

GOII

GLOBAL QUALITY INFRASTRUCTURE INDEX

TRENDS, COMPARISON, & USE OF DATA

REPORT 2021

BY
ULRICH HARMES-LIEDTKE
JUAN JOSÉ OTEIZA DI MATTEO
MÓNICA MUÑOZ



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AUTHORS: Dr Ulrich Harmes-Liedtke, Juan José Oteiza Di Matteo and Mónica Muñoz

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CONTACT: uhl@mesopartner.com, jjoteiza@analyticar.com.ar

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¹ GQII Website <https://gqii.org>

LIST OF ACRONYMS

AB	Accreditation body	MITI	Ministry of Industry and International Trade (Malaysia)
AFRAC	African Accreditation Cooperation	MLA	Multi-Lateral Recognition Arrangement (the term used by the IAF)
APAC	Asia Pacific Accreditation Cooperation	MRA	Mutual Recognition Arrangement (the term used by BIPM and ILAC)
ARAC	Arab Accreditation Cooperation	MS	Management Standards
ASEAN	Association of Southeast Asian Nations	NAB	National Accreditation Body
BIPM	International Bureau of Weights and Measures	NQI	National Quality Infrastructure
BMZ	Federal Ministry for Economic Cooperation and Development (Germany)	NQP	National Quality Policy
BMWK	Federal Ministry for Economy and Climate Action (Germany)	NSB	National Standards Body
CAB	Conformity Assessment Body	OECD	Organization for Economic Cooperation and Development
CIPM	International Committee for Weights and Measures	OIML	International Organization of Legal Metrology
CMC	Calibration and Measurement Capabilities	QMS	Quality Management System
CROSO	CARICOM Regional Organization for Standards and Quality	QI4SD	Quality Infrastructure for Sustainable Development Index
GQII	Global Quality Infrastructure Index	PTB	Physikalisch-Technische Bundesanstalt (German Federal Metrology Institute)
IAAC	Inter-American Accreditation Cooperation	SDG	Sustainable Development Goals
IAF	International Accreditation Forum	QI	Quality Infrastructure
IEC	International Electrotechnical Commission	TC	Technical Committee
ILAC	International Laboratory Accreditation Cooperation	UK	United Kingdom
ISO	International Organization for Standardization	UNIDO	United Nations Industrial Development Organization
INetQI	International Network on Quality Infrastructure	USA	United States of America
ITC	International Trade Centre	WHO	World Health Organization
ITU	International Telecommunication Union	WTO	World Trade Organization
KSC	Key and Supplementary Comparisons		
KCDB	Key Comparison DataBase		

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Through this cooperation, the GQII Index gains scientific backing, strengthening its use in academia and application.

Finally, we thank the Executive Director of the Organismo Nacional de Acreditación de Colombia (ONAC), Alejandro Giraldo, for his support in translating the GQII publications into Spanish and in disseminating the results via the website and the webinars "Charlas con Ulrich".



FORWARDS

EMANUELE RIVA

*Chair of the International Network on Quality Infrastructure (INetQI) and
Chair of the International Accreditation Forum, Inc. (IAF)*

Why is it important to compare with the Global Quality Infrastructure Index (GQII)?

We buy things daily - to eat, to keep ourselves warm, to wear, to entertain ourselves, to move around, and to show affection for our loved ones. We make these purchases without realising the long journey these goods (or services) endure before reaching our hands – the number of tests and inspections they must pass, the certifications they require, and the number of commercial exchanges that need to take place.

This is all possible thanks to, among other things, the Quality Infrastructure (QI), which plays an essential role in each leg of the journey. According to the definitions found in various circles, including the Organisation for Economic Co-operation and Development (OECD) and the World Trade Organization (WTO), QI is understood as a reference framework for defining and developing rules to demonstrate and guarantee the quality of products and services on the market. It is the institutional reference framework for any form of economic integration.

It is, therefore, important for policymakers and markets to increase their understanding of QI and periodically measure its diffusion and trends. This research, based on data and expert opinion, as well as the contribution of research centres and universities in this latest edition, has a robust scientific depth.

In summary, this research tells us:

- // The 2021 Global Quality Infrastructure Index (GQII) indicators show widespread improvement compared to 2020, thus signalling an improvement in QI globally;
- // The development of QI has been much more significant in advanced countries, thereby increasing the gap in QI development levels between them and their developing counterparts;
- // This update of the GQII 2021 composite indicator shows few changes in the highest positions of the ranking table. Meanwhile, countries in the middle experience more significant upward or downward shifts. This is probably due to the methodological changes in the calculation and the different quality and availability of data from one year to the next. Data quality and availability are still a challenge, but I believe that in the future, the data generated by the International Accreditation Forum (IAF) CertSearch (the global database of management systems certifications managed by the IAF) could strengthen the database of the GQII; and
- // There is an exciting relationship between the GQII 2021 and some macroeconomic indicators. In particular, the positive correlation between the GQII 2021 and the Sustainable Development Goals Index (SDG Index) is of interest: countries with the most advanced QI systems are associated with higher levels of sustainable development.

In conclusion, every nation should approach this index strategically and work towards improving its position in the ranking because the GQII's correlation with economic development and its relevance for creating a sustainable future is evident.

KNUT BLIND

Professor for Innovation Economics at the Technical University Berlin and Head of the Business Unit Innovation and Regulation of the Fraunhofer Institute for Systems and Innovation Research ISI in Karlsruhe/ Germany

The Global Quality Infrastructure Index (GQII) is an important tool to measure and compare quality infrastructure (QI) development worldwide. The compilation and publication of data from metrology, standardization, accreditation, and conformity assessment institutions enable the scientific study of QI as a system and highlight its importance for economic development, innovation, and the competitiveness of countries.

The Chair of Innovation Economics at the Technical University of Berlin sees itself as a centre for research on QI and its impact. In this regard, we support the GQII programme and publish the index on our website.¹ Under the leadership of our guest researcher and creator of the GQII, Dr. Ulrich Harnes-Liedtke, the Chair supports the further development of the index and QI research based on GQII data.

QI has only recently started attracting the attention of both policymakers and researchers. Only last month, the Organisation for Economic Co-operation and Development (OECD) published its review of Germany's Innovation Policy. An entire chapter was devoted to QI and its role in innovation. In the review, the OECD stated that "Germany has one of the world's most advanced and well-respected quality and certification systems (or "quality infrastructure"), which has supported international competitiveness" (OECD, 2022, p. 36). This is in line with the findings of the GQII, which has positioned Germany at the top of the ranking for the last two years. In the review, the OECD highlights Germany's strong position in standardization. This has allowed Germany to assume the role of a "rule maker" rather than just a "rule taker", which is crucial for its leading role in innovation and international competitiveness in many industries.

However, Germany's leading role in innovation and trade is being threatened by the increasing lack of leadership in the international standardization of key technologies, mostly in realm of digitalisation. Therefore, the OECD recommends that the German government digitalise its QI to secure its leading position in standard-setting. In the same vein, both insights from the German Standardization Panel and a QI-FoKuS survey revealed significant room for improvement related to digital standards and the digitalisation of German conformity assessment bodies. The OECD proposes to look at QI more strategically, as the German Federal Ministry of Economics and Climate Protection (BMWK) is currently implementing in the context of the National Strategy for Hydrogen Economy.

Although Germany is positioned at the top of the GQII, there is still room for improving and modernising its QI, especially concerning digitalisation.

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¹ <https://www.tu.berlin/inno/forschung/projekte/aktuell/global-quality-infrastructure-index>.

2

INTRODUCTION

Quality infrastructure (QI) is the technical backbone for international trade, with metrology, standardization, accreditation and conformity assessment services providing reliability and trust between trading partners. In addition, QI services are increasingly relevant for the health sector and sustainable development.

Due to the growing importance of QI worldwide, stakeholders inside and outside the QI ecosystem are becoming more interested in reliable data and information on their development status. This interest goes hand in hand with the increasing digitalisation of the economy and society, which QI institutions must consider.

The GQII Index is a pioneer in measuring the development status and dynamics of QI worldwide. The team of authors has been working on the measurability of national quality systems for over a decade. In close coordination with representatives and experts from QI bodies, key indicators were identified, the data collected, and a composite index was validated.

The GQII Report 2021 builds on the experience of previous studies and the GQII Report 2020 (Harmes-Liedtke/ Oteiza 2021). It focuses on the presentation and interpretation of the data collected in the second half of 2021 and its comparison with the previous year's values. Interested readers can find the background and methodological principles of the GQII explained in detail in the GQII Report 2020.

The 2020 to 2021 data comparison is particularly relevant because of the COVID-19 outbreak. On 11 March 2020, the World Health Organization (WHO) officially declared the disease a global pandemic. In the months that followed, people around the globe were affected, with massive impacts on the economy and society. QI institutions were challenged to expand their services, especially in the health sector. Standards organisations temporarily released standards for masks and ventilators. The development and production of vaccines created a surge in demand for conformity assessment services. Due to mobility constraints, remote audits, and digital communication, such as virtual standards committee meetings, received a significant boost. In contrast, some companies could not maintain their certifications, and the use of some laboratory services decreased during the economic crisis.

The 2021 GQII data shows that QI service provision and use continued to grow even after the onset of the COVID-19 pandemic. This trend holds, albeit varying degrees, for all QI components and GQII indicators. However, comparing countries 2 and country groups shows that QI has grown

² In this report, we often use the terms "country" and "economy" as synonyms. If we understand the term country to refer to sovereign states or member states of the United Nations, this applies to most of the countries in the ranking. Exceptions are "countries" such as the Palestinian Territories or Kosovo, but also Macao, Hong Kong and Taiwan, whose statehood is not generally recognised.

much more strongly in high-income economies than in emerging and developing countries. Despite intensive efforts of international development cooperation in QI, the disparity has widened further. QI in developing countries can be described as trailing behind the leader (FURMAN; HAYES, 2004) . This means that despite their investments in QI, many countries need help to catch up with the leading nations.

In the GQII ranking of economies, we generally observe only minor changes between 2020 and 2021 in the top part of the table. In fact, among the top 25, there are only drops by up to 3 positions (Australia, Canada, Hungary) and advances in the ranking by up to 5 (Switzerland and Turkey). Germany led the order, followed by China and the United States of America (USA). At the same time, the United Kingdom (UK) and Japan still occupy the fourth and fifth positions, respectively. This is in line with the expectation that building a QI system is a lengthy process that has spanned many decades in the leading countries.

There were significant changes in the middle and end of the ranking table. The jumps often resulted from relatively minor differences between countries in the midfield and at the bottom of the order.

As the GQII allows for the first annual comparison in 2021, the changes in rank should be viewed with caution. Undoubtedly, much of the data represent fundamental changes in the development of the QI components, which can be validated in detail by analysing the data underlying the index. However, there are also weaknesses in the data sources that can only be identified and eliminated with more extended time series. Examples of this are the further participation of the certification bodies

in the International Organization for Standardization (ISO) Survey (see technical notes of ISO Survey) or the lack of validation of the data by individual accreditation bodies. Finally, we must mention that there have been improvements to the formula, making it more demanding when recognising QI capabilities. The changes impact two of the three QI areas.

We now incorporate economies' participation in the International Electrotechnical Commission (IEC) Technical Committees (TC) in Standards. In Accreditation, we have weighted the count of conformity assessment bodies (CABs) based on the recognition that every National Accreditation Body (NAB) has in the International Laboratory Accreditation Cooperation (ILAC) and International Accreditation Forum (IAF) for each scope. We have also tightened the criteria for calculating CAB coverage (we only look at bodies accredited by national authorities this time). Finally, we decided to recognise no longer the membership status of the Accreditation Body (AB) of origin when a country accredits conformity bodies certified only abroad. This is penalising countries without an AB.

The impact of the formula changes on the table is slightly distorted. Incorporating participation in IEC technical committees generates a zero shift in the top 50 economies, while the next 50 move up four positions on average. The rest of Table 1 falls five places on average. No cases of extreme movements were observed. Only Macao and Venezuela fell by more than ten positions.

The recalculation of the coverage of conformity assessment bodies (CABs coverage) affects only a quarter of the cases, leaving the value of this component

unchanged for the rest of the economies. On average, the countries affected lose one scope of the 17 surveyed by the indicator, equivalent to 6 percentage points.

As mentioned above, the impact of not recognising the membership status of the AB of origin in cases of cross-border accreditation mainly affects small economies without their own NABs.

Finally, the weighted count of conformity assessment bodies in calibration, testing, management systems, and product certification punishes economies without international recognition of their NABs through ILAC and IAF Mutual Recognition Arrangements (MRA).

If we apply the prior formula to the data collected in 2021 and compare both rankings, we see that only 10% of the economies have changed their position by more than ten places. The top 25 does not show net changes in part; that is, movements in both directions are netted, and in no case greater than six places—the more developed the economy in terms of QI, the less the impact of the new algorithm. From position 26 to 100, more countries gain positions, while net decreases are observed in the rest of the table.

The progressive deterioration of the positions is consistent with the fact that the formula punishes the less developed in terms of QI. This helps us to better discriminate in an area of the table where the scores are very similar, and slight differences generate significant distances in the ranking. Our decision not to make further changes to the GQII formula allows us to compare the data over time.

As in the edition GQII2020, this report includes comparisons of the GQII with other development indicators. The strong correlation between countries' QI development and export activities is confirmed again. Similar holds, albeit less strongly, for the correlation between the GQII and economic complexity. QI remains an essential element of a country's trade performance and competitiveness. New to this report is an analysis of the relationship between the GQII with the Sustainable Development Goals (SDG) Index. Here, too, we find a strong correlation between countries' QI development status and the achievement of their SDG targets.

A particular focus of this report is the use of GQII data, including the ranking itself, as well as the indicators on which it is based and the extensive database behind it. In Chapter 4 The authors share examples of how GQII data has been used in various projects to promote QI and develop quality policies.

The projects draw on experiences from four continents and different funders, including the Federal Ministry for Economic Cooperation and Development (BMZ), the Caribbean Development Bank, the European Union, the International Trade Centre, the World Bank and the Physikalisch-Technische Bundesanstalt (PTB). These examples are intended to help readers use the GQII as an information base for their studies and country comparisons.

The report's annexes contain examples of QI country profiles and a chronicle of important QI events in 2021. This chronicle is intended to highlight the connection between quantitative and qualitative data.



3

DATA ON THE DEVELOPMENT OF THE GLOBAL QUALITY INFRASTRUCTURE IN 2021

3.1 General trends

The GQII data shows progress in QI development worldwide between 2020 and 2021. This is presented in Figure 1. In the field of metrology, there were increases in the number of calibration and measurement capabilities (CMCs) by 1.6%, Key and Supplementary Comparisons (K&SCs) by 6.6%, and accredited calibration laboratories by 12.2%. In the field of standardization, the number of members from different economies participating in ISO TCs increased by 1.9%, and the number of organisations certified with ISO Management Standards (MS) grew by 17.4%. With respect to participation in IEC TCs, we have determined 5576 participants for this year for the first time and therefore have no information on the development. In accreditation there were increases in the numbers of accredited testing laboratories by 6.9%, product certification bodies by 14.9%, management system certification bodies by 28.0%, and accredited medical laboratories by 38.9%. The authors interpret the latter as an indication of the greater importance of conformity assessment in the health sector in the wake of the COVID-19 pandemic.

