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### **Deconstructing Quality Infrastructure: A Quantitative Analysis of the Global QI Index**

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# Deconstructing Quality Infrastructure: A Quantitative Analysis of the Global QI Index\*

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## Abstract

Quality Infrastructure (QI) is defined as the system comprising organizations (public and private), policies, legal and regulatory frameworks, and practices that support and enhance the quality, safety, and environmental feature of goods, services, and processes. The Global Quality Infrastructure Index (GQII) is a publicly available database and ranking system that compares QI development across 185 countries. This paper reviews the GQII's methodology and examines how sensitive the country rankings are to methodological adjustments. We employ three distinct approaches: (1) computing component rankings using alternative percentile functions; (2) measuring indicators in per capita terms; and (3) estimating component weights through regression analysis linking QI indicators to economic performance. Our findings confirm that the GQII provides fundamentally robust information for policymakers and researchers. However, while top performing countries remain relatively stable, countries ranked in the middle and the bottom may change their rank depending on the methodology used. This suggests robustness in the index's ability to identify leaders in QI development, and for lagging countries the preference to rank groups of countries based on common QI factors rather than individual countries' performance.

J.E.L.: L15, O25, O14.

Keywords: Quality Infrastructures, Quality Management, Standards, Certification, Metrology, Industrial and Innovation Policy, Innovation indicators.

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## List of acronyms

ARD - Average Absolute Rank Difference

BIPM – *Bureau International des Poids et Mesures* (International Bureau of Weights and Measures)

CAB - Conformity Assessment Body

CMC - Calibration and Measurement Capability

CGPM – General Conference on Weights and Measures

GQII - Global Quality Infrastructure Index

IAF - International Accreditation Forum

IEC- International Electrotechnical Commission

INetQI - International Network for Quality Infrastructure

ISO - International Organization for Standardization

ITU - International Telecommunication Union

NMI – National Metrology Institute

NQI – National Quality Infrastructure

PTB - Physikalisch-Technische Bundesanstalt (German National Metrology Institute)

QI - Quality Infrastructure

QI4SD – Quality Infrastructure for Sustainable Development

UNIDO - United Nations Industrial Development Organization

## 1. Introduction

Quality Infrastructure (QI) underpins modern economic systems, playing a vital role in international trade, economic development, industrial competitiveness, and consumer protection. QI systems ensure that products and services meet essential quality, safety, and environmental standards through a network of institutions, regulations, and practices (UNIDO 2020 and Harmes-Liedtke et al 2024).

In recent years, two initiatives have been created to measure QI development at the country level. The first is the Global Quality Infrastructure Index (GQII), developed by the consulting firms Mesopartner and Analyticar and supported by the German National Metrology Institute (NMI) - the Physikalisch-Technische Bundesanstalt (PTB). GQII is currently available for 2020, 2021, 2023 and 2025. The second, launched by the United Nations Industrial Development Organization (UNIDO) with support from the International Network for Quality Infrastructure (INetQI), is the Quality Infrastructure for Sustainable Development (QI4SD) Index, which has so far been published in 2022 and 2024. Since 2023, UNIDO, PTB, and Mesopartner have been working together on the indices and are planning a joint index for 2026. This paper uses data from the GQII 2023 and aims at exploring methodological alternatives to inform the further development of the index, and in general QI measurement.

The measurement of QI plays a central role for the development of a robust QI system with remarkable policy implications across multiple domains (Kellermann, 2019). QI systems reduce technical barriers to trade by establishing common standards and conformity assessment procedures. Countries with well-developed QI systems can access international markets more easily, as their products are more likely to meet importing countries' requirements. QI is also a fundamental component of industrial development strategies. A strong metrology system ensures measurement accuracy, which is crucial for manufacturing precision; well-developed standards facilitate technology transfer and diffusion; and accreditation systems build confidence in domestic producers (World Bank, 2025). Government investments in QI can create positive externalities across the entire economy, supporting industrial upgrading and technological sophistication. A well-developed QI system is also key to protecting consumers by ensuring product safety, environmental sustainability, and public health standards. Regulatory authorities rely on QI institutions to implement and enforce consumer protection policies efficiently. QI plays a crucial role in ensuring quality and safety in all industries, including food, pharmaceutical, and construction. Finally, modern innovation systems are increasingly dependent on QI. Standards can facilitate innovation by codifying and diffusing knowledge (Blind et al., 2023; Blind and Münch, 2024), while metrology capabilities are essential for research and development (R&D) in frontier fields such as nanotechnology, quantum computing, and advanced materials (Brown, 2021; Link, 2021; OIML, 2015; Swann, 2009).

The GQII attempts to measure the development of national QI systems by assessing three key pillars: metrology, standardization, and accreditation. Each pillar consists of several indicators that are transformed and aggregated to create pillar-specific indices, which are then combined to form the overall GQII (Harmes-Liedtke et al., 2024). While the GQII

provides valuable comparative information for policymakers and researchers, any composite index involves methodological choices that may influence the results and subsequent policy recommendations. Countries may prioritize different aspects of QI based on their development stage, economic structure, strategic goals and quality culture (Harmes-Liedtke et al., 2025). Understanding how methodological choices affect rankings is therefore crucial for appropriate policy design and implementation.

This paper examines how sensitive the GQII rankings are to alternative methodological choices in data normalization, aggregation, and weighting. By exploring these variations, we aim to better understand the robustness of the GQII as a measurement tool, identify potential improvements to its methodology, and provide analysts and policymakers with a clear understanding of the strengths and weaknesses of their countries' National QI (NQI). Ultimately, our analysis will help clarify whether analytical results and policy priorities derived from the GQII are sensitive to calculation methods or represent truly fundamental aspects of QI development.

Beyond its analytical contributions, this paper aims to contribute to the broader measurement and expansion of QI and its promotion globally. Importantly, the development of comparable data through the GQII enables QI institutions to leverage information collected for other purposes and increase their visibility to policymakers and international development cooperation agencies.

The rest of the paper is structured as follows. The second section reviews the main emerging literature on QI, its measurement, and its role for economic development. Section 3 illustrates the methodology used to assess the GQII. In section 4, we present the results and the different rankings. Section 5 discusses the results and their policy implications, and section 6 concludes.

