

Exploring the Role of Designated Institutes within National Quality Infrastructures



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Introduction

The term Quality Infrastructure (QI) refers to the public and private institutional framework for metrology, standardisation, accreditation, and services relating to conformity assessment such as testing, calibration, inspection and verification are closely associated and build a system of national and international organizations for barrier-free trade following relevant, standards, guides, rules and regulations, policies, protocols, etc. Metrology is considered as a major pillar within the QI. Thus, it plays a critical role in all areas of human endeavour and across all sectors of industry, trade, regulations, legislation, defence, environment, education, science, food, transport, health, and quality of life.

QI Evolution

Over the past century, the growing demand for enhanced global comparability, improved measurement traceability, and reduced uncertainties has significantly expanded the scope of metrology into emerging fields and highly specialized applications. This evolution—driven by successive industrial revolutions, the expansion of global trade, increasingly complex regulatory frameworks, and shifting societal needs—has highlighted the challenges faced by National Metrology Institutes (NMIs) in meeting every new and specialized metrological demand. To address these gaps, Designated Institutes (DIs) play a vital role within a country's QI by providing efficient and effective solutions to meet emerging traceability needs under the framework of the CIPM Mutual Recognition Arrangement (CIPM-MRA). DIs enhance national metrological capabilities, extend the scope of measurement traceability, and contribute significantly to building a robust National Measurement System (NMS), thereby reinforcing the overall QI.

Current Situation

As of now, 258 institutes participate in the CIPM Mutual Recognition Arrangement (CIPM-MRA), including 98 National Metrology Institutes (NMIs), 156 Designated Institutes (DIs), and 4 international organizations. This global framework enables mutual recognition of calibration and measurement certificates, fostering international trust in measurement results. The Calibration and Measurement Capabilities (CMCs) of NMIs and DIs produced under the CIPM-MRA, and aligned with national measurement standards, are overseen by the Joint Committee of the Regional Metrology Organizations and the BIPM (JCRB). These CMCs undergo a rigorous peer review and approval process, requiring an independently reviewed Quality Management Systems and successful participation in international comparisons. Figure 1 illustrates the number of CMCs held and Key & Supplementary Comparisons participated in for the most active countries, reflecting the broad coverage of modern metrology by their NMIs and DIs.

Figures 2 and 3 illustrate a clear correlation between the number of Calibration and Measurement Capabilities (CMCs), Key & Supplementary Comparisons, and a country's GDP (in million USD). Countries with a high number of CMCs and international comparisons tend to exhibit strong industrial and economic growth, underscoring the strategic value of advanced metrological infrastructure. Conversely, nations lacking robust metrology systems face significant challenges in meeting global quality standards, which hampers competitiveness. Figure 4 shows the relationship between GDP and the Quality Infrastructure for Sustainable Development (QI4SD) Index—developed by UNIDO in collaboration with INetQI. This index encompasses five key dimensions: metrology, standardization, conformity assessment, accreditation, and policy. A well-developed metrological infrastructure is essential for industrial growth, strategic advancement, and social development. While facilities like advanced laboratories for maintaining national standards are costly to establish and maintain, their absence severely limits a country's ability to access international markets, ensure product safety, and comply with domestic and international standards. Thus, maintaining a sufficiently developed network of NMIs and DIs to cover a country's metrological needs is vital not only for trade and economic growth but also for building consumer trust and safeguarding public welfare.