3.2 The 2021 Ranking

The GQII ranks 184 countries according to the relative development of their QI. A formula calculates a score for each country based on its position in the sub-rankings for metrology, standards and accreditation. The 2021 GQII ranking is presented in Table 1 and illustrated in Figure 2 below.

QI Evolution by Areas			
QI Areas	2020	2021	
Metrology			
CMCs	25.536	25.944	1,6%
Key&Suppl. Comp.	11.883	12.671	6,6%
CABs - Calibration Labs*	10.828	12.149	12,2%
Standardization			
IEC Tech. Comm.	n.d.	5.576	
ISO Tech. Comm.	21.540	21.960	1,9%
ISO MS Certification	1.345.381	1.578.961	17,4%
Accreditation			
CABs - Testing Labs*	53.432	57.111	6,9%
CABs - Product Certification*	3.574	4.105	14,9%
CABs - MS Certification*	2.329	2.980	28%
CABs - Medical Labs	2.329	10.412	38,9%

Figure 1: QI development from 2020 to 2021

A country that ranks first in all areas would score 1. In the GQII 2021, the top-ranked country (Germany) scored 0.9958, while the lowest-ranked country (Timor-Leste) scored 0.1190. The composition of the top 25 countries in QI development is virtually unchanged from the previous edition, with 24 countries in the 2020 Top 25 Group remaining in the 2021 Top 25 Group. The new entrant to the top 25 is Finland (25th), displacing the Russian Federation from 24th to 31st. Geographically, the top 25 are mainly located in Europe, North America, and Asia-Pacific, with some exceptions, such as India (10th), Brazil (13th), Australia (14th), Turkey (16th), Mexico (18th) and South Africa (20th).

In contrast, less economically advantaged parts of the world, which include many emerging countries and small economies, remain in the middle and lower parts of the table, repeating the patterns observed in 2020. Movements within this group, however, are very significant in 2021, with large shifts in positions from the previous year.

There are various reasons for a country to move up or down in the ranking. Firstly, it responds to absolute improvements or losses in the development of QI,

a phenomenon captured through the index's three components. Secondly, given that the ranking is an ordering of countries based on the score they obtain, a country may, for example, gain relative positions if its "neighbours" in the table do worse that year, without this implying an improvement in absolute terms of the QI of the country that has advanced in the ranking. Finally, given the nature of data collection on accreditation, there is a possibility that some data may be inaccurate. As mentioned above, this problem was mitigated by validating all collected data against their official sources, achieving coverage of just under 70% of the total number of CABs counted.

If the 2021 GQII ranking is examined by QI component, in metrology, the first three places are occupied by the USA (1st), Germany (2nd), and China (3rd). China leads the standardization ranking (1st), followed by Germany (2nd) and Japan (3rd). In accreditation, the podium this year goes to Germany (1st), followed by the USA (2nd) and China (3rd). It is worth noting that the first three economies in the 2021 GQII ranking (1st Germany, 2nd China and 3rd United States) are in the top 8 in each area measured by the index.

Quality Infrastructure World Overview: GQII 2021 over 184 economies

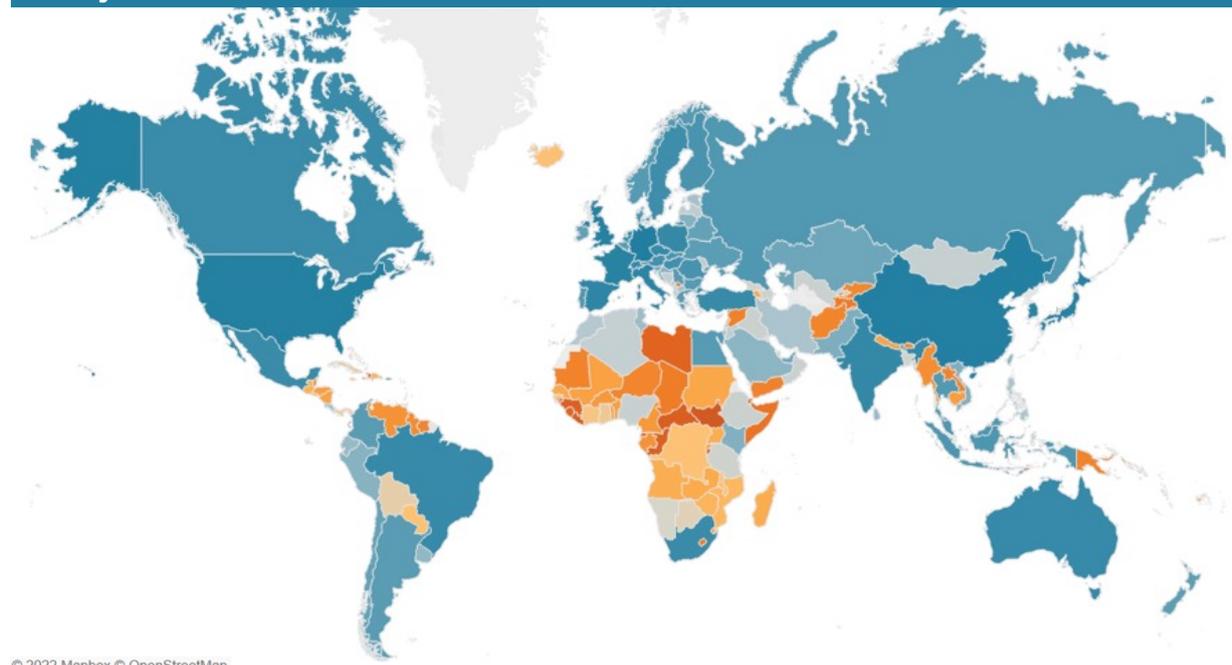


Figure 2: Overview of QI development worldwide according to the 2021 GQII

Table 1: 2021 GQII ranking table

GQII 2021: Global Ranking and Subrankings by QI area (184 Economies)						
Economy Name	Economy Code	GQII Rank	GQII Scores	Rank Metrology	Rank Standardization	Rank Accreditation
Germany	DEU	1	0,996	2	2	1
China	CHN	2	0,990	3	1	3
United States	USA	3	0,987	1	8	2
United Kingdom	GBR	4	0,982	4	4	6
Japan	JPN	5	0,976	5	3	12
France	FRA	6	0,973	7	6	11
Korea, Republic of	KOR	7	0,962	6	7	17
Italy	ITA	8	0,957	15	5	4
Spain	ESP	9	0,949	13	10	7
India	IND	10	0,932	21	9	5
Poland	POL	11	0,927	19	15	7
Switzerland	CHE	12	0,924	14	12	21
Brazil	BRA	13	0,924	11	20	18
Australia	AUS	14	0,923	9	18	22
Czech Republic	CZE	15	0,923	18	13	14
Turkey	TUR	16	0,921	16	25	10
Netherlands	NLD	17	0,914	20	11	15
Mexico	MEX	18	0,913	10	42	9
Canada	CAN	19	0,912	8	24	26
South Africa	ZAF	20	0,909	12	27	19
Sweden	SWE	21	0,897	22	16	24
Hungary	HUN	22	0,886	26	23	20
Austria	AUT	23	0,885	25	22	24
Romania	ROU	24	0,870	32	17	29
Finland	FIN	25	0,865	27	21	39
Slovak Republic	SVK	26	0,862	23	36	32
Denmark	DNK	27	0,853	33	29	27
Indonesia	IDN	28	0,851	38	39	15
Malaysia	MYS	29	0,850	40	30	23
Singapore	SGP	30	0,845	24	45	34
Russian Federation	RUS	31	0,843	17	14	64
Portugal	PRT	32	0,842	30	26	41
Thailand	THA	33	0,833	29	32	48
Greece	GRC	34	0,828	42	37	28
Norway	NOR	35	0,828	44	28	33
Belgium	BEL	36	0,825	41	19	44
Egypt	EGY	37	0,825	37	44	35
Bulgaria	BGR	38	0,824	35	35	42
Serbia	SRB	39	0,823	39	34	40
Colombia	COL	40	0,818	43	41	31
Argentina	ARG	41	0,818	31	40	46
Ukraine	UKR	42	0,812	28	43	51
New Zealand	NZL	43	0,805	34	48	43
Ireland	IRL	44	0,793	54	38	37
Belarus	BLR	45	0,789	36	46	53
Chile	CHL	46	0,786	47	53	36
Slovenia	SVN	47	0,764	46	52	49
Kazakhstan	KAZ	48	0,760	45	65	30
United Arab Emirates	ARE	49	0,754	53	54	45
Pakistan	PAK	50	0,717	63	51	55
Viet Nam	VNM	51	0,712	64	60	38
Croatia	HRV	52	0,706	48	50	70
Kenya	KEN	53	0,703	49	63	58
Israel	ISR	54	0,702	52	33	83
Lithuania	LTU	55	0,699	55	69	52
Peru	PER	56	0,694	65	55	57
Taiwan (Province of China)	TWN	57	0,681	50	121	13
Saudi Arabia, Kingdom of	SAU	58	0,677	56	47	86
Uruguay	URY	59	0,664	51	77	61
Ecuador	ECU	60	0,649	57	84	60

GQII 2021: Global Ranking and Subrankings by QI area (184 Economies)						
Economy Name	Economy Code	GQII Rank	GQII Scores	Rank Metrology	Rank Standardization	Rank Accreditation
Sri Lanka	LKA	61	0,646	79	61	50
Hong Kong, China	HKG	62	0,642	61	93	47
Luxembourg	LUX	63	0,636	83	56	62
Tunisia	TUN	64	0,635	58	64	74
Estonia	EST	65	0,615	60	70	80
Costa Rica	CRI	66	0,613	67	85	59
North Macedonia	MKD	67	0,608	73	81	56
Iran	IRN	68	0,603	72	31	109
Philippines	PHL	69	0,600	80	49	94
Morocco	MAR	70	0,577	59	68	105
Montenegro	MNE	71	0,564	62	82	91
Moldova, Republic of	MDA	72	0,564	76	97	63
Qatar	QAT	73	0,561	91	58	84
Jordan	JOR	74	0,558	103	71	65
Latvia	LVA	75	0,556	71	82	75
Albania	ALB	76	0,550	95	106	54
Bosnia and Herzegovina	BIH	77	0,550	69	73	95
Mauritius	MUS	78	0,547	85	91	66
Algeria	DZA	79	0,543	97	59	87
Mongolia	MNG	80	0,538	81	88	72
Nigeria	NGA	81	0,536	115	57	92
Oman	OMN	82	0,534	92	62	98
Uzbekistan	UZB	83	0,532	84	96	67
Ethiopia	ETH	84	0,530	94	90	69
Iraq	IRQ	85	0,530	66	67	118
Azerbaijan	AZE	86	0,524	70	101	78
Tanzania	TZA	87	0,520	98	86	71
Bangladesh	BGD	88	0,515	82	87	89
Georgia	GEO	89	0,513	74	99	85
Cyprus	CYP	90	0,508	105	72	93
Bahrain, Kingdom of	BHR	91	0,507	116	75	81
Namibia	NAM	92	0,501	96	110	68
Kuwait, the State of	KWT	93	0,499	93	66	110
Botswana	BWA	94	0,490	86	115	76
Bolivia, Plurinational State of	BOL	95	0,483	78	94	103
Cuba	CUB	96	0,483	68	108	104
Malta	MLT	97	0,473	89	80	111
Panama	PAN	98	0,472	75	89	117
Ghana	GHA	99	0,470	88	79	113
Côte d'Ivoire	CIV	100	0,462	140	74	102
Jamaica	JAM	101	0,458	87	111	99
Democratic Republic of the Congo	COD	102	0,456	128	107	82
Malawi	MWI	103	0,455	128	118	73
Iceland	ISL	104	0,455	125	75	108
Paraguay	PRY	105	0,455	77	131	96
El Salvador	SLV	106	0,435	101	102	106
Mozambique	MOZ	107	0,430	118	138	79
Zimbabwe	ZWE	108	0,423	118	113	101
Dominican Republic	DOM	109	0,419	105	105	112
Trinidad and Tobago	TTO	110	0,419	100	95	120
Guatemala	GTM	111	0,413	105	129	100
Angola	AGO	112	0,407	141	136	88
Uganda	UGA	113	0,405	118	78	138
Seychelles	SYC	114	0,404	104	143	97
Madagascar	MDG	115	0,403	141	140	90
Lebanese Republic	LBN	116	0,402	118	92	132
Zambia	ZMB	117	0,396	90	134	116
Senegal	SEN	118	0,393	128	100	124
Armenia	ARM	119	0,392	141	98	121
Sudan	SDN	120	0,388	98	104	136

GQII 2021: Global Ranking and Subrankings by QI area (184 Economies)						
Economy Name	Economy Code	GQII Rank	GQII Scores	Rank Metrology	Rank Standardization	Rank Accreditation
Nepal	NPL	121	0,378	141	112	122
Nicaragua	NIC	122	0,374	110	147	107
Mali	MLI	123	0,374	141	116	123
Palestinian Territories	PSE	124	0,372	126	129	114
Benin	BEN	125	0,371	126	128	115
Cambodia	KHM	126	0,365	108	124	130
Honduras	HND	127	0,365	118	126	126
Eswatini	SWZ	128	0,361	118	180	77
Burkina Faso	BFA	129	0,352	141	132	125
Cameroon	CMR	130	0,351	141	103	147
Rwanda	RWA	131	0,351	128	114	142
Barbados	BRB	132	0,344	111	119	162
Saint Lucia	LCA	133	0,340	108	125	154
Macao, China	MAC	134	0,340	116	133	140
Venezuela, Bolivarian Republic of	VEN	135	0,339	102	161	119
Togo	TGO	136	0,337	141	141	127
Gabon	GAB	137	0,337	128	117	154
Fiji	FJI	138	0,331	141	120	148
Myanmar	MMR	139	0,329	141	123	146
Brunei Darussalam	BRN	140	0,328	128	136	137
Bhutan	BTN	141	0,321	141	134	143
Bahamas	BHS	142	0,321	141	127	149
Guyana	GUY	143	0,320	111	144	149
Kyrgyz Republic	KGZ	144	0,314	128	149	135
Niger	NER	145	0,309	141	151	133
Afghanistan	AFG	146	0,309	141	139	154
Suriname	SUR	147	0,307	111	150	154
Lao People's Democratic Republic	LAO	148	0,305	141	142	149
Mauritania	MRT	149	0,304	141	145	141
Papua New Guinea	PNG	150	0,304	141	146	139
Syrian Arab Republic	SYR	151	0,299	124	108	164
Yemen	YEM	152	0,298	141	160	134
Chad	TCD	153	0,290	141	148	154
Guinea-Bissau	GNB	154	0,290	141	171	129
Belize	BLZ	155	0,286	111	167	149
Liechtenstein	LIE	156	0,286	141	157	144
Lesotho	LSO	157	0,285	141	170	131
Tajikistan	TJK	158	0,280	141	158	153
Gambia	GMB	159	0,275	141	159	162
Cabo Verde	CPV	160	0,273	141	163	154
Maldives	MDV	161	0,270	141	164	154
Kosovo	XKX	162	0,266	141	180	128
Somalia	SOM	163	0,265	141	175	145
Burundi	BDI	164	0,254	170	122	164
Samoa	WSM	165	0,236	141	180	154
Dominica	DMA	166	0,232	135	152	164
Saint Kitts and Nevis	KNA	167	0,230	135	156	164
Saint Vincent and the Grenadines	VCT	168	0,220	135	162	164
Sierra Leone	SLE	169	0,215	170	153	164
Libya	LBY	170	0,213	170	154	164
Haiti	HTI	171	0,213	170	155	164
Antigua and Barbuda	ATG	172	0,206	135	174	164
Grenada	GRD	173	0,205	135	176	164
Congo	COG	174	0,197	170	165	164
Guinea	GIN	175	0,196	170	166	164
Liberia	LBR	176	0,194	170	168	164
Djibouti	DJI	177	0,192	170	169	164
Central African Republic	CAF	178	0,189	170	171	164
Vanuatu	VUT	178	0,189	170	171	164
Equatorial Guinea	GNQ	180	0,187	170	176	164
Tonga	TON	181	0,182	170	178	164
Solomon Islands	SLB	182	0,180	170	179	164
South Sudan	SSD	183	0,165	170	180	164
Timor-Leste	TLS	183	0,165	170	180	164

3.3 Changes from 2020 to 2021

The authors assume that the state of QI in a country change slowly. Creating new quality services and gaining international recognition usually requires several years of continuous commitment and funding.