## **2. Literature review**

In recent years, the measurement of NQI systems has gained interest among researchers, policymakers, and international development organizations. NQI encompasses the institutional framework that supports and ensures the quality of goods and services through metrology, standardization, accreditation, conformity assessment, and, in some definitions, market surveillance (UNIDO, 2020). Reliable measurement of NQI is crucial for benchmarking, identifying best practices, fostering innovation, and supporting economic development (Harmes-Liedtke and Ramkissoon, 2024). However, the heterogeneity of data sources, lack of standardized data collection methods, and varying degrees of data transparency have posed significant challenges to comparative analysis and policy evaluation. Two major composite indices have emerged to address the need for systematic measurement of NQI: the Global Quality Infrastructure Index (GQII) and the Quality Infrastructure for Sustainable Development (QI4SD) Index.

The theoretical foundations for understanding the role of QI in economic development draw from innovation system theory (Lundvall et al., 2011) and evolutionary economics (Nelson, 2008, Nelson and Winter, 1982). Both frameworks put emphasis on how capabilities and innovation systems play a key role in supporting technological progress and industrial competitiveness (Freeman, 1987; Edquist, 2013). QI, therefore, serves as a critical component of national innovation systems by providing the assessment of the capabilities necessary for improving technological advancement and market access (Lall and Pietrobelli, 2005, Metcalfe, 1995; OECD, 2005). Building on these foundations, recent work examined QI's role within broader socio-technical transformations, highlighting how regulation, standardization, metrology, conformity assessment, and accreditation together contribute to systemic change (Blind, 2024). More recently, the World Bank has also emphasized the role of QI on business environment reforms (Kellermann and Keller, 2014; World Bank, 2018), and the influence of standards, and their compliance, on economic development (World Bank, 2025). The economic rationale for QI investment lies in its ability to reduce information asymmetries and transaction costs, and thereby facilitate trade and industrial upgrading processes (North, 1990; Guasch, 2007).

The literature underscores the growing recognition of the importance of robust NQI systems for economic and social development (Blind, 2024). Two recent studies (Blind et al., 2026, and 2025) look at the economic impact of QI on Germany, and several European countries finding robust econometric evidence of its relevance. Since sufficiently long timeseries data on composite QI development indicators were not available, proxy indicators for the individual QI components were used. Blind et al. (2026) measure standards as the stock of national, European, and international standards derived from the NAUTOS database, with additional differentiation for metrology-related standards (ICS 17). Conformity assessment is proxied by the number of ISO 9001 certificates from the ISO Survey, accreditation by a dummy variable indicating membership to the International Accreditation Forum (IAF) multilateral agreement, and market surveillance by the number of Safety Gate (RAPEX) notifications. Scientific metrology is approximated by metrology-specific standards and, alternatively, patent data. Similar proxies for the individual QI pillars were used in Blind et al. (2025). Across both studies, standards consistently show a positive and statistically significant association with GDP. ISO 9001 certifications display significant effects, particularly for trade, though sometimes with mixed signs depending on specification. IAF membership emerges as economically meaningful in the country panel models, while market surveillance produces ambivalent or negative coefficients. The German study estimates that the absence of QI would correspond to a reduction of approximately 7.8% in GDP. However, both papers emphasize severe data availability and measurement constraints.

Measuring QI development is challenging because QI is inherently a multidimensional phenomenon, lacks standardized metrics, and suffers from persistent data gaps (Harmes-Liedtke and Ramkissoon, 2024). Coordination among organizations responsible for QI is often limited, both horizontally across institutions and vertically across governance levels, resulting in fragmented data collection and curation. Furthermore, informal or unaccredited services remain invisible to standard assessments, and QI development itself is non-linear, with some

components advancing more rapidly than others. Moreover, the trajectory and structure of QI systems are highly context-dependent, varying significantly across countries. Data comparability over time in general can be affected by methodological changes and database updates. For instance, the comparability over time of the ISO survey, which provides data on the number of certificates and sites by country for ISO management system standards, suffers from the varying participation of companies and countries in the survey.

In the area of standardization, leading organizations such as the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and the International Telecommunication Union (ITU) offer data on membership, participation in technical committees, and the number of ISO number certifications. These data sets reveal disparity proxies in engagement among countries, with higher levels of participation typically correlating with stronger NQI systems. Accreditation and conformity assessment data are similarly collected by international bodies, but the availability and granularity of such data vary widely, limiting comprehensive analyses (Harmes-Liedtke and Ramkissoon, 2024).

The development of composite indices like GQII and QI4SD represents significant progress in measuring and benchmarking NQI globally.<sup>1</sup> However, persistent challenges related to data quality, transparency, and standardization remain. Ongoing efforts to harmonize measurement approaches and improve data accessibility are expected to enhance the utility of these indices, supporting evidence-based policy and international cooperation on QI. This paper offers a methodological contribution in this regard.

### 3. Methodology

To further understand and test the validity of the GQII, in this section we first unpack the GQII to explain in detail how it is built, and then propose three different approaches – i.e., exploiting different ranking methods, per capita measures, and regression-based weights – that modify the 2023 GQII scores and country rankings.

#### 1.1 The GQII Methodology

The GQII is computed as the arithmetic mean of three component indices:

$$\text{GQII} = (\text{Metrology} + \text{Standardization} + \text{Accreditation}) / 3$$

Each component is constructed from multiple indicators that are normalized into percentiles and then aggregated.

The metrology component consists of five indicators:

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<sup>1</sup> The development of systematic approaches to QI measurement has also been supported by tools such as the CALIDENA (<https://www.calidena.ptb.de>) to analyse QI value chains.

1. Membership Metrology: Scores countries as 1 for BIPM Member States, 0.75 for Associates of the General Conference on Weights and Measures (CGPM), 0.5 for Regional Metrology Organization members, and 0.1 otherwise.
2. CIPM - Consultative Committees: Evaluates membership in ten international metrology committees, with full membership scored as 1, observer status as 0.5, and non-membership as 0. The number of committees that countries participate in is then summed.
3. Conformity Assessment Bodies (CABs) - Calibration Labs: Counts the number of calibration laboratories in the country.
4. Calibration and Measurement Capability (CMC) Coverage: Measures the breadth of calibration and measurement capabilities across nine technical areas, with each area scored as 1 if present and 0 if absent.<sup>2</sup> The sum of the CMC areas covered is then calculated.<sup>3</sup>
5. Key & Supplementary Comparisons (K&SC): Counts the total number of key and supplementary comparisons for each economy.

Each of these indicators is transformed into percentile ranks, and the metrology component is calculated as the arithmetic mean of these percentiles.