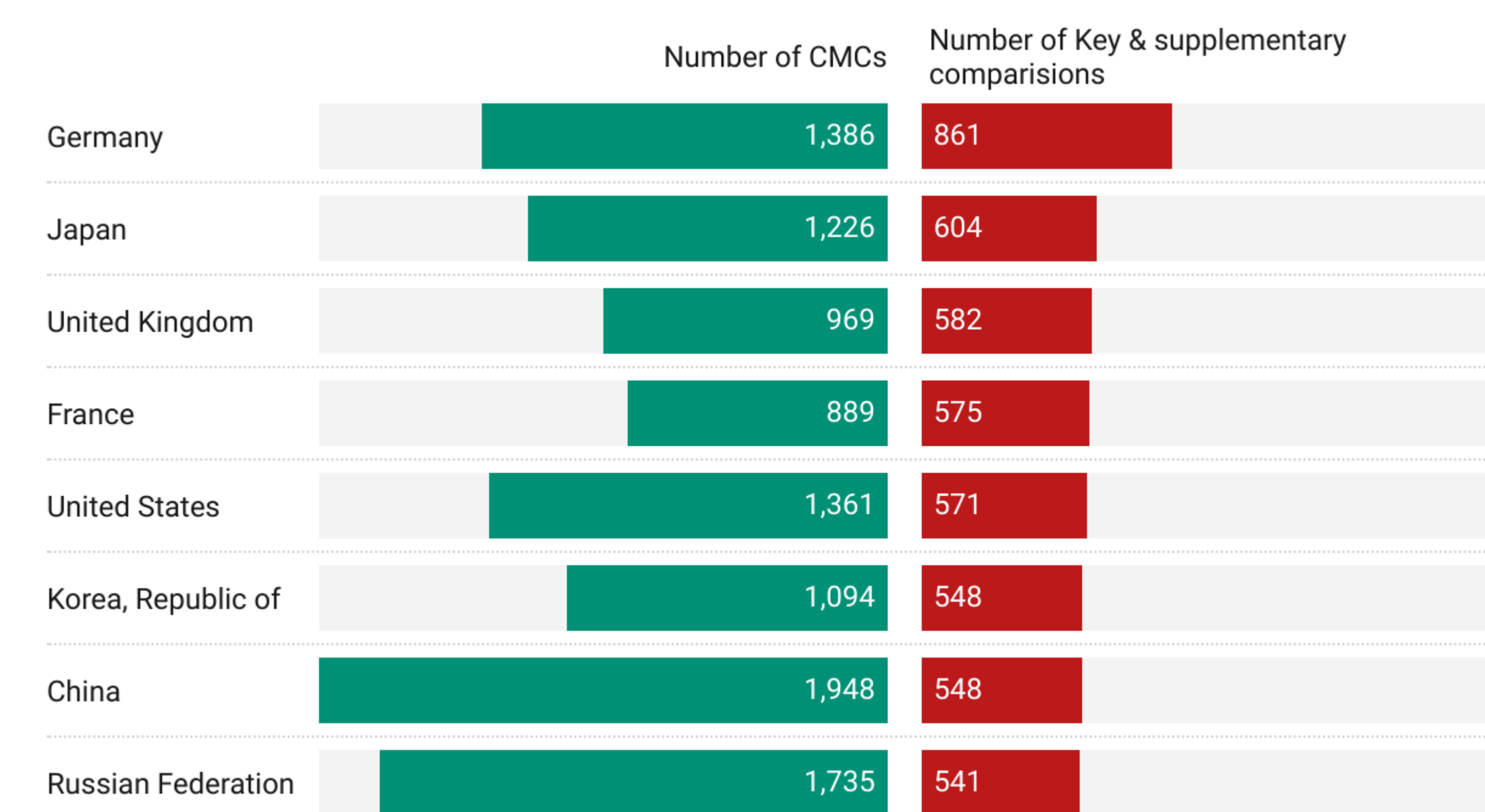


Figure 1: Number of CMCs and participation in Key & Supplementary comparisons of the most active countries