Since the compilation of time series data on QI development is only at its beginning and the data quality still has shortcomings, changes between 2020 and 2021 should be treated with caution. Where the authors are aware of changes in data collection, they make these transparent. For other changes, the plausibility was checked through selective expert interviews.

The comparison of the years 2020/ 2021 showed the following changes.

An overall view of the scores achieved by the 184 economies shows a general decline in their scores. Only six countries have escaped this trend (Montenegro, Estonia, Turkey, France, Germany and China). This is explained by the fact that the GQII has become more demanding in measuring development in standardization and accreditation. Indeed, we now consider participation in IEC TCs. We also weigh the CAB count according to each NAB's recognition in ILAC and IAF Multi-Lateral Recognition Arrangements (MLAs)/MRAs. Also, small economies lacking NABs have been penalised through the CABs coverage and accreditation membership status terms.

The above effect is noticeable if we compare 2020 versus 2021 world maps, as seen in Figure 3 .

Dual Map

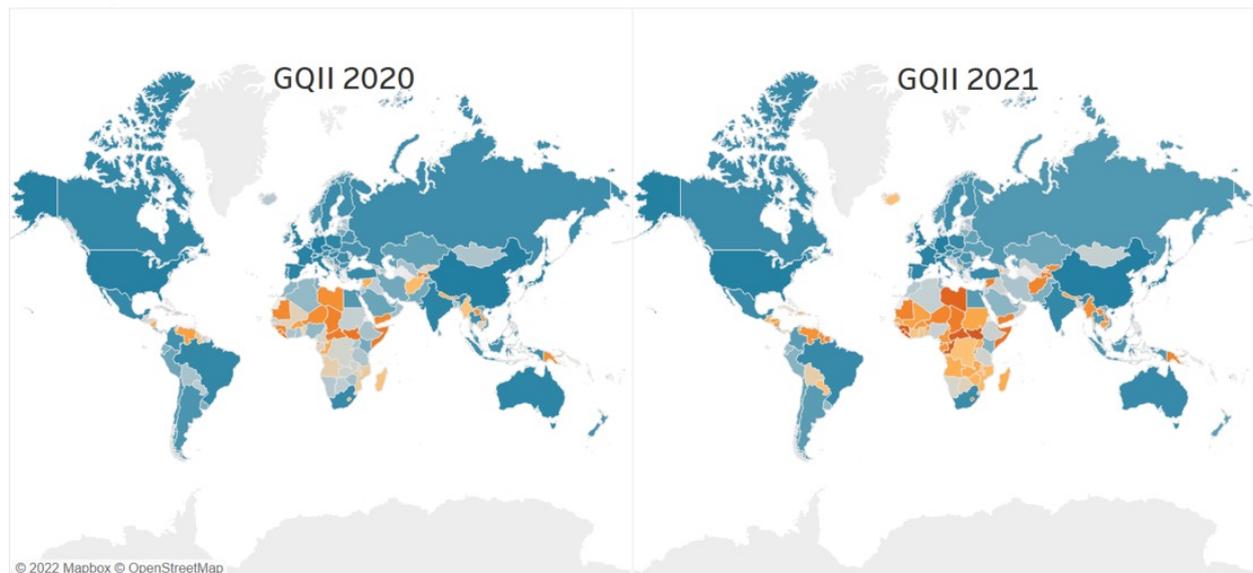


Figure 3: 2020 versus 2021 GQII world map comparison

Now we see more orange areas (lower GQII scores) and less intense blue areas (higher GQII scores). In principle, this can be understood as a simple change of scale that affects almost all economies. However, a closer look at the distribution of the 2021 scores of the indicator reveals that the fall is more intense in the middle and lower parts of the table, implying that the distance between the leading economies in terms of QI and the group of followers is more significant in 2021 than in 2020.

Comparing the distribution of QI scores, as illustrated in Figure 4 , the dispersion increases and the median decreases from 2020 to 2021. In other words, the scores of advanced economies have increased relative to those of less developed economies.

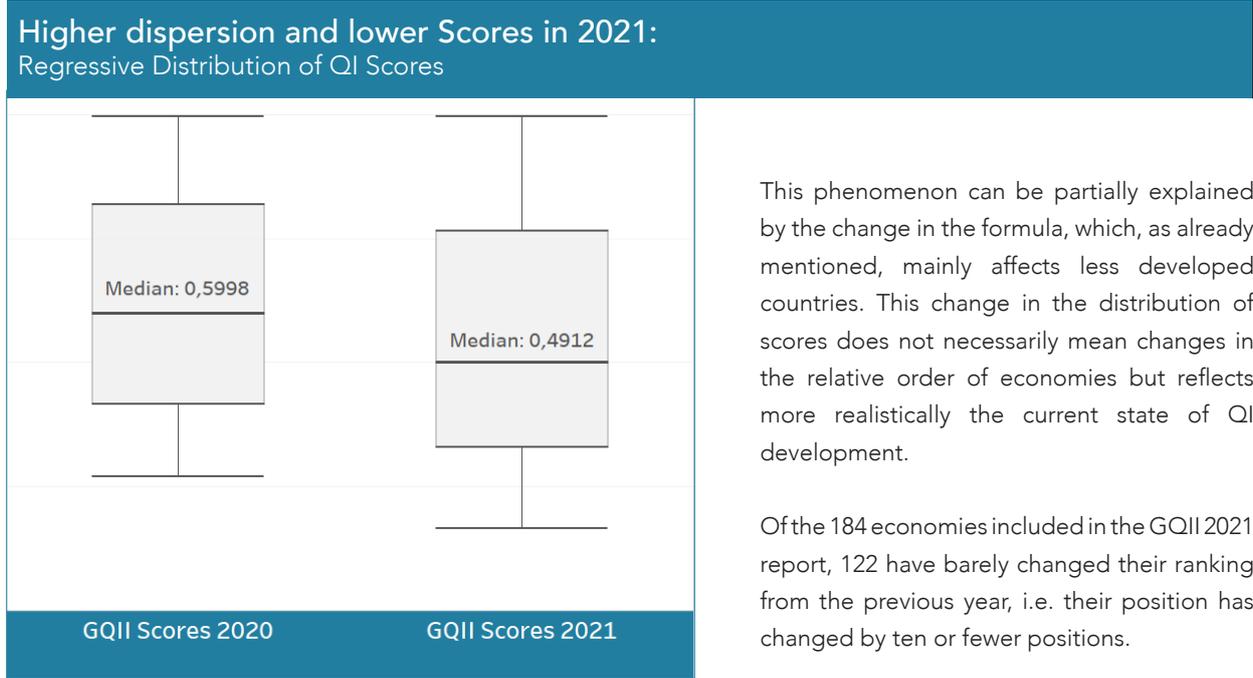


Figure 4: Distribution 2020 vs 2021 GQII scores

As seen in Table 2 , the biggest advancers in the ranking include Montenegro, Moldova, Estonia, Guinea-Bissau, Mozambique, Latvia, and Nepal, among others. They climbed several positions driven by significant improvements in specific components of the indicator. For example, Montenegro moved up 38 places in the ranking. The increase in ISO MS certificates stands out, with a variation of 78%. The count of all CABs considered in the formula also improved, positively impacting their coverage (from 31% in 2020 to 59% in 2021).

A similar analysis can be run for other big winners, such as Nepal. With much more modest improvements than Montenegro. Nepal has increased the number of ISO MS Certificates (from 137 in 2020 to 143 in 2021); it also maintained its CAB coverage even though we now only recognise domestic CABs for this component, and it even declared new conformity assessment bodies in the areas of MS and Product Certification. This partially explains why Nepal managed to move up 22 positions in the global ranking.

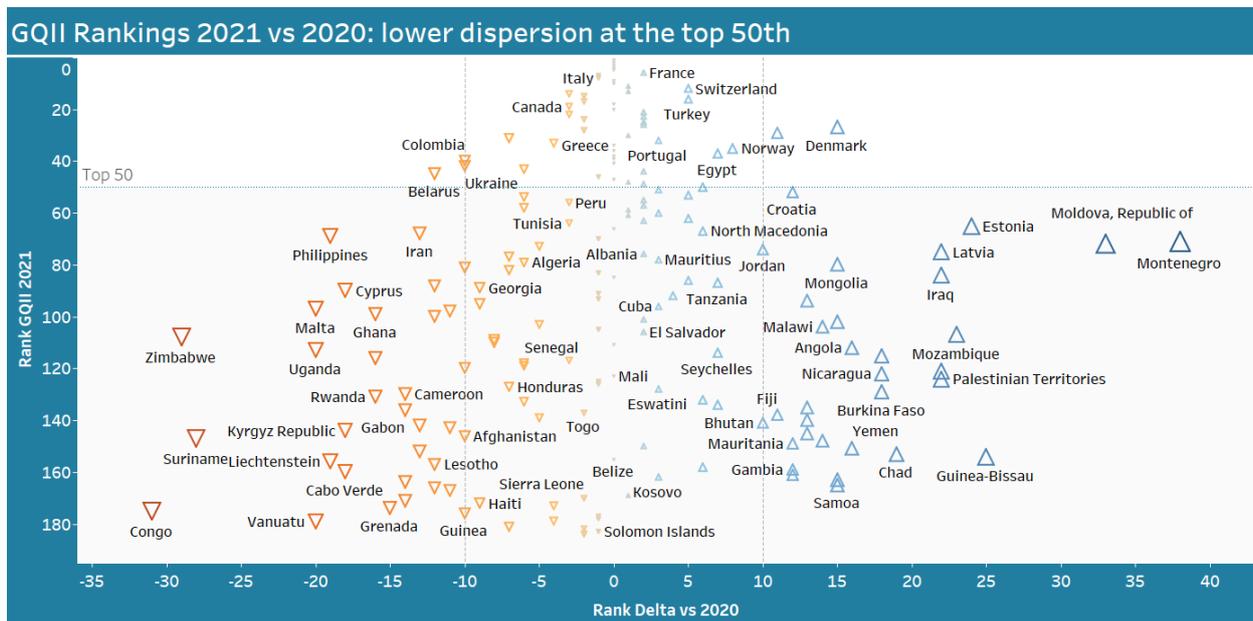


Figure 5: Changes in the positions of the top 50 countries from 2020 to 2021 according to GQII data

Big winners 2021

	Montenegro		Moldova, Republi..		Guinea-Bissau		Estonia		Mozambique		Latvia		Nepal	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
CMC Coverage	33%	33%	33%	44%	0%	0%	44%	44%	0%	0%	33%	33%	0%	0%
CABs - Calibration Labs	2	3	3	3	0	0	17	8	0	2	18	14	0	0
Key&Suppl. Comp.	16	16	20	25	0	0	21	21	0	0	22	23	0	0
CIPM - Cons. Committees	0%	0%	0%		0%		0%	0%	0%		0%		0%	
ISO MS Certificates	306	546	137	146	2	3	1.619	1.700	80	60	1.613	1.656	137	143
ISO Tech. Comm.	36	36	27	22	0	0	59	63	7	5	14	14	7	7
CAB Coverage	31%	59%	50%	41%	0%	6%	75%	71%	13%	6%	88%	76%	13%	12%
CABs - Testing Labs	20	21	75	63	0	1	12	98	6	17	13	95	1	1
CABs - MS Certification	0	2	2	2	0	0	0	4	1	0	1	5	0	1
CABs - Product Certification	1	2	13	12	0	0	2	11	0	1	2	15	0	1
GQII Rank	109	71	105	72	179	154	89	65	130	107	97	75	143	121
Rank Delta		38		33		25		24		23		22		22

Table 2: Biggest winners in 2021

The main driver behind countries advancing by more than ten positions in the global ranking is the number of CABs in the following areas: testing laboratories, calibration laboratories, management systems certification and product certification. This is presented in Table 3. There have been notable improvements in the last two areas compared to 2020.

These countries also stand out for having increased or maintained their ISO MS Certificates, improved their participation in ISO TCs, and achieved a higher status in their ISO membership. In summary, the areas of accreditation and standards have been, on average, the most prominent promoters of upgrades within this group, although they also showed improvements in metrology.

On the opposite side, as seen in Table 4, certain economies have shown significant drops in the ranking, which can be explained by the changes to some variables behind the indicator. For example, Zimbabwe, the most extreme case, shows sharp declines in metrology and standards. The coverage of CMCs went from 22% to 0%, along with reductions in the number of comparisons and calibration laboratories.

The number of ISO MS Certificates also dropped, averaging 89%. Small economies, such as Suriname, have paid dearly for the decline in specific components of the indicator. The numbers show that the CAB coverage component fell from 19% to 0%. Despite increasing its ISO MS certificates by 63%, Suriname still dropped 28 positions in the table. This country has also shown no improvement in membership status in any of the international bodies we surveyed (ISO, IEC, ILAC, IAF, the International Bureau of Weights and Measures (BIPM), and other regional bodies).

Drivers for rising economies that gained more than 10 positions in 2021 (Avg. of 30 economies)

	2020	2021
CMC Coverage	13%	14%
CABs - Calibration Labs	228	234
Key&Suppl. Comp.	355	372
CIPM - Cons. Committees	1%	6%
ISO MS Certificates	26.972	27.566
ISO Tech. Comm.	1.094	1.125
CAB Coverage	22%	22%
CABs - Testing Labs	1.006	1.353
CABs - MS Certification	47	183
CABs - Product Certification	45	120
GQII Rank	129	111
Rank Delta		18

Table 3: Drivers of upgrading by more than 10 positions in the 2021 global ranking

Big drops 2021														
	Philippines		Vanuatu		Malta		Uganda		Suriname		Zimbabwe		Congo	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
CMC Coverage	22%	22%	0%	0%	0%	0%	0%	0%	0%	0%	22%	0%	0%	0%
CABs - Calibration Labs	49	2	0	0	12	2,25	1	2	0	0	4	2	0	0
Key&Suppl. Comp.	22	22	0	0	7	7	0	0	0	0	9	0	0	0
CIPM - Cons. Committees	0%		0%		0%		0%		0%		0%		0%	
ISO MS Certificates	5.503	5.121	7	2	311	316	208	216	108	176	226	24	26	20
ISO Tech. Comm.	109	115,5	0	0	35	38,5	78	86	12	0	39	37	0	0
CAB Coverage	50%	0%	0%		63%	18%	38%	0%	19%	0%	44%	47%	6%	
CABs - Testing Labs	188	3	0		6	12	5	5	1	1	13	15	2	
CABs - MS Certification	9	1	0		12	3	1	1	1	0	1	1	0	
CABs - Product Certification	3	0	0		0	0	0	0	0	0	0	0	0	
GQII Rank	50	69	159	178	77	97	93	113	119	147	79	108	144	174
Rank Delta		-19		-19		-20		-20		-28		-29		-30

Table 4: Biggest drops in global ranking based on the GQII for 2021

In general, economies that have fallen by more than 10 positions in the ranking show significant declines in the number of calibration and testing laboratories. The rest of the components show mixed results, with slight decreases or increases. In any case, it must be said that this is a group of 25 economies, representing tiny portions of the total number of CABs, comparisons, committee participation, ISO MS certificates, and low coverage in relative terms of both CMCs and accreditation scopes. On average, this has meant a drop of 16 positions. This is summarized in Table 5.