Similarly, the standardization component comprises four indicators:<sup>4</sup>

1. IEC Technical Committee: Measures participation in International Electrotechnical Commission technical committees. Countries receive a score of 1 if they are a participating member or 0.5 if they are an observer.
2. ISO Technical Committee: Measures participation in the International Organization for Standardization technical committees. Countries receive a score of 1 if they are a participating member or 0.5 if they are an observer.
3. ISO MS Certificates: Counts ISO management system certificates issued in the country.
4. Memberships for ISO or IEC: Evaluates membership status in international standardization bodies. Full members receive a score of 1, associate/correspondent members receive a score of 0.75, and affiliate/subscriber members receive a score of 0.5. Otherwise, a score of 0.1 is received.

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<sup>2</sup> The KCDB data are separated into different metrological areas: Acoustics, Ultrasound, Vibration (AUV), Electricity and magnetism (EM), Length (L), Mass and related quantities (M), Photometry and radiometry (PR), Chemistry and biology (QM), Ionizing Radiation (RI), Thermometry (T), Time and frequency (TF). The members of the CIPM Consultative Committee (CC) carry out the key comparisons in their area.

<sup>3</sup> We consider the breadth (coverage of CMC areas) and not the depth (total number of CMCs) because the two are highly correlated (0.79).

<sup>4</sup> While ISO, IEC, and ITU are the three main international standardization bodies, ITU indicators were not included in the GQII standardization component, as the GQII focuses on general QI indicators and telecommunication represents a specific sectoral field. By contrast, UNIDO's QI4SD Index does make use of ITU indicators in its standardization component.

As with metrology, each indicator is transformed into percentile ranks and averaged to form the standardization component.

The accreditation component also uses percentile ranking of multiple indicators related to accreditation bodies and accredited conformity assessment bodies in the country. More specifically, the accreditation pillar is composed of the following indicators:

1. IAF Membership: Measures the participation in IAF Multilateral Recognition Agreement. Countries receive a score of 1 if they are full signatories, 0.75 if they hold associate membership, or 0.1 otherwise.
2. ILAC Membership: Measures the participation in ILAC. Countries receive a score of 1 if they are full signatories, 0.75 if they hold associate membership, or 0.1 otherwise.
3. RAO Membership: Measures the participation in Regional Accreditation Organizations (RAOs)<sup>5</sup>. Countries receive a score of 1 if they are full signatories, 0.75 if they hold another type of membership, or 0.1 otherwise.
4. CABs coverage: Countries receive a score of 1 if coverage is provided in a accreditation scope. Data was collected on 15 scopes.<sup>6</sup>
5. CABs Product Certification: Total number of labs covering ISO/IEC 17065
6. CABs MS Certification: Total number of labs covering ISO/IEC 17021-1
7. CABs Testing Labs: Total number of labs covering ISO/IEC 17025

Like the other two components, each indicator is transformed into percentile ranks and averaged to form the accreditation component. However, the weighing is a little different here as sub-components 5-7 together are counted as 1 with each contributing 0.3333.

In the standard GQII, the underlying component indices (metrology, standardization, and accreditation) are calculated using the percentile ranking formula

$$\text{Component\_pcrank} = (1 - (\text{Component\_rank} - 1) / (\text{n\_nonmissing} - 1)) \times 100$$

where Component\_rank is the rank of the country for that component (with 1 being the best) and n\_nonmissing is the total number of countries with non-missing values for that component. This formula creates percentile scores ranging from 0 to 100, with higher values representing better performance.

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<sup>5</sup> List of RAOs: AFRAC, APAC, ARAC, EA, IAAC, SADCA.

<sup>6</sup> Certification of Persons (ISO/IEC 17024), Validation and Verification (ISO/IEC 17029), Medical Testing Laboratories (ISO 15189), Inspection Bodies (ISO/IEC 17020), Proficiency Testing Providers (ISO/IEC 17043), Reference Material Producers (ISO 17034), Food Safety Management Systems (FSMS) (ISO 22000), Quality Management Systems (QMS) (ISO 9001), Environmental Management Systems (EMS) (ISO 14001), Information Security Management Systems (ISMS) (ISO/IEC 27001), Energy Management System (EnMS) (ISO 50001), Medical Devices – Quality Management Systems (MDMS) (ISO 13485), Occupational Health and Safety, Management Systems (OH&SMS) (ISO 45001), Biotechnology - Biobanking (ISO 20387), ISO 14065.

Composite indices like the GQII are powerful tools for simplifying complex multidimensional realities, but they necessarily involve methodological choices that can significantly impact results (Nardo et al., 2008). The rationale behind transforming each indicator in percentile ranking (i.e., converting values into relative positions within the distribution) lies in the different nature of the indicators, such as binary variables to capture memberships or continuous values to count laboratories. Percentile rankings, in this context, harmonise the indicators and make them easier to compare and aggregate. Raw indicator values typically have different scales, units, and distributions, and therefore they need to be normalized before aggregation. Common normalization methods include min-max normalization (i.e., scaling values between 0 and 1 based on minimum and maximum values), Z-score standardization (i.e., transforming values based on mean and standard deviation), and – as for the GQII – percentile ranking. The choice of the normalization method affects how differences between countries are represented and can significantly impact final rankings. For instance, percentile ranking emphasizes relative positions regardless of the magnitude of differences, while min-max normalization preserves information about the relative distances between observations. In addition, extreme values and missing data can distort composite indices. The GQII methodology handles these issues through the percentile ranking approach, which reduces the influence of extreme values. However, different approaches to missing data (e.g., imputation, exclusion) may potentially lead to different results, particularly for countries with incomplete data.

Another source of variation can be represented by the weighting system. The weights assigned to different components and indicators reflect implicit value judgments about their relative importance. Equal weighting (as used in the standard GQII) is transparent but assumes all components contribute equally to the concept being measured.<sup>7</sup> Alternative approaches include expert-based weights – where weights are derived from expert opinions, statistical weights – which are based on statistical properties of the data (e.g., principal component analysis), or outcome-based weights – where weights are derived from empirical relationships with outcomes of interest.

The method used to combine indicators and components can significantly affect results. The GQII uses arithmetic averaging, which allows perfect substitutability between components (i.e., a high score in one area can compensate for a low score in another). Alternative approaches include geometric averaging (which penalizes unbalanced profiles) and more complex non-compensatory methods.