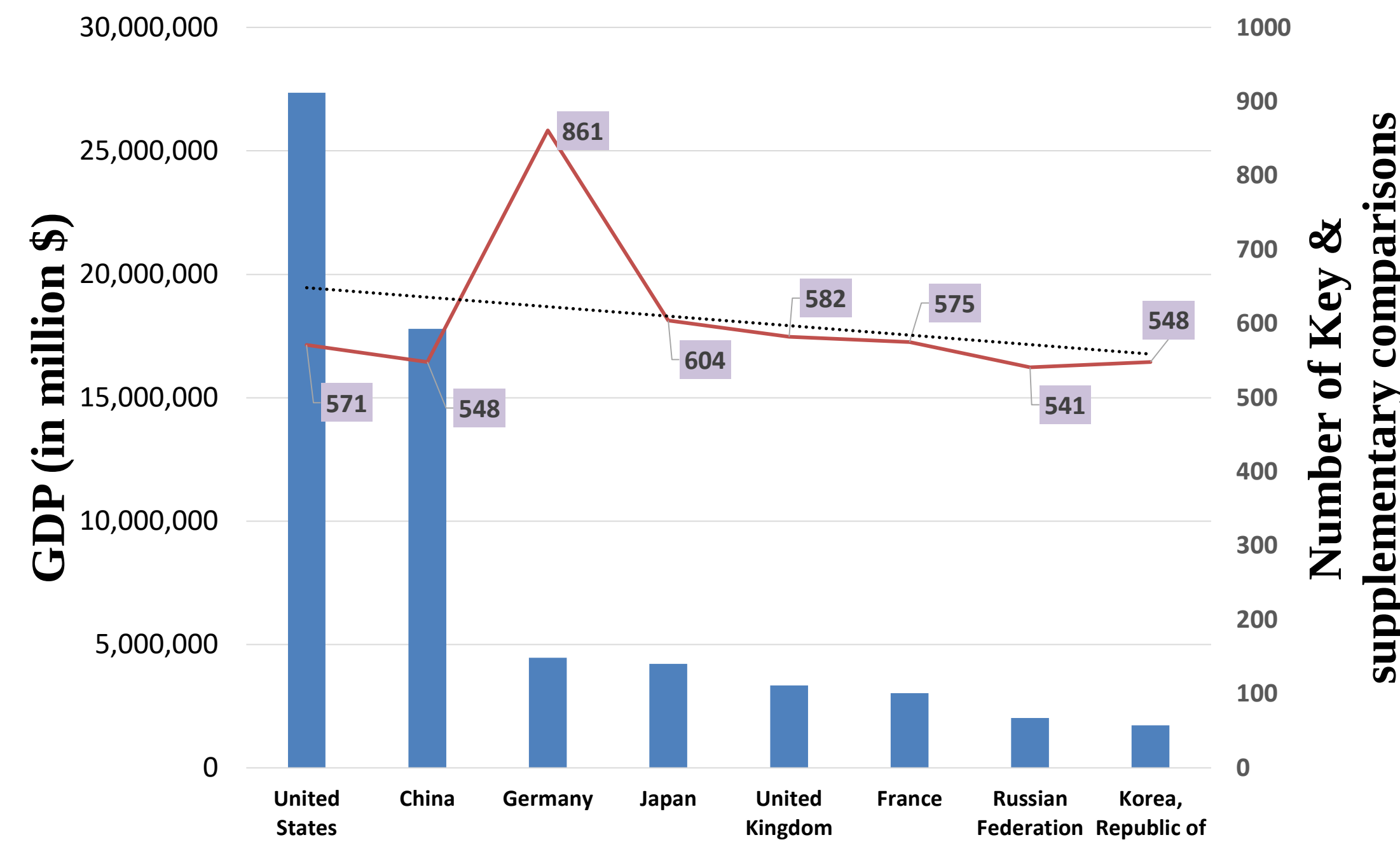


Figure 3: Correlation of participation in Key & Supplementary comparisons and GDP (in million USD) of the most active countries