Drivers for falling economies that lost more than 10 positions in 2021 (Avg. of 25 economies)

	2020	2021
CMC Coverage	9%	8%
CABs - Calibration Labs	343	288
Key&Suppl. Comp.	213	229
CIPM - Cons. Committees	0%	0%
ISO MS Certificates	32.056	33.657
ISO Tech. Comm.	839	870
CAB Coverage	32%	18%
CABs - Testing Labs	2.895	2.631
CABs - MS Certification	88	83
CABs - Product Certification	125	127
GQII Rank	105	121
Rank Delta		-16

Table 5: Drivers of declines in global ranking in GQII 2021



3.4 Correlations

The link between international trade and QI is well established. Bilateral and multilateral trade agreements and the WTO explicitly refer to the mutual recognition of accredited conformity assessment services. The CMCs declared and recognised by each country, and the adoption of international standards are essential for exporting and importing activities worldwide. In this edition of the GQII, we again see a strong positive correlation between the value of exports of goods and services and the degree of QI development, reaching a coefficient of 88%. This is illustrated in Figure 6.

The idea that economies develop QI around their export capacity is again supported by the data collected in 2021. China, the USA and Germany lead the ranking of exporters (2020) and the GQII 2021. Hong Kong's economy stands out for a very high number of exports (8th out of 184) but only reaches the 69th position in the GQII 2021, with the area of standardization being the lowest of the three (130th out of 184). The fact that Hong Kong is a city-state and part of the People's Republic of China may play a role here.

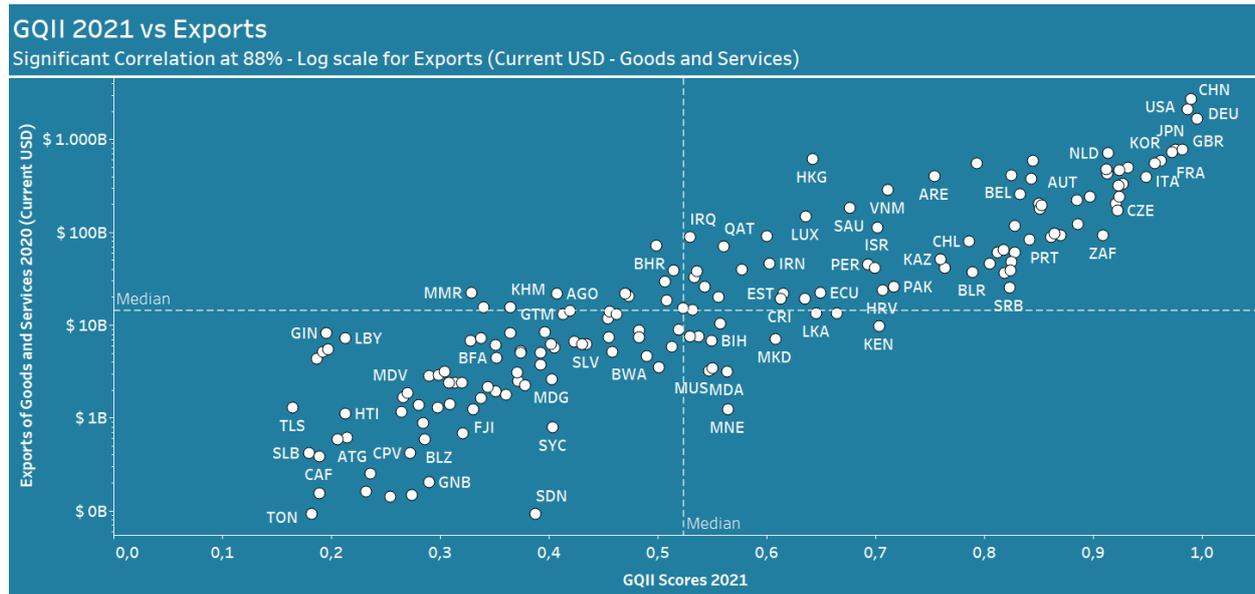


Figure 6: Correlation between the GQII and exports



The Economic Complexity Index (ECI) of a country refers to the knowledge intensity included in producing exported goods. This indicator predicts economic growth (HAUSMANN; HIDALGO; BUSTOS; COSCIA et al., 2013) and explains variations in income inequality (HARTMANN; GUEVARA; JARA-FIGUEROA; ARISTARÁN et al., 2017). As in the previous edition, a high correlation between GQII and ECI is observed, reaching 80% this year. This is illustrated in Figure 7. It is easy to link both indicators through trade and export activity.

Japan, Singapore, and Israel are strong in exports and knowledge, and their QI has highly developed QI. In contrast, Australia, Ecuador, and Nigeria have similar QI values, but their economies are less complex (being exporters of natural resources).

But beyond these cases, it is exciting how knowledge incorporated into the production of tradable goods is strongly associated with the development of QI. Expertise and quality seem to go hand in hand. However, it is still being determined which is the underlying driver (perhaps the economy?), and which should manifest itself first in its ability to drive the other. Future editions of the GQII could enrich the panel data and enable probabilistic causality tests to determine the order of the factors.

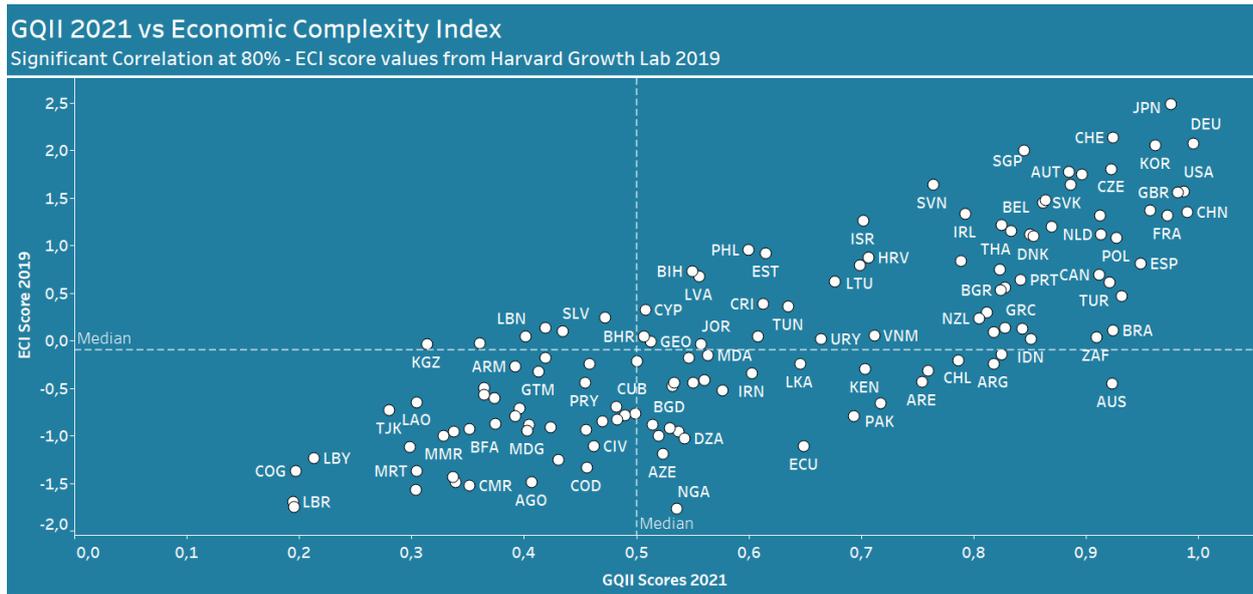


Figure 7: Correlation between the ECI and the GQII 2021

This year we are considering a new indicator to cross-reference with the GQII - the SDG Index (SACHS, 2021). SDG Index is the first worldwide study to assess where each country stands about achieving the SDGs. The SDGs were adopted by all member states of the United Nations in 2015 with a target of realising them by 2030. The 17 pillars of the indicator revolve around transformations needed in Society, the Economy, and Environment to achieve the 2030 Agenda. The SDG Index considers several indicators related to education, health and well-being, clean energy and industry, land and sustainable cities, and digital technologies.

The correlation between the SDG Index and the GQII is favourable and relatively strong, with a value of 74% for the set of countries covered by both indicators. Health, energy, and care for natural resources and people are just a few areas of the SDGs with a clear correlation with QI. In general, the economies that have progressed towards meeting the SDGs tend to be more developed in terms of QI, without this representing any causal relationship. The graph shows that despite being in the top half of the QI table, India, Pakistan, and Nigeria lag relatively far behind in meeting the SDGs.



Figure 8: Correlation between the GQII 2021 and the SDG Index



4

Data collection and quality

The informative value of the GQII depends mainly on the quality of the underlying data. GQII data is based on publicly available data by organisations for metrology, standards, and accreditation. In the 2020 GQII report, we went into detail about the data sources of the GQII. To avoid repetition, in this report, the authors focus on innovations in data collection and aspects of data comparison.

The ranking is based on a formula of 14 indicators, which are in turn fed by 8.600 data points. The formula is presented in Equation (1). In our experience, the number of 14 indicators is sufficient to assess a nation's QI development level and allow for international comparisons.

$GQII_i =$

$$\begin{aligned} & \left\{ [Metro. Membership_i + CMC Coverage_i + CIPM Cons. Comm._i + K\&SC_i + CABs (Calbr. Labs.)^*_i] \times \frac{1}{5} \right. \\ & + [Stdzn. Membership_i + ISO Tech. Comm._i + IEC Tech. Comm._i + ISO Survey_i] \times \frac{1}{4} \\ & \left. + [Acred. Membership_i + CAB Coverage_i + (CABs (ISO 17065)_i + CABs (ISO 17021)_i + CABs (Tst. Labs.)^*_i/3)] \times \frac{1}{3} \right\} \times \frac{1}{3} \end{aligned}$$

Notes: All values in the formula are expressed in Percentile Ranks. *ISO/IEC 17025

For a detailed analysis, the GQII database offers additional information, e.g., on the different accreditation scopes.

Methodological changes:

// Data sources

- IEC membership data
- For standardization and metrology, we use original data published by the international technical organisation and time cut (no historical trace, e.g., technical committee).
- Data-centric: Flow of data, best practice data integration

// Data collection and validation

- In the second half of the year 2021
- All ABs had the opportunity to send their data or could validate the count of the research team.
- Cross-border unique data by GQII, weighted by scope recognition
- Data cleaning and curation

// Data analysis

- Comparison of 2020 data with 2021 data to identify problems
- Data-centric: Flow of data, best practice data integration

// Data access sharing

- Online data presentation and access
- Self-service or support by GQII experts

The renewed data collection allowed the authors to improve the data quality further. This applies to the collection of figures on accredited conformity assessment bodies, which were reported by 82 out of 135 accreditation bodies. This explains that 68% of all collected accreditation data on IEC standards were also included in the calculations. Otherwise, the formula of the GQII ranking remained unchanged, so an annual comparison was easily possible.

Use of the GQII Data

The results of the GQII serve a variety of organisations in both the public and private sectors around the world. In this section, the authors demonstrate a range of applications that can serve multiple purposes for users of the index and its underlying data.

5.1 QI landscape by economies

Profiles by country and dashboards are applications that have proven particularly useful for key actors in developing national quality systems or their constituent bodies. An example can be seen in Figure 9.

Using the data collected by the GQII as a basis, each profile issues general information on the QI components analysed by the GQII, providing a comprehensive view of the economy and the state of evolution of the national quality system. They are also helpful for comparison over time and with other economies.

They are usually published as part of the annual report of the index, allowing a valuable overview of the country's QI. Thus, the profile will present data such as position in the ranking, position disaggregated by component, and values observed by part, among others.

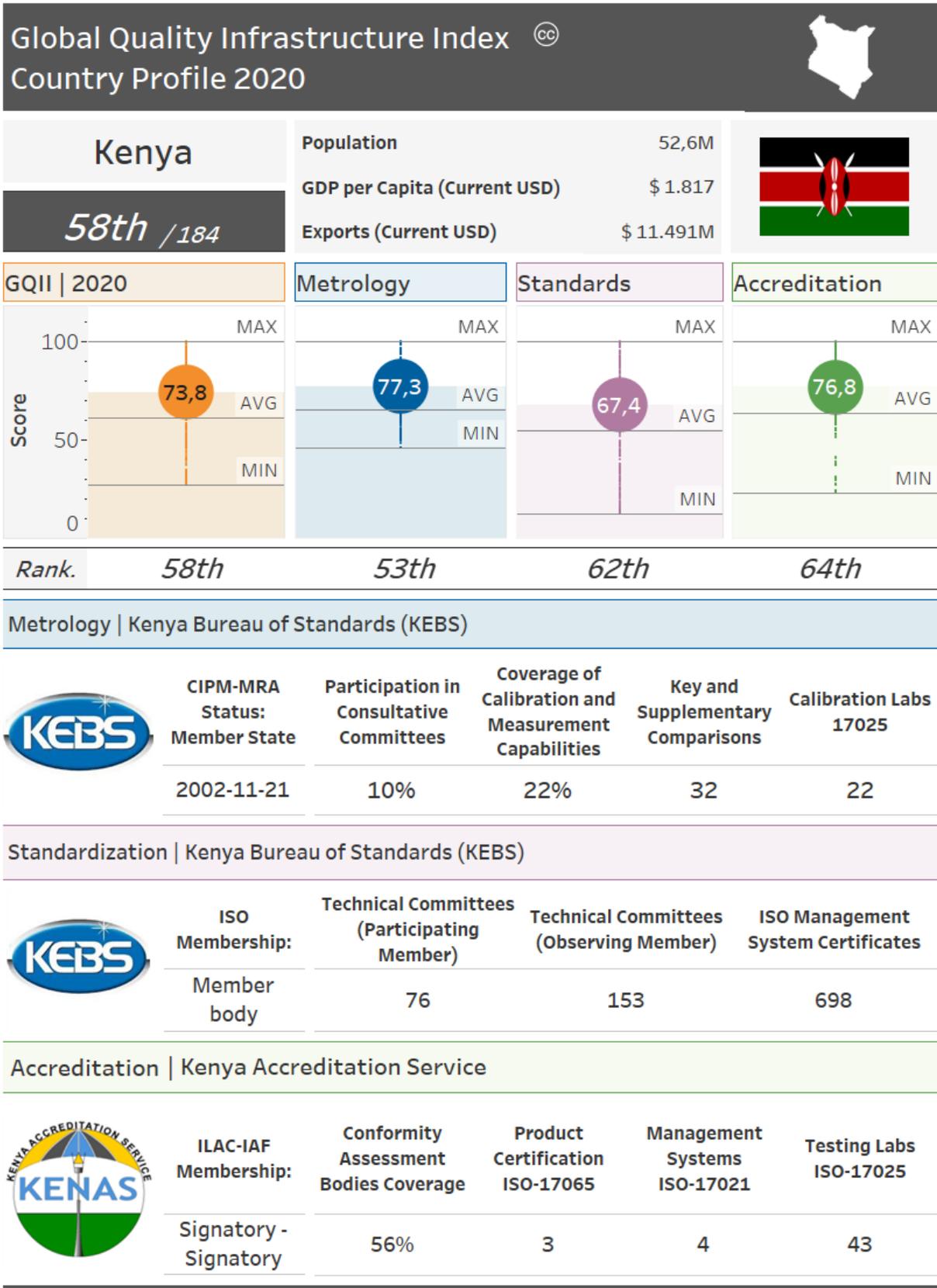
Furthermore, country profiles can be commissioned by interested entities or persons, which helps to refund the effort of the authors to prepare the GQII. For example, for developing National Quality Policies (NQPs), country profiles may include data on the institutional environment or even more detailed descriptions for each component, to name a few possibilities.