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<sup>7</sup> The equal weighting implicitly assume that metrology, standardization, and accreditation contribute equally to QI development. In practice, however, these components are functionally interdependent and sequentially linked: standards set requirements that drive demand for conformity assessment; accreditation ensures the technical competence of conformity assessment bodies; and metrology underpins all components by providing the measurement traceability on which standards and conformity assessment ultimately rely. This systemic interdependence means that the relative importance of each component may vary across countries depending on their development stage, economic structure, and sectoral priorities — and that progress in one area may be constrained by gaps in another. The regression-based weighting approach explored in Section 2.3 offers one empirical strategy to account for these differences, though it cannot fully capture the dynamic, non-linear interactions among QI components. Modelling such system dynamics formally remains an open avenue for future research.

### 1.2 The GQII and the value of missing data

As percentile ranking methods and how they deal with missing values may lead to different results, we first calculate one variant of the GQII, namely GQII', using a different methodological approach. Then we will compare the two indicators. Our proposed variant follows the same structure of combining the three component indices (metrology, standardization, and accreditation), but it differs in the way percentiles are computed.

More specifically, GQII' uses a modified percentile ranking formula with a fixed total number of countries ( $n = 212$ ) in the denominator, regardless of the actual number of non-missing observations in each component:

$$\text{GQII}' = (\text{Metrology}' + \text{Standardization}' + \text{Accreditation}')/3$$

where each component is calculated using:

$$\text{Component\_pcrank}' = (212 - \text{Component\_rank})/(212 - 1) 100$$

This approach ensures a consistent scaling factor across all indicators, potentially reducing distortions when different indicators have varying numbers of missing values. Like the standard GQII, higher values in GQII' represent better performance.

For both GQII and its variant GQII', missing values in the raw indicators are set to zero after the percentile rankings are calculated.

### 1.3 GQII per capita

To address potential biases arising from country size differences, we compute a population-adjusted variant of the GQII (GQII\_pc) that normalizes relevant indicators by population before percentile ranking and aggregation. Several GQII indicators are inherently influenced by country size and may not accurately reflect per capita quality infrastructure development.

In particular, we identify and adjust the following count-based indicators:

- CABs - Calibration Labs: Number of calibration laboratories divided by population (per million inhabitants)
- ISO MS Certificates: Number of ISO management system certificates divided by population (per million inhabitants)
- Key & Supplementary Comparisons: Number of comparisons divided by population (per million inhabitants)

For these population-adjusted indicators, we first normalize by population using 2023 World Bank population data:

$$\text{Indicator\_pc} = (\text{Raw\_Indicator\_Value} / \text{Population}) \times 1,000,000$$

Thus, the per capita GQII follows the same three-component structure as the standard GQII:

$$\text{GQII}_{\text{pc}} = (\text{Metrology}_{\text{pc}} + \text{Standardization}_{\text{pc}} + \text{Accreditation}_{\text{pc}}) / 3,$$

and the normalized indicators are then converted to percentile rankings using the same formula as the standard GQII:

$$\text{Component}_{\text{pcrank}} = (1 - (\text{Component}_{\text{rank}} - 1) / (n_{\text{nonmissing}} - 1)) \times 100$$

This adjustment addresses the advantage that larger countries may have in absolute counts while preserving the relative *intensity* of QI development. The per capita approach offers a more accurate comparison of QI development, particularly relevant for policy makers interested in QI density and accessibility rather than absolute capacity. To maintain methodological consistency, countries with missing population data are excluded from the per capita calculations.

#### *1.4 Regression-based weights*

To derive empirically grounded component weights, we estimate the relationship between QI components and economic performance using ordinary least squares regression. This approach, referred to as “reverse engineering”, allows the data to reveal which dimensions of QI have the strongest association with economic outcomes.

More specifically, we regress GDP on all QI indicators:

$$\text{GDP} = \beta_0 + \beta_1 \text{Metrology} + \beta_2 \text{Standardization} + \beta_3 \text{Accreditation} + \varepsilon$$

The resulting coefficients ( $\beta_1$ ,  $\beta_2$ , and  $\beta_3$ ) provide weights that reflect the relative empirical importance of each component in explaining economic performance.

This approach has several advantages. First, it provides an evidence-based alternative to equal weighting which may also evolve over time; second, it connects QI development directly to economic outcomes, enhancing policy relevance of the index; third, it can reveal which dimensions of QI are most strongly associated with economic development.

However, the approach may also exhibit some limitations, particularly a potential endogeneity (GDP may influence QI development and vice versa) and the implicit assumption that economic performance is the primary outcome of interest for QI development.

#### *1.5 Comparing different rankings*

When comparing multiple rankings of the same set of countries based on different methodological approaches, several statistical tools can be employed to quantify the degree of similarity or difference between rankings. These tools are essential for determining whether methodological variations produce substantively different results or minor adjustments only. In our analysis, we use the Spearman's Rank Correlation Coefficient ( $\rho$ ) to assess the strength and direction of association between two rankings. The coefficient

ranges from -1 (perfect negative correlation) to +1 (perfect positive correlation), with 0 indicating no correlation.

Spearman's rho is calculated as

$$\rho = 1 - (6 \sum d_i^2) / (n(n^2 - 1))$$

where  $d_i$  is the difference between the ranks of country  $i$  in the two rankings being compared, and  $n$  is the number of countries. This measure is particularly useful for understanding the overall similarity between rankings.

Alternatively, we use the Average Absolute Rank Difference (ARD). This is a straightforward measure that computes the average magnitude of ranking changes across all countries

$$ARD = (1/n) \sum_{i=1}^n |R_{i1} - R_{i2}|$$

where  $R_{i1}$  and  $R_{i2}$  are the ranks of country  $i$  in the two rankings being compared. Lower values indicate greater similarity between rankings.

### *1.6 Sensitivity analysis*

Beyond comparing different methodological approaches, we also conducted a sensitivity analysis to assess the robustness of the GQII to small changes in individual indicators. Sensitivity analysis helps identify which components and indicators have the greatest influence on country rankings and reveals potential vulnerabilities in the index methodology. Understanding how rankings respond to marginal changes in input values is particularly relevant for policymakers seeking to prioritize interventions for improving QI. For each indicator in the GQII, we simulate a 1% increase in its value while holding all other indicators constant, then recalculate the rankings and measure the resulting changes.