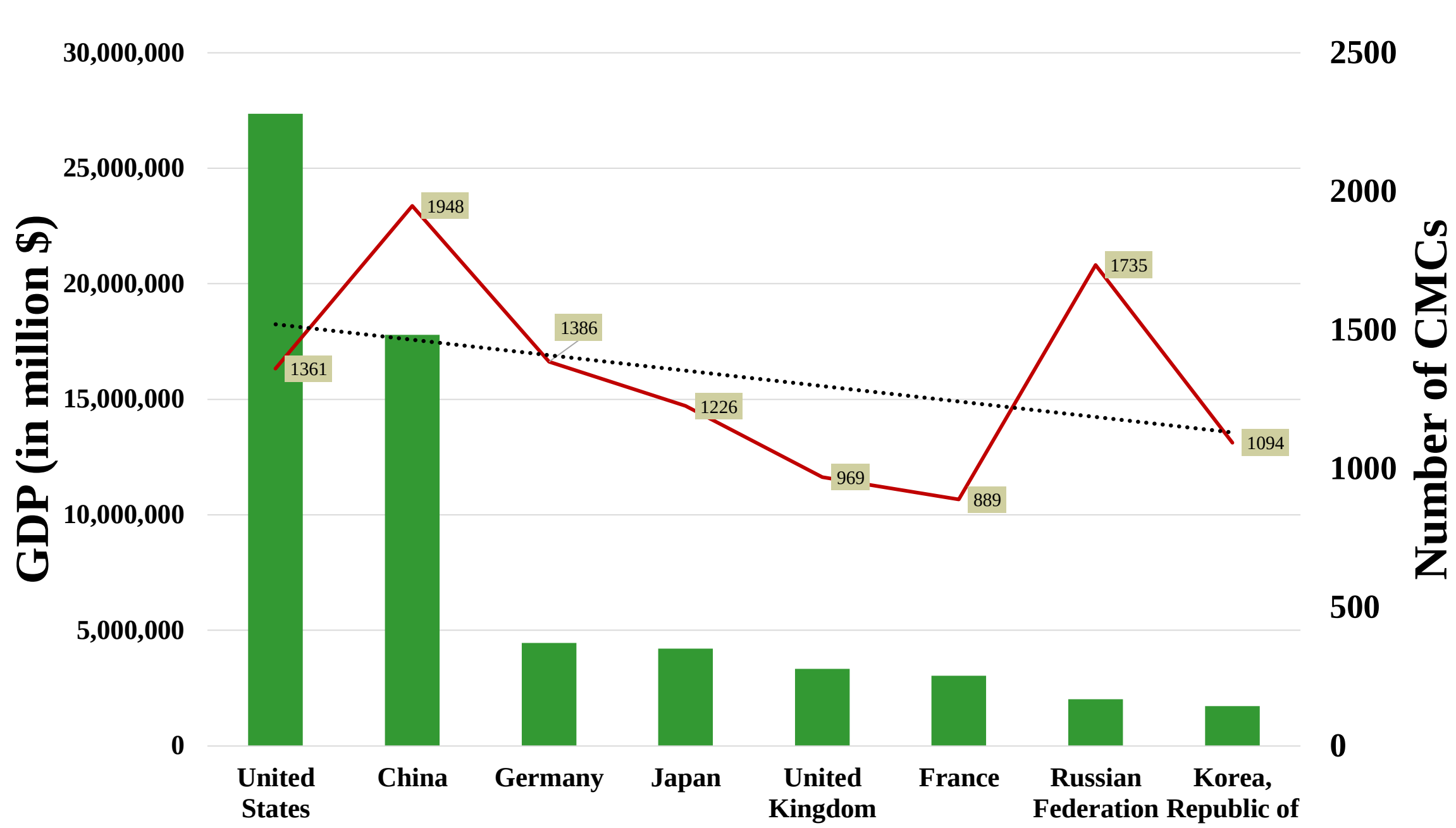


Figure 2: Correlation of number of CMCs and GDP (in million USD) of the most active countries