Figure 9 shows how the profile is represented. In this case the country profile was conducted by the authors as a diagnostic tool useful in developing an NQP for Kenya. Other examples can be found in the annexes of the GQII 2020 and this report.

Figure 10 shows an example of a dashboard developed to support the development of Sri Lanka's NQP, which was developed in a project for The World Bank. This solution promotes data-driven decision-making, which is especially relevant for outlining strategic plans.

Dashboards can include information collected in the GQII and expand on data from the country, combining data and showing specific figures to meet the interest of the requesting agency.

The Sri Lankan case focuses on promoting international trade. This provides an example of how QI data for a country can be expanded and combined to make it more readily available to meet the needs of both QI bodies and governmental and regional development support institutions.



Source: <https://gqii.org/>

Figure 9: 2020 GQII Country Profile for Kenya

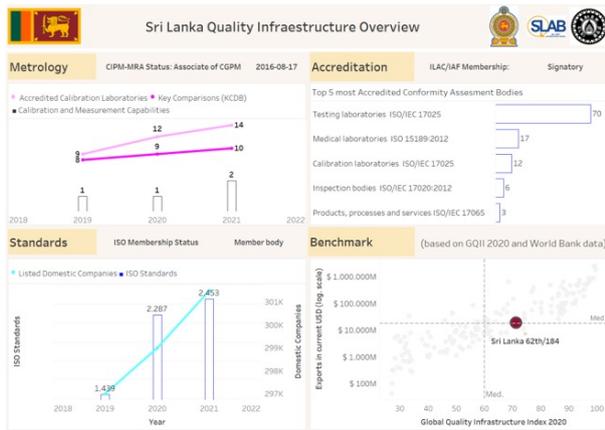


Figure 10: Overview of Sri Lanka's QI

5.2 Analysis of correlations with other variables

One of the objectives of the GQII is to provide evidence-based data that not only allows the authors to know the current state of QI in the world, but also facilitates its exploitation to promote transparency and analysis that contribute to the evolution of QI as an ally for international trade and economic, social, and sustainable development.

In the GQII reports, updated data is analysed each year, and relevant correlations are included, such as the one in Figure 11, showing the rank in the GQII and its relationship with the volume of exports of goods and services.

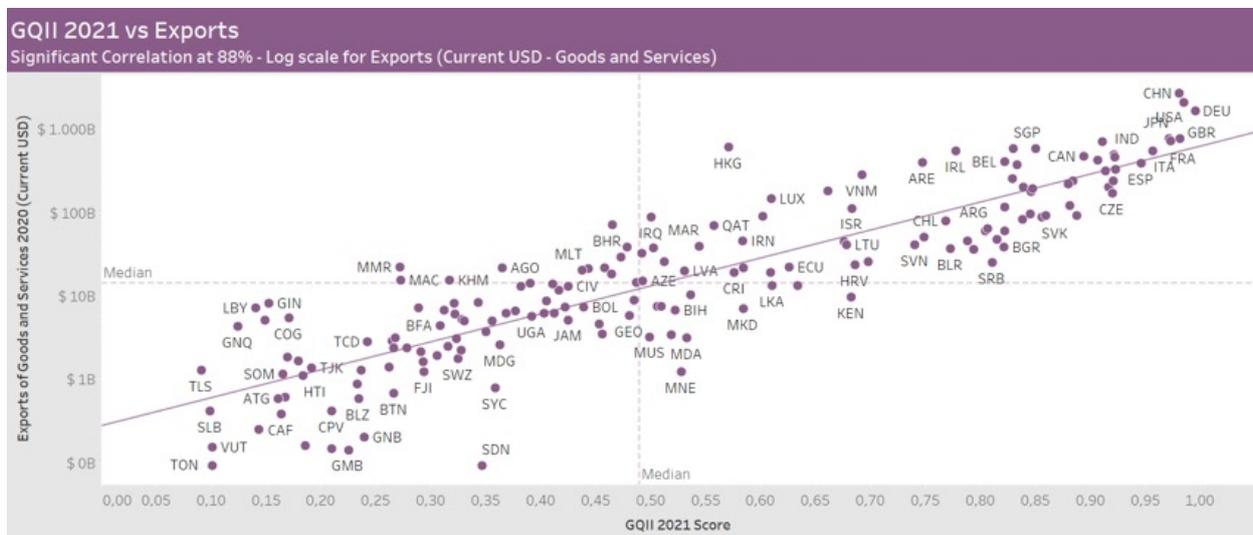


Figure 11: Correlation between the 2021 GQII and exports

The correlations of the GQII ranking with other comparable variables and indices for other fields is a highly relevant application for public policymakers, researchers and a variety of actors interested in the promotion and development of QI, as it supports an essential hypothesis that states that the higher the level of QI development, the better the performance of other related variables, without this implying causality.

Another example of applying the GQII for correlation analysis is in the context of development aid. In the year 2021, the BMZ asked the authors of the GQII for a study comparing the project budget against the GQII 2020 ranking, as seen in Figure 12.

The study aimed to collect data, analyse, and relate the performance of specific variables to make use of evidence in evaluation and planning tasks focused on achieving a



Figure 12: Comparison between net QI budg-et and GQII 2020

more significant impact on the development cooperation promoted by the Ministry (MARSCHALL, 2018). To achieve this, the study used data from the GQII, such as the ranking of recipient economies and critical indicators from the BMZ's project portfolio (budget, type and number of projects, QI components, etc.).

5.3 Traceability of QI data over time

Traceability of QI allows a more accurate analysis by providing historical and contextualised information on the performance, activities and results of QI bodies.

The data collected for the GQII and complementary information can be used in various applications such as comparative tables, historical series, and benchmarking. Additionally, specialised studies on specific QI activities can be done using the QI data collected annually by the GQII for 184 economies worldwide.

The applications mentioned above may be included in the GQII Report, or expressly requested by an organisation interested in the study of QI components and their performance at the economic, regional or international level; as well as by researchers and policymakers interested in the analysis of a particular activity or the development of strategic recommendations for the promotion of QI.

The Association of Southeast Asian Nations (ASEAN) Regional Integration Support by the EU (ARISE) Plus Malaysia project, funded by the European Union (EU) and implemented by the International Trade Centre (ITC) in collaboration with the Ministry of International Trade and Industry (MITI), aims to develop Malaysia's QI system further.

Scope	Level 2	Level 3	2020	2021	In-crease
IAF MLA	Product Certification	ISO/IEC 17065:2012	25	29	16%
	Management System Certification	ISO/IEC 17021-1	74	84	14%
	Person Certification	ISO/IEC 17024:2012	5	6	20%
	Validation and Verification	ISO/IEC 17029:2019	0	0	
ILAC MRA	Testing	ISO/IEC 17025:2017	597	611	2%
	Medical Laboratories	ISO 15189:2012	69	76	10%
	Calibration	ISO/IEC 17025:2017	101	105	4%
	Inspection	ISO/IEC 17020:2012	17	21	24%
	Proficiency Testing	ISO/IEC 17043:2010	0	4	
	Reference Material Production	ISO 17034:2016	0	0	
	Biobanking Facilities	ISO 20387:2018	0	0	

Table 6: Number of accredited conformity assessment bodies

Level 2	Level 3	Number of Distinct Accredited Bodies	Number of Distinct Accredited Bodies	Increase
Food Safety	ISO 22000:2018, 2005 (FSMS)	11	12	9%
QMS	ISO 9001:2015 (QMS)	28	28	0%
Environmental	ISO 14001:2015 (EMS)	19	21	11%
Information Security	ISO/IEC 27001:2013 (ISMS)	2	3	50%
Energy	ISO 50001:2018, 2011 (EnMS)	1	1	0%
Medical Devices	ISO 13485:2016 (MDMS)	4	5	25%
Occupational Health and Safety	ISO 45001:2018 (previously OHSAS 18001)	13	18	38%

Table 7: Number of accreditations in certified management systems

The project strives to align Malaysia's QI with ASEAN and EU standards, and one of the activities is the development of an NQP. To this end, an assessment of Malaysia's National Quality Infrastructure (NQI) was developed. Specific data was collected for each component, its activities, and its evolution over the last few years.

An example of the data systematised in the assessment is presented in Table 6 and Table 7, which show respectively the number of accredited CABs and the detailed count

of accreditations in certified management systems in the years 2020 and 2021. The elaboration of these tables, which was made possible through data collection for the GQII, has allowed for the visualisation of the degree of progress in these two specific activities.

The ability to map specific components of QI at the economywide or international level has proved to be an added value that the GQII can provide to national and regional QI-promoting bodies.

5.4 Display the origin of the accreditation

Specialised studies based on GQII data, such as the Cross-Border Accreditation Study published in 2021 (HARMES-LIEDTKE/ MATTA 2021), are another example of the applicability of the index. The Cross-Border Accreditation Study addresses the cross-border activities of accreditation bodies, illustrating for the first time an

international picture of how accreditation services are exported and imported.

Figure 13 reflects the positions of the economies on the world map, making it possible to observe the relationship patterns in which transnational accreditation links occur.

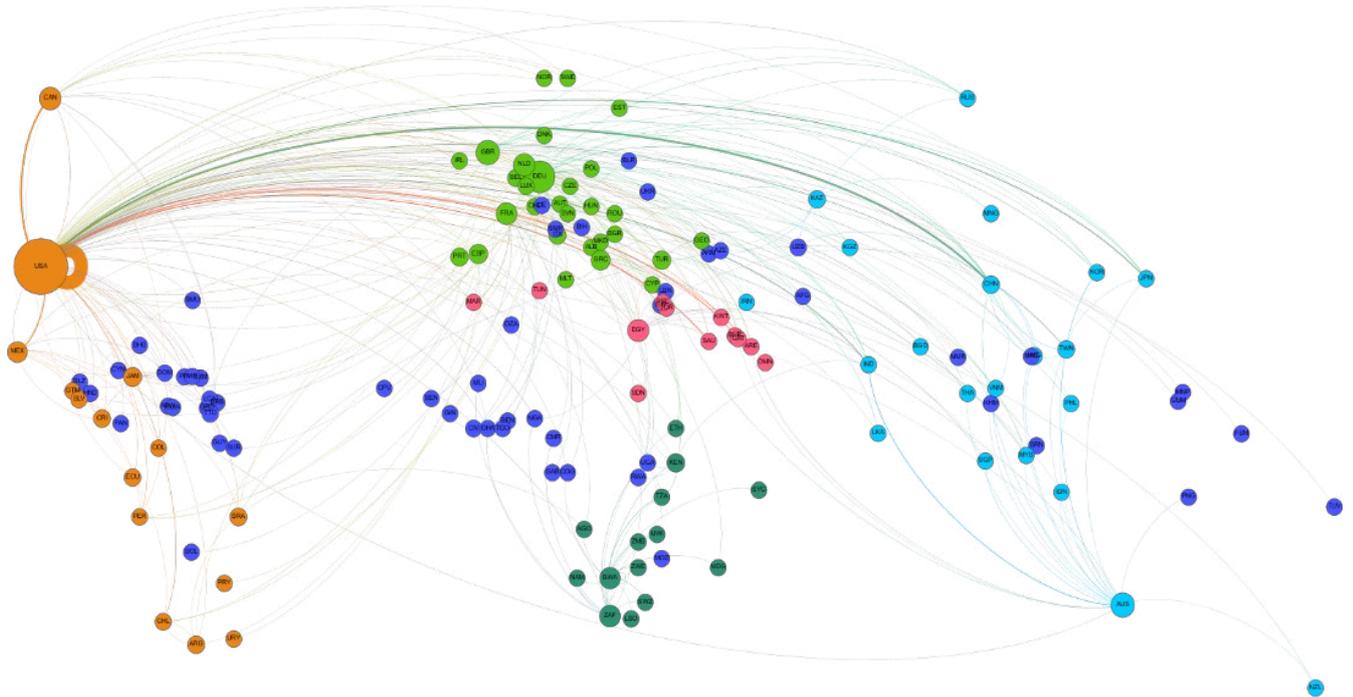


Figure 13: World overview of cross-border accreditation

Cross Border Accreditation - India

Source: <https://gqii.org> (Creative Commons apply)



Figure 14: Cross-border accreditation - India

Furthermore, this publication analyses the activities of accreditation bodies outside their country of origin. For example, accreditation exports from India, as seen in Figure 14.

Ultimately, this study highlights the cooperation but also the competition between NABs. Its elaboration can be useful in fostering international coordination of accreditation activities for national accreditation institutions and regional bodies promoting QI internationally.

5.5 Benchmarking with other countries

Benchmarking is widely used in various sectors and industries for investigating, tracking and verifying behaviour or practices suitable for a given purpose. Thus, the comparability of the data is one of the central elements in ensuring the quality of the analysis and the eventual replicability of the practices observed.

In the context of QI, efforts and data sources that allow access to systematised and comparable information are still incipient. Hence the GQII intends to contribute by presenting the annual ranking and the open and accessible availability of the data.

An example of this exciting application is the benchmark (see Table 8) conducted to assess the state of development of Malaysia's QI compared to a selection of other countries. The consultants compared the GQII data for each QI sub-component for Malaysia with that of Germany (first-ranked country in the GQII), Australia, Mexico and Indonesia. The selected economies have characteristics that provide a valid and relevant comparison in the ARISE Plus Malaysia project mentioned above context.

In this case, research and analysis were carried out to provide those responsible for designing the NQP with benchmark scenarios comparable to the context of the Malaysian economy.

GQII 2020: Subcomponents by economy										
Economy	CMC Coverage	Total K&SC	CABs Calibration laboratories ISO/IEC 17025	Participation in Consultative Committees	Total ISO MS Certificates	Technical Committee Observing Member	Technical Committee Participating Member	CABs Products, processes and services ISO/IEC 17065	CABs Quality management systems ISO 9001	CABs Testing laboratories ISO/IEC 17025
Germany	100%	759	512	10	67.356	41	699	340	131	2.436
Australia	100%	319	203	9	10.587	85	285	48	89	2.479
Mexico	89%	281	353	8	10.538	55	90	68	68	1.011
Indonesia	78%	84	223	0	9.752	170	100	75	52	1.181
Malaysia	89%	95	94	0	13.710	130	162	29	26	587

Note: 2021 data for Malaysia ISO/IEC 17065

Table 8: Benchmarking the state of development of Malaysia's NQI



5.6 Thematic analysis (impacts of COVID-19 on QI)

The GQII data can also be used for sectoral analyses. One example is the development of certifications and accreditations in the health sector between 2020 and 2021.