This sensitivity analysis complements our methodological comparisons by providing a more granular understanding of the GQII's behaviour. While the methodological variants examine large-scale structural changes to the index, sensitivity analysis explores incremental changes that more closely approximate real-world policy interventions. Together, these approaches provide a comprehensive picture of the GQII's robustness and policy relevance.

## **4. Results**

Table 1 shows the countries with the largest difference between the ranking based on the GQII and the ranking based on the GQII', which uses alternative percentile formula as described in Section 3. The average rank difference between GQII and GQII' is 2.98, and the same is larger (4.76) when comparing GQII with GQII\_pc. The full table with both rankings can be found in Appendix A. We observe that while rankings are almost unchanged from GQII to GQII\_pc, when considering the population size, some countries like India, Brazil, or Indonesia show large differences in terms of ranking.

**Table 1. Countries ranked based on ranking differences, in absolute terms**

Country	GQII-GQII' difference	Country	GQII-GQII_pc difference
TJK	16	IND	26
MNG	15	BRA	21
PSE	14	IDN	19
MAC	14	MLT	18
MLT	14	QAT	16
LBY	13	MAC	16
NPL	13		
LBN	12		

Note: Countries with the largest difference between GQII and GQII' and GQII and GQII\_pc, in absolute terms. The full table with all countries is presented in Appendix A.

To better analyse how different the two rankings are, we compute the Spearman's and the Kendall's rank correlation coefficients (Table 2). The correlation is very high, suggesting that the two rankings are similar. The hypothesis that the indices are independent is therefore rejected. However, some countries may experience large, significant changes, either negative or positive.

**Table 2. Spearman's and Kendall's rank correlation coefficients for the two GQII measures.**

Correlation coefficient	GQII – GQII'	GQII – GQII_pc	GQII' – GQII_pc
<b>Spearman (<math>\rho</math>)</b>	0.9962	0.9916	0.9892
<b>Kendall (<math>\tau</math>-a)</b>	0.9596	0.9335	0.9168
<b>Kendall (<math>\tau</math>-b)</b>	0.9605	0.9344	0.9177
<b>Obs.</b>	185	185	185

Note: Spearman's and Kendall's correlation coefficients between GQII and GQII'. The p-value tests the independence between the two indices.

The sensitivity analysis also shows interesting results. Table A2 in Appendix A shows how rankings change if we increase each GQII component (i.e., metrology, standards, and accreditation) separately by 20%. While almost no difference occurs when metrology increases by 20%, slight changes can be seen when accreditation (Spearman correlation 0.99) and standards (Spearman correlation 0.95) increase.

Table 3 analyses the balance of QI development across countries by examining differences between their rankings in the three core QI components: metrology ( $\Delta$ MET), standardization ( $\Delta$ STD), and accreditation ( $\Delta$ ACC), after they separately increase by 20%. For example, when we simulate an increase of 20% in each pillar separately, North Macedonia would maintain its rank in metrology (relative to the baseline of not changing any pillar), while it would

increase its rank in standardization of 8 positions, and decrease its rank (i.e., improve) of one position in accreditation. The results reveal significant variation in how evenly countries have developed their QI systems. On one extreme, economies like Northern Macedonia (MKD), Syria (SYR), and Saint Kitts and Nevis (KNA) show high imbalances with differences of 7 positions between their best or worst performing components and the original GQII, indicating highly uneven QI development. Syria, for instance, ranks relatively well in standardization (158th) but poorly in both metrology (164rd) and accreditation (165th). Conversely, several countries, including the United States, United Kingdom, Spain, India, and South Korea demonstrate perfectly balanced QI systems with identical rankings across all three components. The analysis identifies 16 countries with notable imbalances (differences greater or equal to 3 positions), suggesting that uneven QI development in the three pillars is a common occurrence, especially in small economies. From a policy perspective, countries with large differences across components have clear opportunities for targeted investment. These countries can focus resources on strengthening their weakest QI pillar, depending on their needs, rather than spreading efforts equally across all areas. This targeted approach may be particularly valuable for developing countries with limited resources, allowing them to achieve more balanced and potentially more effective QI systems. However, the impact that each pillar has on the outcome variable (e.g. GDP) should also be taken into account in the choice of the preferred policy strategy on targeting.

**Table 3. QI Component Difference (selected countries)**

Country	$\Delta$ MET	$\Delta$ STD	$\Delta$ ACC	GQII	Max Difference	Best component	Worst Component
MKD	82	89	81	82	7	Accreditation	Standardization
SYR	164	158	165	165	7	Standardization	Accreditation
KNA	173	166	173	173	7	Standardization	Metrology/Accreditation
IRQ	87	82	89	87	5	Standardization	Accreditation
UGA	121	117	124	121	4	Standardization	Accreditation
TWN	55	59	54	55	4	Accreditation	Standardization
HTI	174	170	174	174	4	Standardization	Metrology/Accreditation
GEO	74	80	76	78	4	Metrology	Standardization
CYP	78	74	74	74	4	Standardization/Accreditation	Metrology
JOR	79	75	75	75	4	Standardization/Accreditation	Metrology
MAR	76	78	80	79	3	Metrology	Accreditation
FJI	136	138	140	139	3	Metrology	Accreditation
URY	66	70	69	69	3	Metrology	Standardization
YEM	127	128	122	126	4	Accreditation	Standardization
COM	128	129	123	127	4	Accreditation	Standardization
IRN	62	60	66	62	4	Standardization	Accreditation

Notes: the full list of countries is in Appendix A.

The regression analysis reveals significant heterogeneity in how different QI components relate to economic performance. The empirically derived weights in Table 4 show that

standardization consistently dominates across different economic indicators, while the relative importance of metrology and accreditation varies depending on the outcome measure.

**Table 4. Regression-based weights**

	GDP	Trade	Exports
Metrology	-0.006 (0.013)	0.009 (0.010)	0.020 (0.015)
Standardization	0.051*** (0.007)	-0.009* (0.005)	0.045*** (0.008)
Accreditation	0.013** (0.006)	0.005 (0.003)	0.010 (0.006)
N	174	146	138

To better understand the relative importance of each domain on GDP, Trade, and Exports, we normalise weights (Table 5). When weights are normalized to sum to 1, standardization receives the highest weight for GDP (0.721) and exports (0.605), while showing more balanced importance for trade (0.385). Metrology shows its strongest relative importance for trade (0.389) compared to GDP (0.090) and exports (0.273). Accreditation maintains relatively stable weights across indicators, ranging from 0.121 for exports to 0.227 for Trade.

