

On the Figures of Merit for Quantum Software Security: Toward a Benchmarking Rubric

Background & Motivation

QPA Research Group

- Quantum software increasingly runs on multi-tenant, cloud-based **Quantum-as-a-Service (QaaS)** stacks, where compilation and shared hardware lie outside the user's trust boundary.
- Performance** has agreed Figures of Merit — Scale (qubit count), Quality (Quantum Volume), Speed (CLOPS) and software quality metrics are emerging, yet **security** remains unmeasured.
- The few existing indicators Total Variation Distance (**TVD**) and Degree of Functional Corruption (**DFC**) were introduced ad hoc per obfuscation technique on incompatible scales, so no rubric let's a practitioner say tool A is more secure than tool B.

Rahman, B., Haghparast, M., & Mikkonen, T. (2026). On the Figures of Merit for Quantum Software Security: Toward a Benchmarking Rubric. *arXiv preprint arXiv:2608.05831*.

<https://arxiv.org/abs/2608.05831>

Proposed Research Item and Goal

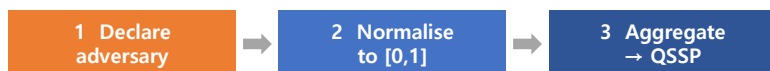
Three-Layer Measurement Gap

L1	Performance FoMs — QV, CLOPS	MATURE
L2	Software quality metrics	EMERGING
L3	Security metrics	FRAGMENTED

Six QaaS Pipeline Stages



Three-Step S-FoM Benchmarking Rubric



- 13 candidate S-FoMs organised by ISO/IEC 25010:2023**
 - Confidentiality:** obfuscation strength (OS), concealment (FC), reverse-engineering (RER), model-extraction (MER).
 - Integrity & Authenticity:** tamper detectability (RTD), output verifiability (OV), device attestation (DAS).
 - Accountability:** provenance completeness (PC), audit-log tamper-evidence (ALT).
 - Resistance:** crosstalk (XS), co-tenancy divergence (COD), attack success rate (ASR).
 - Cross-cutting:** security overhead (SO), reported alongside never inside the score.
- A rubric that makes the numbers commensurable**
 - Declare adversary → normalise to [0,1] → aggregate into a composite **QSSP** score.

Overview Of The Study

6 QaaS Stages → 13 S-FoMs → 1 QSSP Score

► **GOAL:** Make quantum software security measurable and comparable, like performance. ◀