The ISO Survey provides data on the development of management systems. For example, we see a decrease in the pharmaceutical sector's ISO 9001 management certifications from 3266 to 2999 (minus 8.2%). On the other hand, the number of certifications for the design and development of medical devices according to ISO 13485 increased from 23,045 to 25,656 (plus 11.3%).

In the area of accreditation, however, the number of certification bodies accredited for medical devices decreased from 234 to 211 (minus 9.8%). In contrast, we observe a massive increase in the accreditation of medical labs according to ISO 15189 from 7,495 to 10,412 (plus 38.9%).

This assessment refers to global data. With the GQII database, corresponding analyses can also be carried out for individual countries or country comparisons.

QI Evolution by Medical Areas

QI Areas	2020	2021	
Standardization			
ISO 9001 QMS - Pharma	3.266	2.999	-8,2%
ISO 13485 - Medical Devices	23.045	25.656	11,3%
Accreditation			
CABs - Medical Devices	234	211	-9,8%
CABs - Medical Labs	7.495	10.412	38,9%

Note: ISO Surveys 2019 and 2020 considered in the comparison. CABs count correspond to 2020 and 2021.

Figure 15: QI evolution by medical areas





Conclusions and outlook

In its 2021 version, the GQII has established itself as the world's first QI index.³ Key institutions and leaders in QI, development cooperation and academia support the GQII programme. The GQII is a pioneer in promoting a data-driven culture applied to the development of QI by offering organised and centralised data, a curated and accessible database, and an integrated analysis layer through data visuals.

The GQII 2020 is the beginning of a time series. The authors are counting on collecting and analysing global QI data for the subsequent years. Retrospective reconstructions of time series would also be fascinating, but given the incomplete data situation, they would only be of limited informative value and involve considerable effort. In this respect, the authors want to concentrate on the future-oriented development of the GQII.

The authors are trying to strengthen their cooperation with QI organisations and the scientific community to improve the data quality. In QI organisations, the realisation that transparent and externally available data helps gain recognition and promote the use of QI services is only slowly growing. In the age of digitalisation, QI organisations are challenged to make their information systems interoperable. In the age of blockchain technology, data transparency and the protection of legitimate trade secrets do not have to be at odds with each other.

In this report, we have emphasised the potential uses of GQII data. The authors are convinced that there is rising interest in QI intelligence. In this respect, it remains essential to demonstrate possible applications of QI data. This applies to the regular investigation and international comparison of NQI systems, the empirical underpinning of quality policy and the integration of QI in economic, social, and sustainable development studies.

However, the interoperability of QI data is also driven by businesses and consumers. In the context of a digitalised Industry 4.0, the individual components of QI must also be interoperable. New developments, such as the circular economy, require new data on energy and material flows, exponentially increasing the demand for conformity assessment and metrological traceability in the future. These new developments enhance the importance of data and quality and open new applications for analytics and foresight. In this respect, the authors of the GQII see themselves as part of a broader movement to valorise QI data for overall sustainable development.

³ In June 2022, the United Nations Industrial Development Organization (UNIDO) published the Quality Infrastructure for Sustainable Development (QI4SD) Index, <https://hub.unido.org/qi4sd/>. While the GQII refers exclusively to QI data, the QI4SD makes the link between QI and SDGs explicit.