**Table 5. Regression-based weights normalised to sum 1**

	Met	Std	Acc
<b>GDP</b>	0.090	0.721	0.189
<b>Trade</b>	0.389	0.385	0.227
<b>Exports</b>	0.273	0.605	0.121

The regression-based weighting (GQIIw) produces several notable patterns consistent with previous methodological variants. In Table 6 we show countries with the largest difference between the GQII and the GQIIw. On the one hand, top performers remain stable. Leading countries show minimal ranking changes, reinforcing the robustness of the index for identifying QI leaders. On the other hand, middle and bottom countries experience significant shifts. Countries can move substantially up or down the rankings depending on their component profiles. We observe largest negative impacts in economies like Eswatini (SWZ, -33 positions), and Yemen and Comoros (both -27.5 positions). These economies perform worse under the weighted system, suggesting their QI profiles emphasize components with lower empirical weights i.e. contributing *less* to GDP. Largest positive

impacts are, on the other hand, observed in countries like Haiti, which gains 32 positions (174 to 142), Syria (28 positions, 165 to 137), and several other countries improve by 20 or more positions, indicating their QI development aligns well with components that are relevant to GDP.

**Table 6. Countries with largest difference between GQII and GQIIw**

<b>Country</b>	<b>GQII</b>	<b>GQIIw</b>	<b>Diff</b>
SWZ	110	143	-33
COM	126	153.5	-27.5
YEM	126	153.5	-27.5
TWN	55	82	-27
VEN	142	167	-25
MKD	82	104	-22
PRY	118	139	-21
KGZ	95	114	-19
XKX	145	163	-18
NGA	81	63	18
RWA	131	113	18
IRQ	87	69	18
CMR	138	120	18
ISL	113	94	19
UGA	121	99	22
DZA	90	66	24
KNA	173	148	25
SYR	165	137	28
HTI	174	142	32

## 5. Discussion

Our methodological analysis of the GQII reveals important insights about the robustness and limitations of current QI measurement approaches. The findings have significant implications for both policymakers seeking to use the GQII for strategic decision-making and researchers working to advance the field of QI measurement.

The analysis demonstrates that while the GQII shows some sensitivity to methodological choices, the broader patterns and country groupings remain relatively stable across different computational approaches. This finding is particularly confirmed among leading countries, where rankings show remarkable consistency regardless of the specific methodology employed. However, there appears to be a pattern where leading countries maintain stable positions while middle-ranked and lower-ranked countries experience larger deviations

between methodological variants. This suggests that whilst the GQII is most reliable for identifying top performers and laggards in QI development, it should be used with caution when applied to countries in the middle of the distribution. The high correlation coefficients between ranking methods (above 0.96) provide overall confidence in the index's stability, but researchers and policymakers should interpret small ranking differences with careful judgement.

The analysis highlights broader challenges in QI data collection and utilization, which align with concerns raised in recent literature (Harmes-Liedtke and Ramkissoon, 2024). The GQII represents a pioneering effort to systematically collect and analyse QI data for comparative purposes, based on the current availability of QI data; however, the availability and quality of QI data remain insufficient, with significant gaps in time series data and sectoral disaggregation. Moreover, the formulas for the indices were determined based on plausible assumptions, but the understanding of the economics of the relationships between the indicators and their impact on the economy needs further research. The publication of statistical data by the official national QI bodies and their regional and international associations would clearly be welcome, and it would help understand the QI phenomenon and its relevance.

Our analysis of component-level differences reveals significant variations in how evenly countries have developed their QI systems. Some economies (e.g., Haiti and Syria) show huge imbalances with differences exceeding 20 positions between their best and worst performing components, while others like the United States and South Korea demonstrate perfectly balanced development across all three components. This pattern is consistent with broader observations on QI trajectories: countries with less developed QI systems tend to exhibit uneven development across components, reflecting the early stages of their institutional evolution.

At the outset of a development trajectory, only a limited number of QI services are available domestically, while others are sourced from foreign service providers. This is partly explained by the absence of international recognition for nascent local systems — domestic QI services can initially only serve the national market and are not yet accepted for export purposes. As national systems mature and gain international recognition, services gradually become available domestically and the overall QI profile tends to become more balanced. This calls for future research on whether some elements of QI could be substitutes of each other, or rather complements, being equally necessary. The ensuing targeted investment strategies could be devised focusing on the weakest component, or where they are likely to have the greatest impact on overall QI performance, particularly for countries with limited resources. This represents an important avenue for future research; initial conceptual contributions can be found in Harmes-Liedtke et al. (2025).

Our analysis may also suffer from some limitations. First, the importance of population size or economic scale is not explicitly incorporated into our methodology. Second, our analysis is based on a single edition of the GQII, limiting insights into the dynamics of QI development. Third, the focus on the demand-side should be strengthened (Kellermann and Keller, 2014,

and World Bank, 2018). While it is true that the GQII primarily reflects the supply side, measuring the capacity and capabilities of QI institutions, it also includes various demand components. For instance, the number of calibration laboratories indicates the demand for metrology services, because these laboratories occupy a central position between national metrology institutes and industrial metrology at company level. The number of certified management standards is also directly related to the company level, and the number of conformity assessment bodies is an indicator of the demand for accreditation. The main challenge for the GQII is that company data on the use of QI services (e.g. the number of laboratory tests, calibrations, or certified products), are neither systematically collected nor published.

Future QI research using the GQII could benefit from incorporating also indicators that capture QI utilization by businesses, the relationship between QI supply and industrial structure, and the efficiency with which QI services translate into economic outcomes. The collaboration between Mesopartner, PTB and UNIDO to develop a joint index, and current initiatives to digitize quality infrastructure would help improve the accuracy of measurement of global QIs.

## 6. Conclusion

This paper demonstrated that while the GQII rankings exhibit some sensitivity to methodological choices, the broader patterns and country groupings remain relatively stable across different computational approaches. This confirms that the GQII provides fundamentally robust information for policymakers and researchers interested in comparative QI development.

The stability of country groupings, particularly among top performers, suggests that the GQII effectively captures meaningful differences in QI capabilities across countries. China, Germany, the United States, and the United Kingdom consistently rank at the top of the index regardless of methodology, indicating solid QI systems. Similarly, countries with less developed QI consistently appear in the lower tiers of the rankings.

