infrastructure (0.3)	Infrastructure (0.32)	General Infrastructure (0.35)		Electricity production, kWh/capita	0.333	World Economic Forum, INSEAD, & Cornell University. (2016). The Global Information Technology Report: Innovating in the Digital Economy. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/GITR2016/WEF_GITR_Full_Report.pdf For Libya and Yemen:
				Gross capital formation (% of GDP)	0.333	World Economic Forum, INSEAD, & Cornell University. (2015). The Global Information Technology Report 2015: ICTs for Inclusive Growth. Insight Report. Geneva: World Economic Forum and INSEAD. Retrieved from: http://www3.weforum.org/docs/WEF_Global_IT_Report_2015.pdf For Syria:
				International LPI score	0.334	World Bank. (2016). LPI Global Rankings 2016. Retrieved October 4, 2016, 2016, from: http://lpi.worldbank.org/international/global/2016 For Yemen: World Bank. (2014). LPI Global Rankings 2014. Retrieved October 4, 2016, 2016, from: http://lpi.worldbank.org/international/global/2014
		Environmental Sustainability (0.2)		GDP per unit of energy use (constant 2011 PPP \$ per kg of oil equivalent)	0.5	World Bank. (2016). World Development Indicators. Retrieved October 5, 2016, from: http://data.worldbank.org/indicator/EG.GDP.PUSE.KO.PP.KD
				Environmental Performance Index	0.5	Yale University and Columbia University. (2016). Global Metrics for the Environment. New Haven, CT: Yale University. Retrieved from: http://epi.yale.edu/sites/default/files/2016EPI_Full_Report_opt.pdf



Empowered lives.
Resilient nations.



مؤسسة محمد بن راشد آل مكتوم
MOHAMMED BIN RASHID
AL MAKTOUM FOUNDATION