Annex 1: Country Profiles

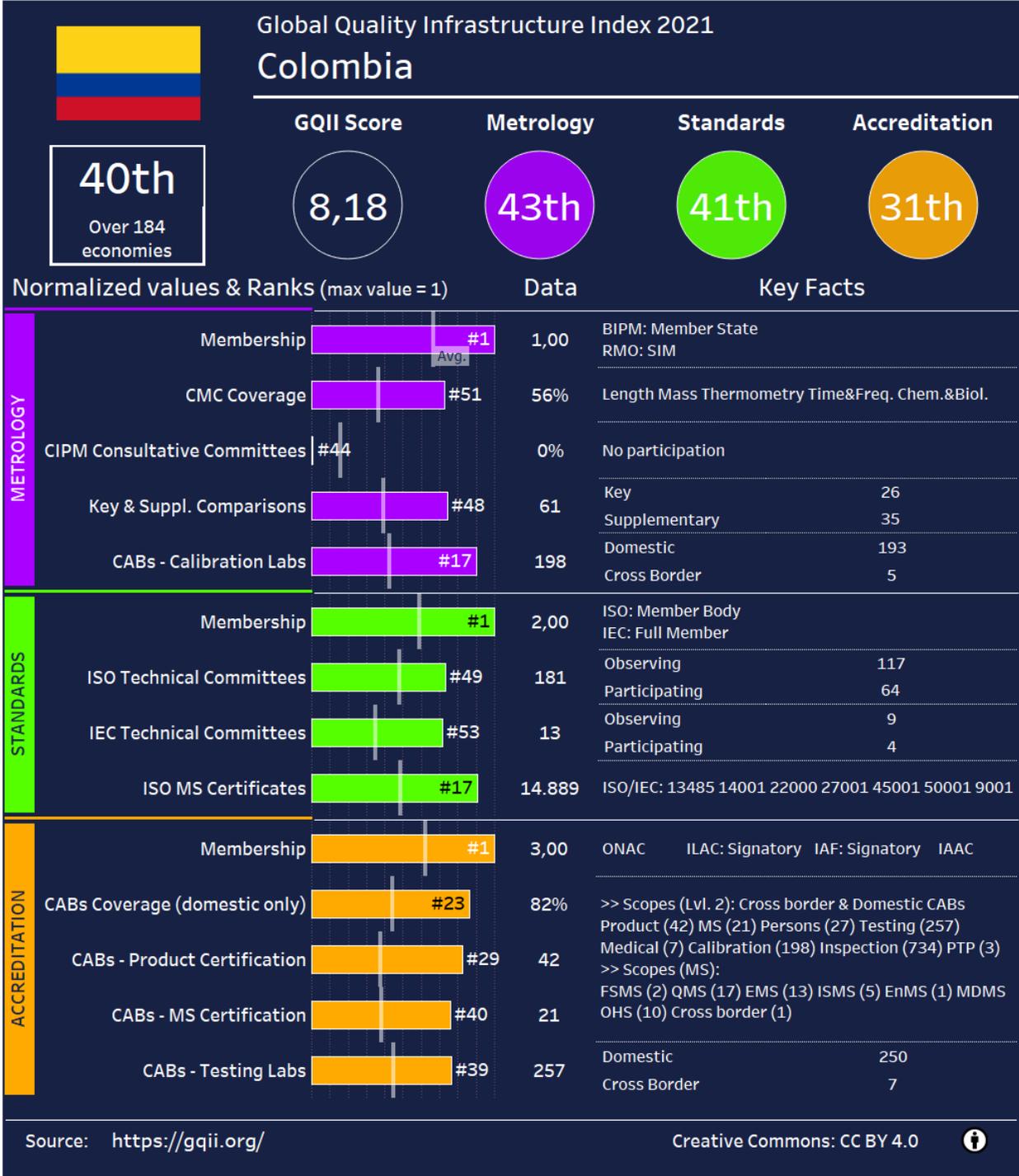


Figure 17: 2021 GQII country profile – Colombia

Annex 1: Country Profiles

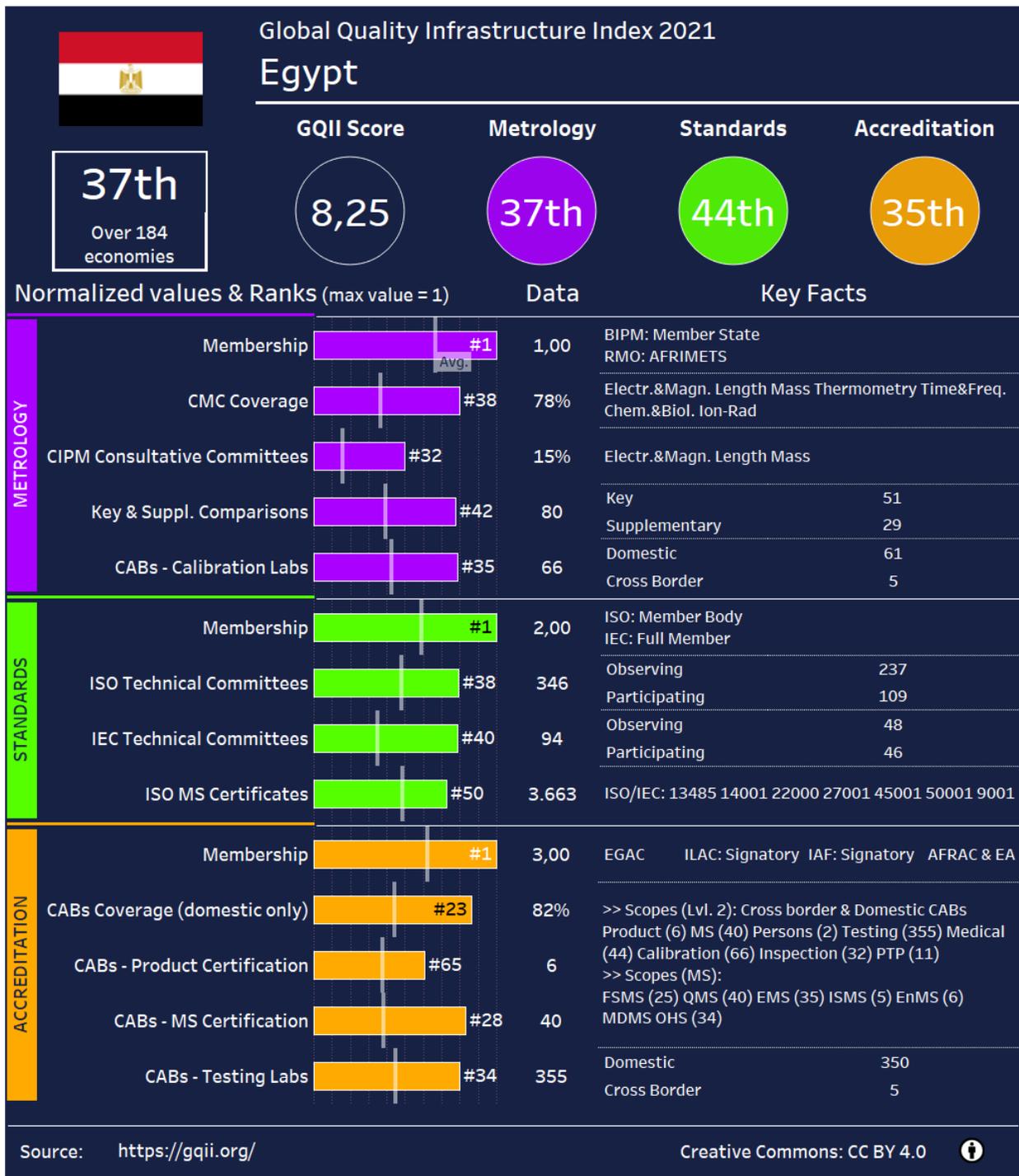


Figure 18: : 2021 GQII country profile – Egypt

Annex 1: Country Profiles

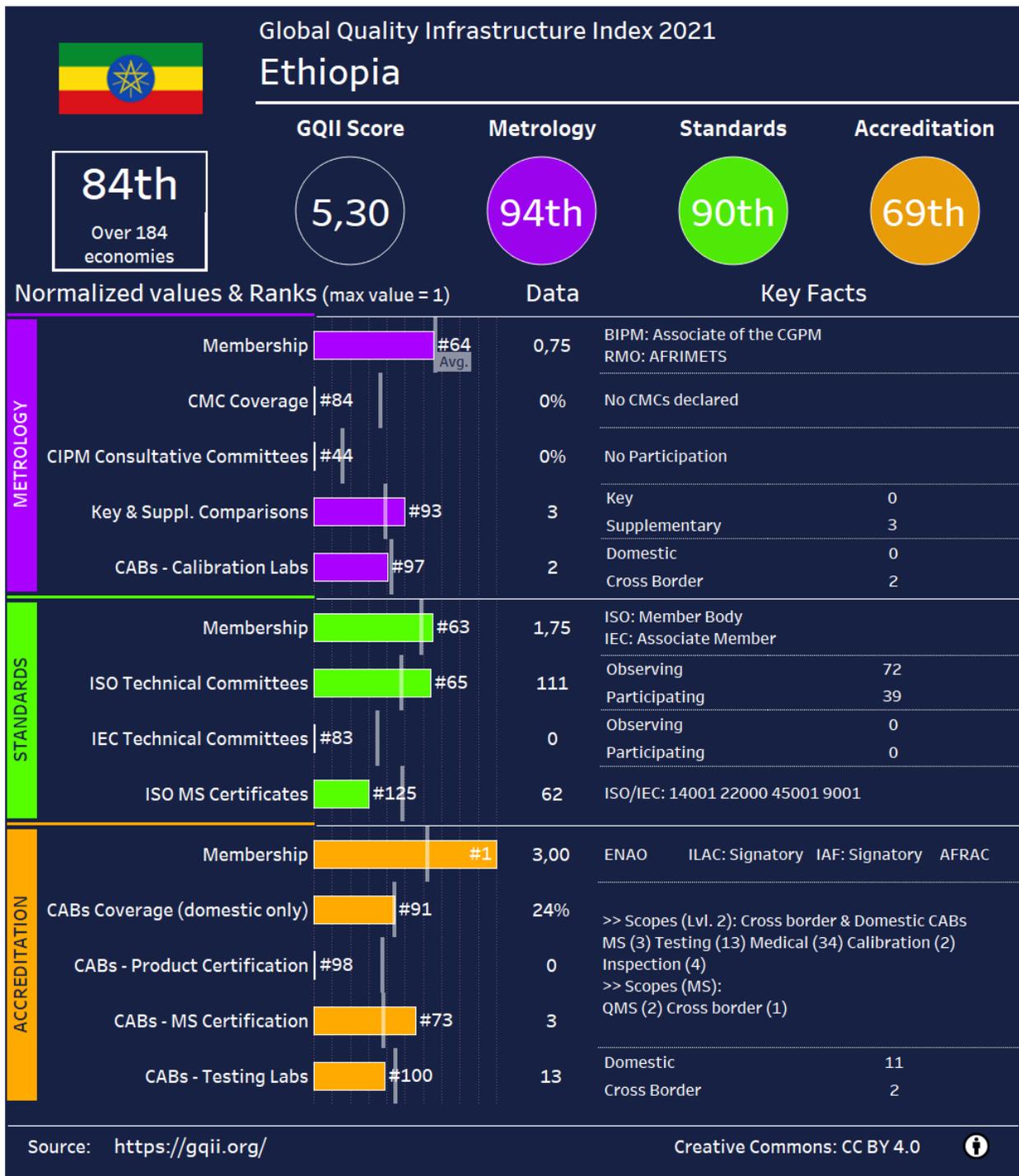


Figure 19: 2021 GQII country profile – Ethiopia

Annex 1: Country Profiles

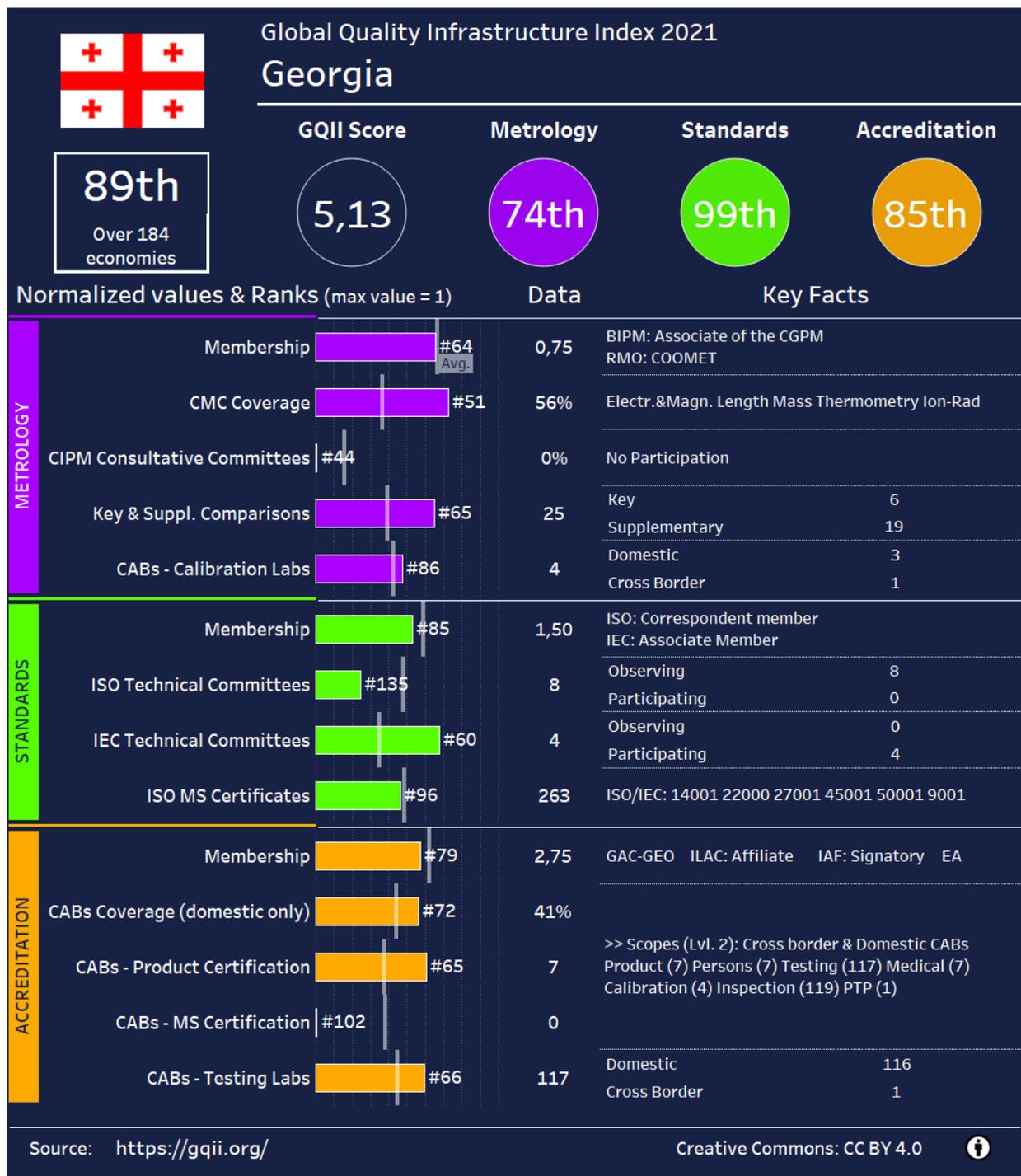


Figure 20: 2021 GQII country profile – Georgia

Annex 1: Country Profiles

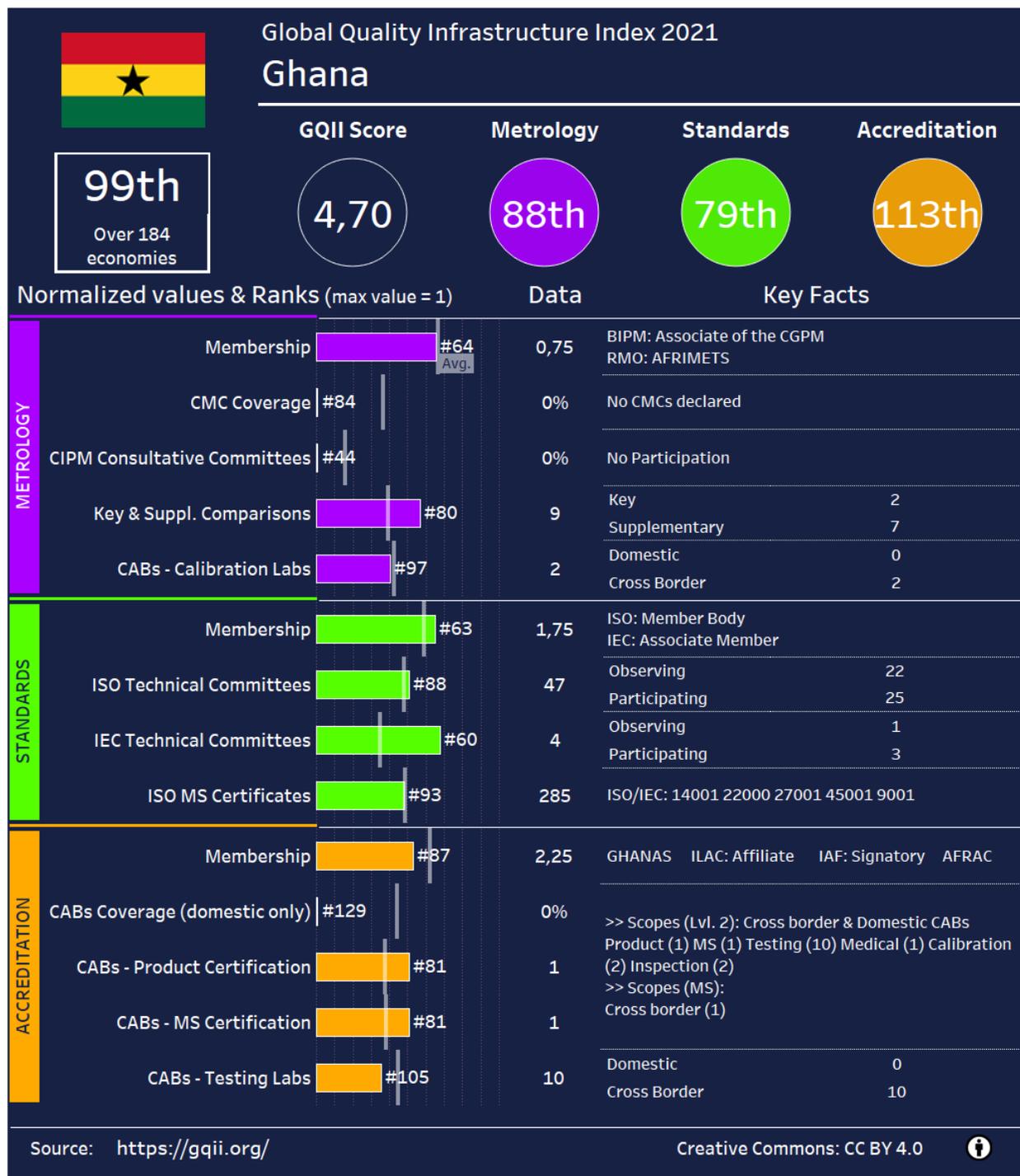


Figure 21: 2021 GQII country profile – Ghana

Annex 1: Country Profiles

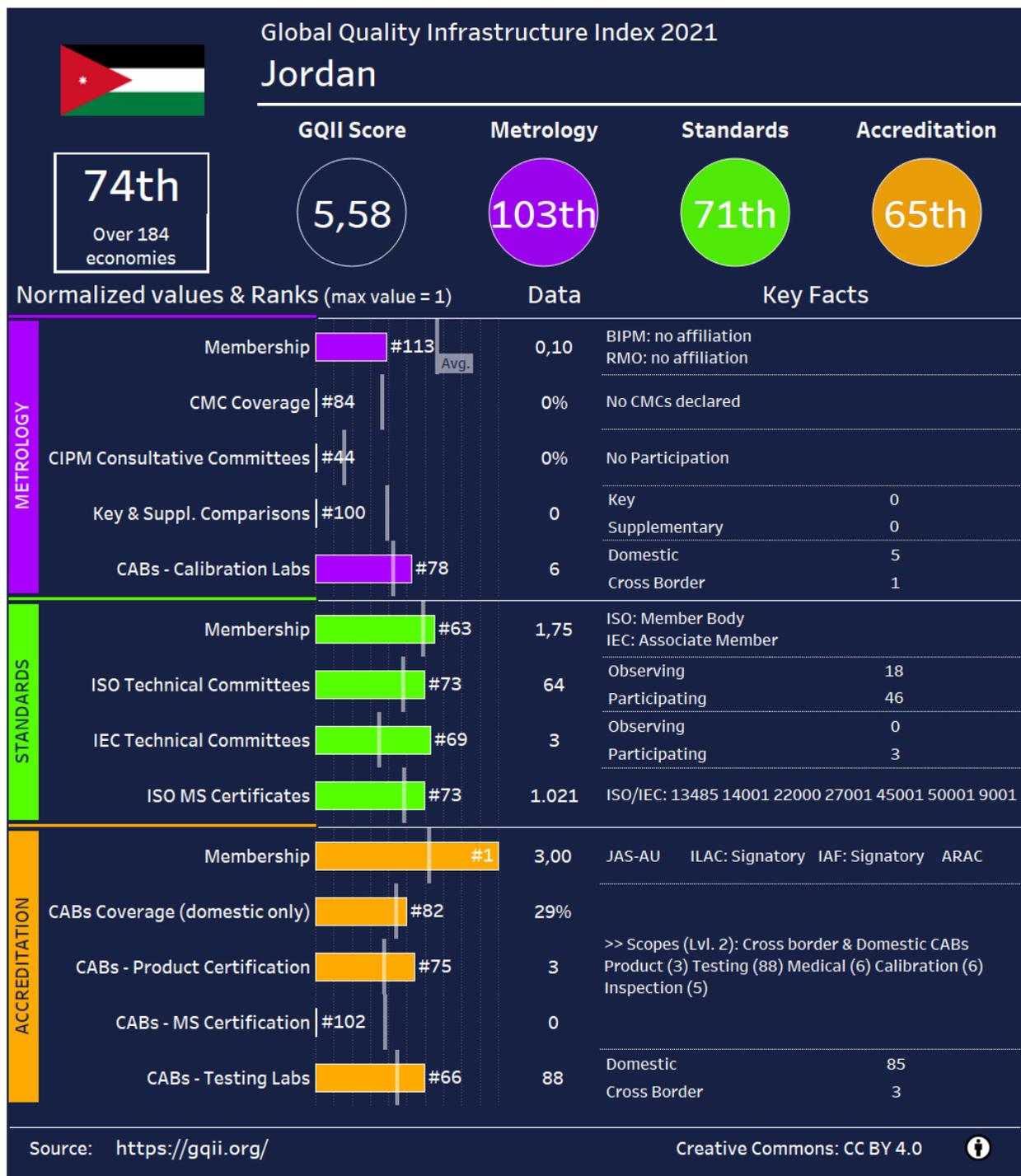


Figure 22: 2021 GQII country profile – Jordan

Annex 1: Country Profiles

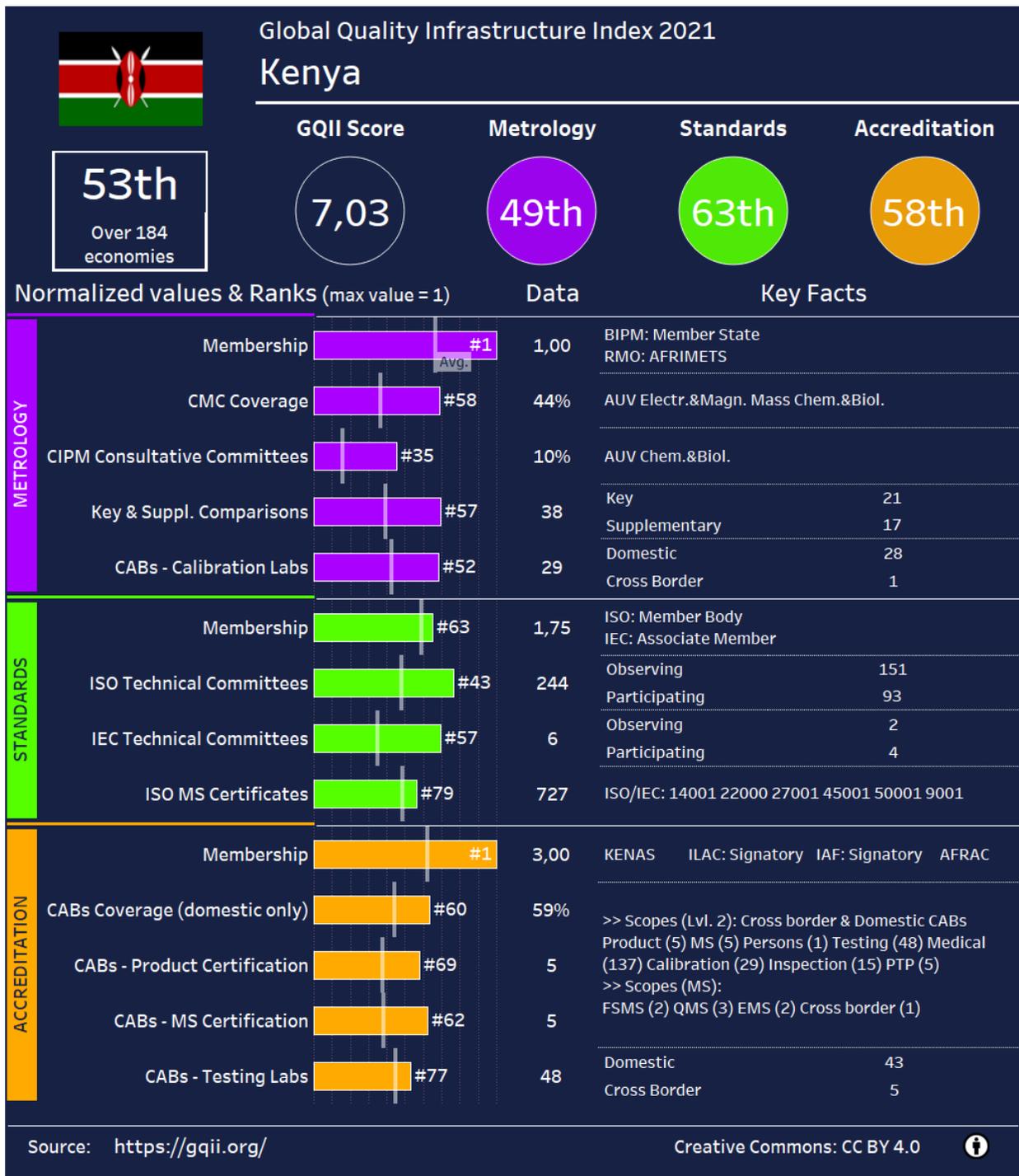


Figure 23: 2021 GQII country profile - Kenya

Annex 1: Country Profiles

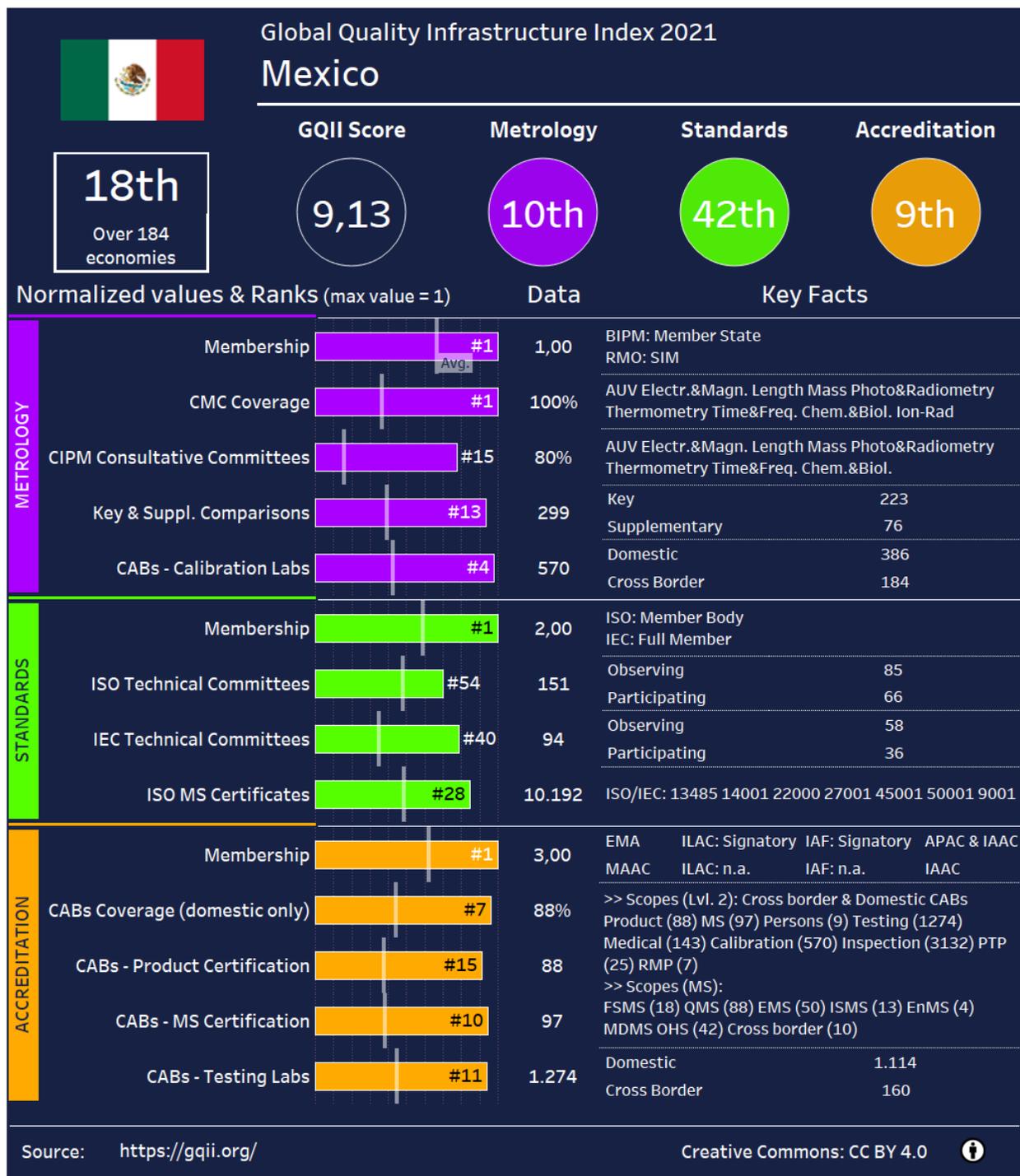


Figure 24: 2021 GQII country profile - Mexico

Annex 1: Country Profiles

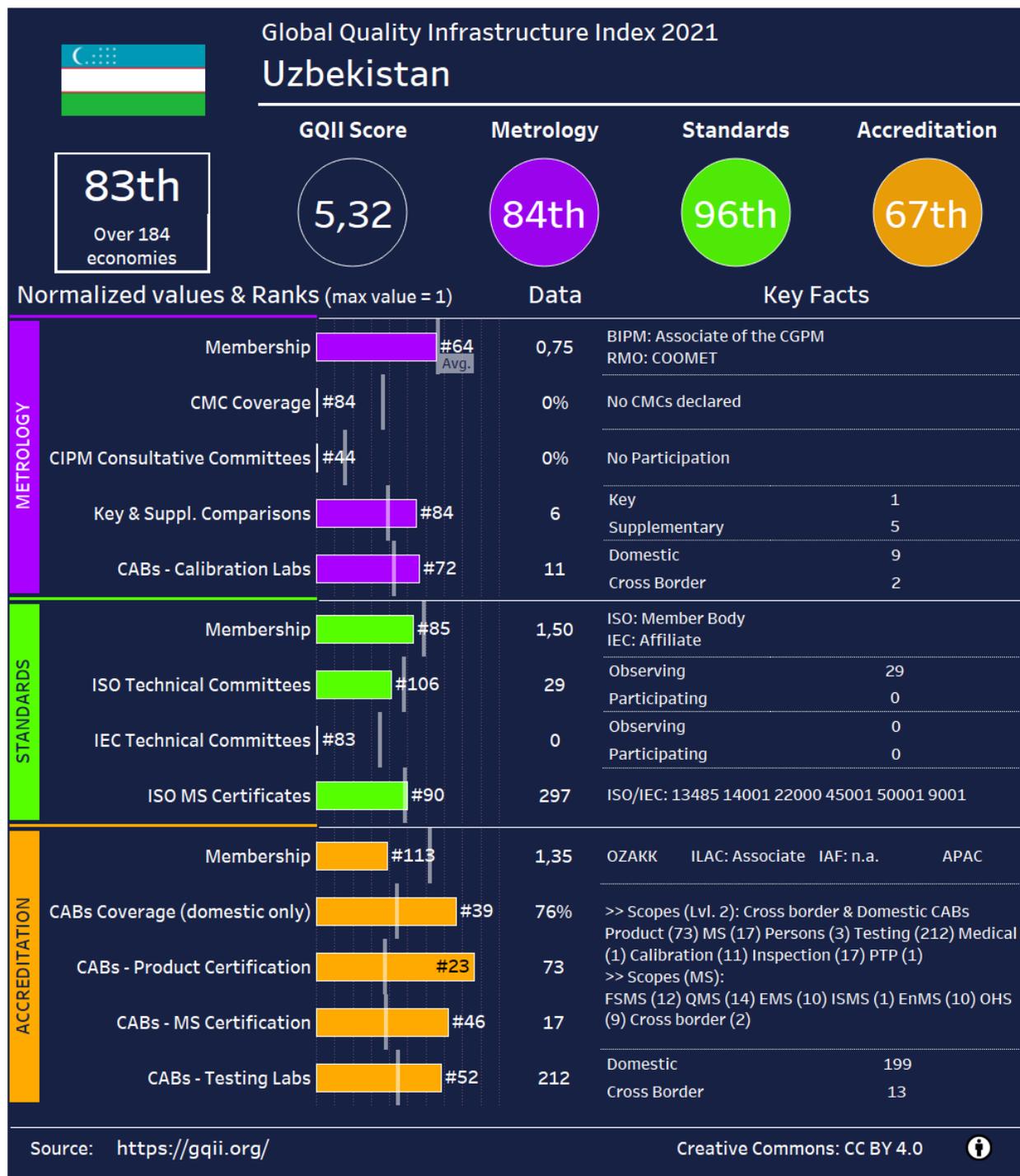


Figure 25: 2021 GQII country profile – Uzbekistan

Annex 1: Country Profiles

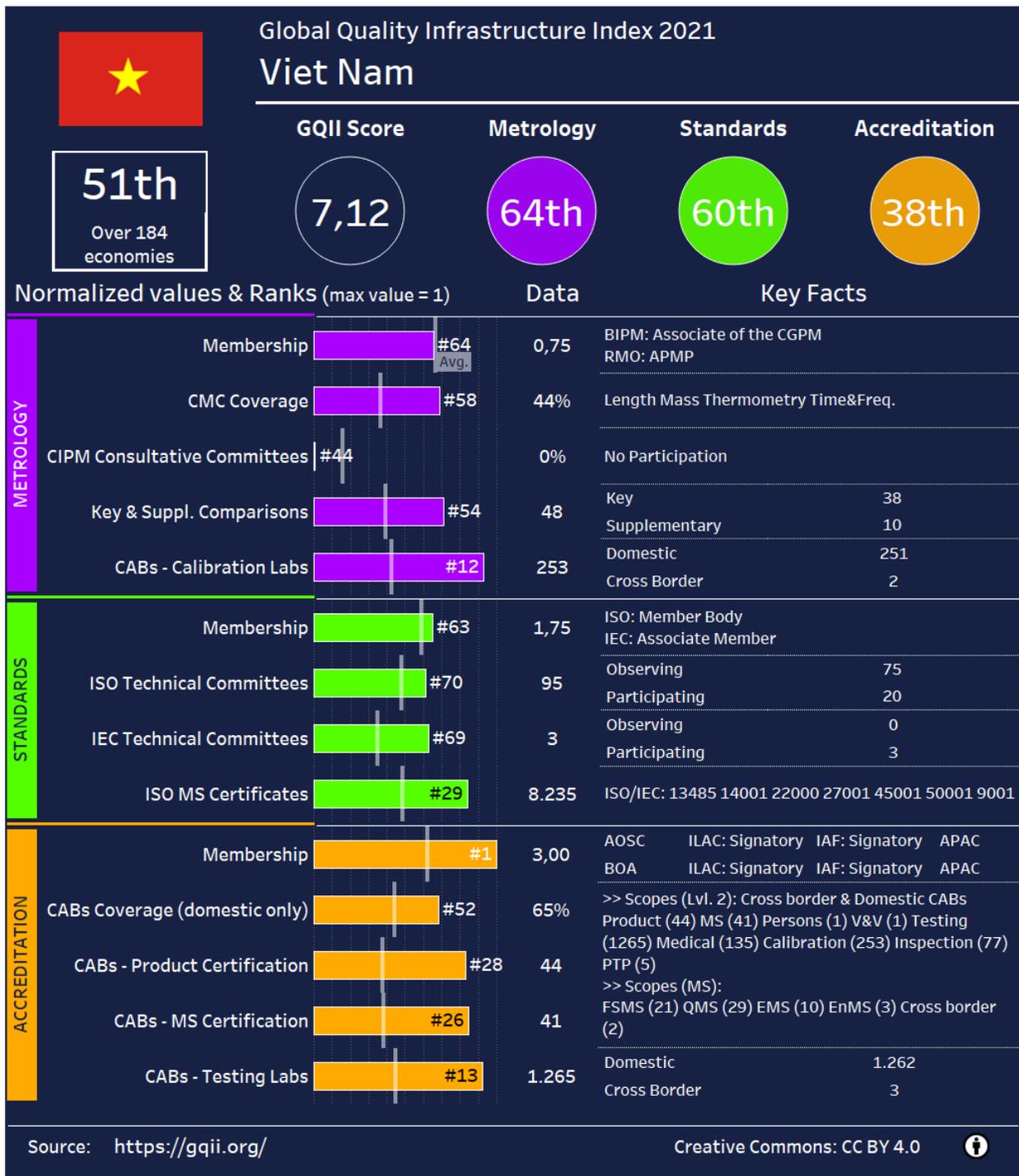


Figure 26: 2021 GQII country profile - Viet Nam

Annex 2: Chronicle of global quality infrastructure in 2021

Date	Organization	News
21/06/16	Mesopartner	Presentation of the GQII2020 by Mesopartner and Analytica
21/09/28	Mesopartner	Presentation of study on Cross border accreditation by Ulrich Harnes-Liedtke and Andres Matta
21/11/03	IAF	Emanuele Riva, IAF Vice-Chair and incoming IAF Chair, will be presenting at the #COP26 side event 'Building back a net-zero resilient economy through Governance, Policy, Standards, Skills & Inclusion'.
21/09/09	IAF_Global	IAF Executive Committee members met today to discuss a range of topics including the 2022 budget, committee work, IAF CertSearch, and the COVID-19 FAQs.
21/09/13	IAF and ILAC	IAF Chair Xiao Jianhua represented IAF at the 8th Annual Meeting of International Organizations which began today, while @ILAC_Official Chair Etty Feller will be representing IAF along with ILAC tomorrow. Learn more about the IO Partnership here https://www.oecd.org/governance/regulatory-policy/The-partnership-in-a-nutshell-flyer.pdf
21/09/30	IAF and ILAC	The IAF MLA Management Committee and @ILAC_Official Arrangement Management Committee held their 30th joint meeting today, discussing evaluation activities and issues relating to the IAF MLA and ILAC MRA.
21/10/12	IAF	#COVID19 has increased the use of remote techniques in #audits, #assessments and #evaluations. IAF, @ILAC_Official and @isostandards recently conducted a survey to collect stakeholders' views on remote techniques, receiving highly positive feedback, https://iaf.nu/en/news/use-of-remote-techniques-supported-by-iaf-ilac-iso-survey/