Nevertheless, our analysis has identified several areas where methodological refinements could strengthen the GQII. The treatment of missing data, especially for lowest country values, represents a particular concern, as different approaches to handling data gaps can give significantly different results for countries with incomplete information. Thus, the current approach of setting percentile ranks to zero for missing values may disadvantage countries with partial reporting capabilities, potentially conflating data availability issues with actual QI weaknesses.

The sensitivity analysis conducted in this study also highlights the importance of understanding marginal improvements in different QI dimensions. By examining how small changes in individual indicators affect overall rankings, policymakers can identify high-leverage areas for targeted intervention.

Several suggestions for future research emerge from this paper. First, as additional editions of the GQII become available, panel data analysis could examine the dynamics of QI development and identify factors driving changes in national QI systems over time. Second, future work should explore more thoroughly demand-side indicators capturing QI service utilization by enterprises and the effectiveness of QI in supporting industrial development. Third, the planned harmonization between the GQII and the QI4SD Index would offer opportunities to develop more comprehensive frameworks integrating economic and sustainability dimensions. Finally, causal inference analysis could address the endogeneity concerns identified in our regression-based weighting approach, better clarifying the direction of causality between QI development and economic outcomes.

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## Appendix A. Full tables

**Table A1. Countries ranked based on GQII and GQII'**

Country	GQII	GQII'	GQII_pc	GQII_w	Country	GQII	GQII'	GQII_pc	GQII_w
DEU	1	1	1	2	AZE	94	96	96	100
CHN	2	2	8	1	KGZ	95	102	97	114
USA	3	3	13	6	BGD	96	93	104	95
GBR	4	4	2	4	COD	97	104	99	93
ITA	5	6	4	3	MNE	98	90	93	98
JPN	6	5	12	5	MWI	99	106	100	103
ESP	7	7	6	9	BOL	100	95	102	101
IND	8	8	34	7	CIV	101	100	103	85
KOR	9	9	10	8	GHA	102	98	107	87
FRA	10	11	19	15	MLT	103	89	85	91
AUS	11	12	7	12	JAM	104	107	101	106
POL	12	10	17	14	ARM	105	99	106	102
CZE	13	13	3	11	PAN	106	108	105	105
CHE	14	15	5	13	MOZ	107	113	111	121
NLD	15	18	15	10	SYC	108	114	98	119
BRA	16	16	37	16	DOM	109	103	110	107
TUR	17	17	32	19	SWZ	110	121	108	143
MEX	18	14	27	27	CUB	111	115	112	115
CAN	19	19	24	21	MDG	112	120	113	127
ZAF	20	20	29	25	ISL	113	110	109	94
SWE	21	21	14	17	GTM	114	105	119	112
HUN	22	22	9	20	AGO	115	123	114	130
FIN	23	23	11	22	LSO	116	124	115	133
IDN	24	24	43	30	SEN	117	109	118	111
AUT	25	25	21	23	PRY	118	117	117	139
THA	26	26	40	28	TTO	119	119	116	109
ROU	27	31	28	18	SLV	120	122	120	118
BEL	28	30	25	24	UGA	121	116	122	99
MYS	29	29	38	26	BEN	122	125	124	123
SVK	30	27	16	34	LBN	123	111	121	108
UKR	31	28	39	41	MLI	124	126	125	116
DNK	32	34	20	29	NPL	125	112	131	117
SGP	33	32	18	39	YEM	126	131	126	153.5
PRT	34	35	26	31	COM	126	131	126	153.5
EGY	35	33	44	38	KHM	128	127	130	135
SRB	36	36	23	33	BFA	129	128	128	125
BGR	37	37	22	32	NIC	130	129	133	145
GRC	38	38	30	35	RWA	131	135	135	113
COL	39	39	42	40	PSE	132	118	132	134
NOR	40	41	31	36	TGO	133	130	136	136
ARG	41	40	45	42	LCA	134	137	123	126
IRL	42	43	35	37	BRB	135	138	137	122
NZL	43	42	36	47	NER	136	134	138	144
SAU	44	44	47	44	HND	137	133	139	140
ARE	45	45	41	45	CMR	138	139	140	120
CHL	46	46	48	50	FJI	139	140	129	132
SVN	47	47	33	51	SDN	140	141	142	124
BLR	48	48	46	48	GAB	141	143	141	129
KAZ	49	49	51	57	VEN	142	149	148	167
VNM	50	50	62	56	BDI	143	144	144	128

PAK	51	52	63	49	BHS	144	145	145	131
PER	52	51	57	55	XKX	145	142	147	163
PHL	53	53	66	52	GUY	146	146	143	152
RUS	54	54	64	43	MMR	147	150	152	147
TWN	55	66	61	82	BTN	148	151	149	141
HRV	56	55	49	53	DMA	149	152	150	149
LTU	57	57	50	65	MAC	150	136	134	155
KEN	58	56	68	62	AFG	151	154	151	138
ISR	59	59	55	46	BRN	152	155	146	151
TUN	60	58	65	64	MRT	153	156	153	146
LKA	61	60	67	59	GNB	154	153	154	166
IRN	62	65	71	54	SLE	155	157	155	150
HKG	63	70	58	77	LAO	156	158	156	156
ECU	64	69	70	76	BLZ	157	159	158	164
CRI	65	68	56	79	GRD	158	160	159	165
UZB	66	61	73	68	PNG	159	161	160	157
LUX	67	63	52	58	LBY	160	147	157	161
LVA	68	62	53	73	SOM	161	162	161	159
URY	69	72	60	74	GMB	162	163	162	158
QAT	70	64	54	60	SUR	163	164	163	169
OMN	71	67	69	61	TJK	164	148	164	160
MNG	72	87	74	80	SYR	165	165	165	137
EST	73	71	59	67	COG	166	166	166	170.5
CYP	74	74	72	72	CPV	166	166	166	170.5
JOR	75	76	82	70	LIE	168	169	168	173
ETH	76	85	84	75	SSD	169	168	169	172
KWT	77	81	80	78	MDV	170	170	170	175
GEO	78	73	76	89	SLB	170	170	170	175
MAR	79	75	86	71	WSM	170	170	170	175
MDA	80	84	79	88	KNA	173	173	173	148
NGA	81	77	90	63	HTI	174	174	174	142
MKD	82	86	75	104	VCT	175	175	175	168
ZWE	83	91	87	90	TCD	176	176	176	162
MUS	84	88	77	86	ATG	177	177	177	177
ALB	85	79	81	92	VUT	178	178	178	178
TZA	86	92	88	84	LBR	179	179	179	181
IRQ	87	78	92	69	CAF	179	179	179	181
BHR	88	83	78	81	DJI	179	179	179	181
NAM	89	94	89	96	GIN	179	179	179	181
DZA	90	82	94	66	TLS	179	179	179	181
BIH	91	80	83	83	TON	184	184	184	184.5
BWA	92	97	91	97	GNQ	184	184	184	184.5
ZMB	93	101	95	110					