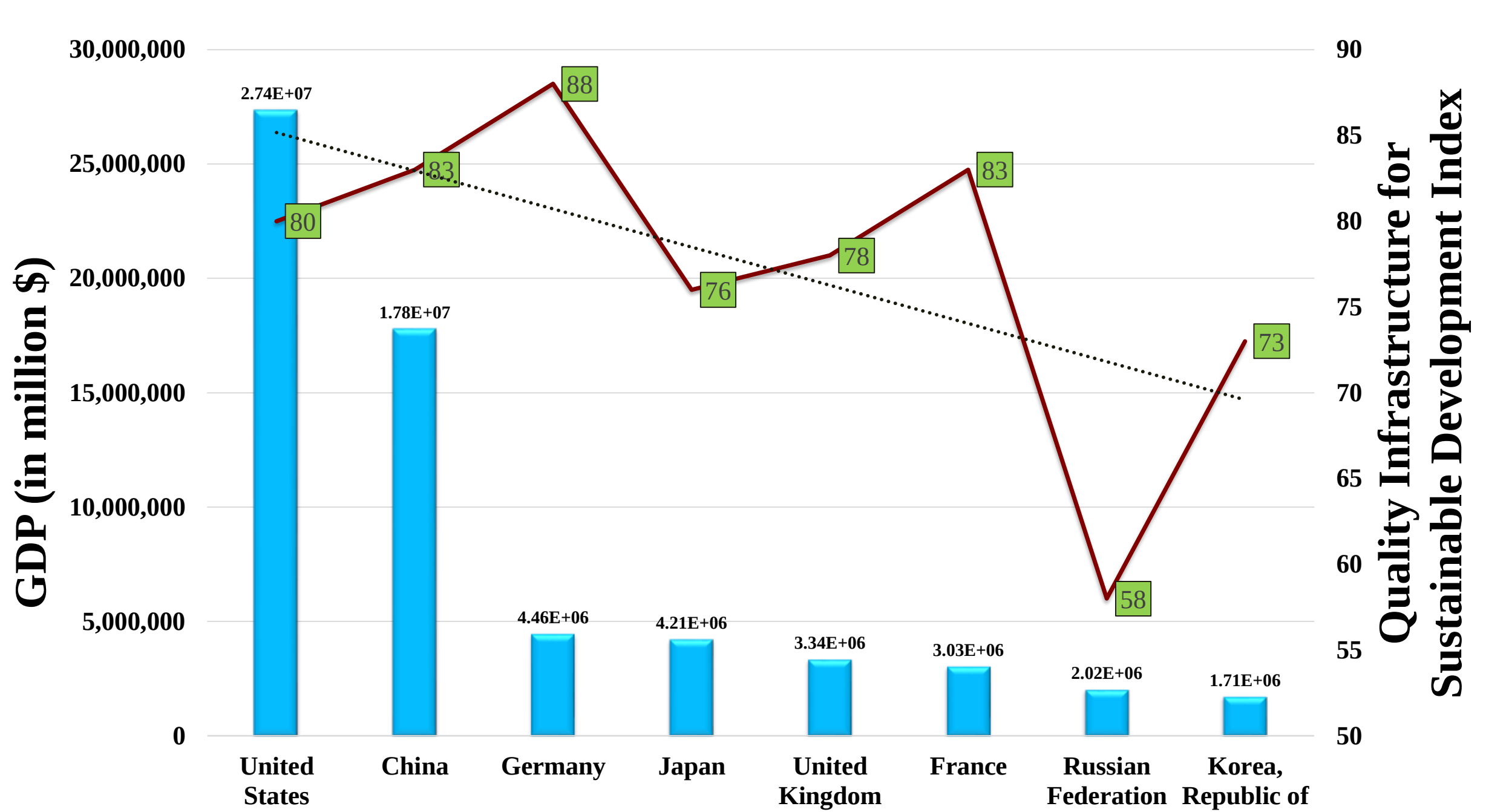


Figure 4: Correlation of GDP (in million USD) and QI4SD index of the most active countries

Conclusion and Way Forward

The findings highlight the critical importance of sustained investment in NMIs and DIs, along with the development of resilient and inclusive QI systems worldwide. Strengthening these institutions not only enhances a country's ability to meet emerging metrological demands but also supports broader objectives such as technological innovation, regulatory compliance, and economic competitiveness. To achieve this, countries must prioritize long-term funding for metrology, foster regional and international collaboration, and promote knowledge transfer through capacity-building initiatives. Support for research, workforce development, and digital transformation in QI will further empower nations—especially developing economies—to bridge gaps in measurement capabilities and fully participate in global trade and innovation ecosystems. These efforts are well-aligned with Resolution 6 of the 27th CGPM on universal adherence to the Metre Convention, and with the United Nations Sustainable Development Goals.