21/10/19	UNIDO	Digital technologies are transforming how we live and work. @UNIDO has published a new brochure on Standards & Digital Transformation: Good Governance in a Digital Age https://hub.unido.org/sites/default/files/publications/Standard_digital_transformation_2021L.pdf
21/10/20	IAF, ILAC and ISO	A survey recently conducted by IAF, @ILAC_Official and @isostandards showed strong support for the use of remote techniques for #audits, #assessments and #evaluations. https://iaf.nu/en/news/use-of-remote-techniques-supported-by-iaf-ilac-iso-survey/
21/10/14	IAF_Global	#WorldStandardsDay on how standards can help us achieve the Sustainable Development Goals.
21/10/15	ILAC	Following its annual meeting this week, the IAF/ @ILAC_Official. JDSC held a workshop on IAF Mandatory Documents, facilitated by Brahim Houla and Andrea Melo. Participants expressed appreciation for the capacity-building initiative and their support for future related workshops.
21/10/29	IAF_Global	IAF Technical Committee held its annual meeting this week, discussing task force and working group activities. Members thanked TC Chair Steve Keeling, whose term will be ending at the upcoming IAF General Assembly, for his strong leadership and hard work
21/11/04	IAF	IAF held its 35th General Assembly online on 04 November 2021. Members heard updates on several activities and, subsequent to the meeting, approved draft resolutions by ballot.
21/11/05	IAF	IAF Members have elected Mr. Emanuele Riva of @ACCREDIA as our new IAF Chair. Read his message to Members and stakeholders
21/11/13	ISO	The @isostandards ISO 14001 user survey closes
21/12/09		IAF has published the new document IAF MD 24:2021 Transition Requirements for ISO 50003:2021. View it here: https://iaf.nu/iaf_system/uploads/documents/IAF_MD_24_Issue_1_Publication_Version.pdf
21/12/15	INetQI	INetQI held its 8th meeting today, chaired by IAF Chair Emanuele Riva, to discuss ongoing and potential projects and initiatives. INetQI is formed of IOs active in promoting and implementing quality infrastructure activities as a tool for sustainable economic development.

Sources: News in the period 01/01/2021 and 31/12/2021 on Twitter accounts of global QI organizations and QI-related tags by INetQ, BIPM, OIML, ISO, IEC, ITU, IAF and ILAC, (UNIDO and PTB)





GLOBAL QUALITY INFRASTRUCTURE INDEX

For information on data and analytics on the quality infrastructure, visit <https://gqii.org>

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