**Table A2. Rankings based on a 20% increase in each GQII component**

Country	ΔMET	ΔSTD	ΔACC	Country	ΔMET	ΔSTD	ΔACC	Country	ΔMET	ΔSTD	ΔACC	Country	ΔMET	ΔSTD	ΔACC
DEU	1	2	1	VNM	50	51	49	MWI	100	99	97	BTN	149	146	147
CHN	2	1	2	PAK	52	50	51	BOL	99	102	101	DMA	148	150	150
USA	3	3	3	PER	51	54	52	CIV	103	100	100	MAC	150	151	149
GBR	4	4	4	PHL	54	53	53	GHA	101	101	102	AFG	151	149	151
ITA	6	5	5	RUS	53	52	55	MLT	102	103	103	BRN	152	152	153
JPN	5	6	6	TWN	55	59	54	JAM	104	104	104	MRT	153	153	154
ESP	7	7	7	HRV	56	55	58	ARM	106	105	105	GNB	154	156	152
IND	8	8	8	LTU	58	58	56	PAN	105	106	109	SLE	155	154	156
KOR	9	9	9	KEN	57	57	57	MOZ	107	108	106	LAO	156	155	155
FRA	10	10	10	ISR	59	56	62	SYC	108	109	107	BLZ	157	159	157

AUS	11	11	13	TUN	60	61	60	DOM	109	107	110	GRD	158	161	159
POL	12	13	11	LKA	63	62	59	SWZ	110	112	108	PNG	159	157	158
CZE	13	12	12	IRN	62	60	66	CUB	111	111	114	LBY	160	162	160
CHE	14	14	14	HKG	61	63	61	MDG	113	114	111	SOM	161	160	161
NLD	16	15	15	ECU	64	64	63	ISL	114	110	116	GMB	163	163	162
BRA	15	16	16	CRI	65	66	64	GTM	112	113	115	SUR	162	165	163
TUR	18	17	18	UZB	67	67	65	AGO	115	116	112	TJK	165	164	164
MEX	17	18	17	LUX	69	65	68	LSO	117	118	113	SYR	164	158	165
CAN	19	19	19	LVA	68	71	67	SEN	118	115	117	COG	166	167	166
ZAF	20	20	20	URY	66	70	69	PRY	116	121	118	CPV	166	167	166
SWE	21	21	21	QAT	70	68	70	TTO	119	119	121	LIE	168	171	168
HUN	22	22	22	OMN	71	69	71	SLV	120	120	119	SSD	169	169	169
FIN	23	23	23	MNG	73	73	72	UGA	121	117	124	MDV	170	172	170
IDN	24	26	24	EST	72	72	73	BEN	122	122	120	SLB	170	172	170
AUT	25	24	25	CYP	78	74	74	LBN	123	123	126	WSM	170	172	170
THA	26	27	26	JOR	79	75	75	MLI	125	124	125	KNA	173	166	173
ROU	27	25	29	ETH	77	76	77	NPL	124	125	127	HTI	174	170	174
BEL	29	28	27	KWT	75	77	78	YEM	127	128	122	VCT	175	175	175
MYS	28	29	28	GEO	74	80	76	COM	127	128	122	TCD	177	176	176
SVK	30	30	30	MAR	76	78	80	KHM	126	127	128	ATG	176	177	177
UKR	31	32	31	MDA	80	81	79	BFA	129	126	129	VUT	178	178	178
DNK	33	31	32	NGA	81	79	83	NIC	130	131	130	LBR	179	179	179
SGP	32	34	33	MKD	82	89	81	RWA	131	130	132	CAF	179	179	179
PRT	35	33	35	ZWE	83	85	84	PSE	132	132	131	DJI	179	179	179
EGY	34	37	34	MUS	84	84	85	TGO	135	135	133	GIN	179	179	179
SRB	36	35	36	ALB	85	87	82	LCA	133	134	136	TLS	179	179	179
BGR	37	36	38	TZA	86	83	86	BRB	134	133	137	TON	184	184	184
GRC	38	38	37	IRQ	87	82	89	NER	137	139	134	GNQ	184	184	184
COL	39	39	39	BHR	88	86	87	HND	138	140	135				
NOR	41	40	40	NAM	90	91	88	CMR	139	136	138				
ARG	40	41	41	DZA	91	88	91	FJI	136	138	140				
IRL	43	42	42	BIH	89	90	90	SDN	140	137	139				
NZL	42	43	43	BWA	92	92	92	GAB	141	141	143				
SAU	44	44	45	ZMB	94	94	93	VEN	142	144	141				
ARE	45	45	44	AZE	93	93	95	BDI	143	142	144				
CHL	46	46	46	KGZ	95	95	94	BHS	145	143	145				
SVN	47	47	47	BGD	97	96	98	XKX	146	148	142				
BLR	48	48	50	COD	98	98	96	GUY	144	145	146				
KAZ	49	49	48	MNE	96	97	99	MMR	147	147	148				

**Table A3. QI Component Difference**

Country	$\Delta$ MET	$\Delta$ STD	$\Delta$ ACC	Max_Difference	Best_Component	Worst_Component
MKD	82	89	81	8	Accreditation	Standardization
KNA	173	166	173	7	Standardization	Accreditation/Metrology
YEM	127	128	122	6	Accreditation	Standardization
COM	127	128	122	6	Accreditation	Standardization
XKX	146	148	142	6	Accreditation	Standardization
SYR	164	158	165	6	Standardization	Accreditation
LSO	117	118	113	5	Accreditation	Standardization
IRQ	87	82	89	5	Standardization	Accreditation
ALB	85	87	82	5	Accreditation	Standardization
NER	137	139	134	5	Accreditation	Standardization
HND	138	140	135	5	Accreditation	Standardization
TWN	55	59	54	5	Accreditation	Standardization
CYP	78	74	74	4	Accreditation/Standardization	Metrology
JOR	79	75	75	4	Accreditation/Standardization	Metrology

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