

# Extended Pattern Coverage Analysis

This report analyzes the coverage of 61 extended patterns across:

- Three sourcing frameworks (Classiq, PennyLane, Qiskit)
- Broader target list of projects

## Summary Statistics

### Framework Coverage

Framework	Patterns Found	Coverage %
Classiq	17	27.9%
PennyLane	20	32.8%
Qiskit	13	21.3%

### Target Project Coverage

Patterns found in target projects: 21 (34.4%)

## Detailed Framework Analysis

### Classiq

Found: 17 patterns

Patterns found:

- Amplitude Amplification
- Basis Change

- Circuit Construction Utility
- Creating Entanglement
- Data Encoding
- Dynamic Circuit
- Function Table
- Grover
- Hamiltonian Simulation
- Initialization
- Oracle
- Phase Shift
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Arithmetic
- Quantum Phase Estimation (QPE)
- SWAP Test
- Variational Quantum Algorithm (VQA)

Missing patterns (44):

- Ad-hoc Hybrid Code Execution
- Alternating Operator Ansatz (AOA)
- Biased Initial State
- Chained Optimization
- Circuit Cutting
- Classical-Quantum Interface
- Error Correction
- Gate Cut
- Gate Error Mitigation
- Hadamard Test
- Hybrid Module
- Linear Combination of Unitaries (LCU)
- Mid-Circuit Measurement
- Orchestrated Execution
- Post-Selective Measurement
- Pre-Trained Feature Extractor
- Pre-deployed Execution
- Prioritized Execution
- Quantum Amplitude Estimation (QAE)
- Quantum Application Archive
- Quantum Application Testing
- Quantum Associative Memory (QuAM)
- Quantum Circuit Translator

- Quantum Classification
- Quantum Clustering
- Quantum Hardware Selection
- Quantum Kernel Estimator (QKE)
- Quantum Logical Operators
- Quantum Module
- Quantum Module Template
- Quantum Neural Network (QNN)
- Quantum Singular Value Transformation (QSVT)
- Quantum-Classic Split
- Readout Error Mitigation
- Schmidt Decomposition
- Speedup via Verifying
- Standalone Circuit Execution
- Uncompute
- Unified Execution
- Unified Observability
- Variational Parameter Transfer
- Variational Quantum Eigensolver (VQE)
- Warm Start
- Wire Cut

## PennyLane

Found: 20 patterns

Patterns found:

- Amplitude Amplification
- Basis Change
- Circuit Construction Utility
- Data Encoding
- Grover
- Hamiltonian Simulation
- Initialization
- Linear Combination of Unitaries (LCU)
- Oracle
- Phase Shift
- Quantum Amplitude Estimation (QAE)
- Quantum Approximate Optimization Algorithm (QAOA)

- Quantum Arithmetic
- Quantum Neural Network (QNN)
- Quantum Phase Estimation (QPE)
- Quantum Singular Value Transformation (QSVT)
- SWAP Test
- Schmidt Decomposition
- Variational Quantum Algorithm (VQA)
- Variational Quantum Eigensolver (VQE)

Missing patterns (41):

- Ad-hoc Hybrid Code Execution
- Alternating Operator Ansatz (AOA)
- Biased Initial State
- Chained Optimization
- Circuit Cutting
- Classical-Quantum Interface
- Creating Entanglement
- Dynamic Circuit
- Error Correction
- Function Table
- Gate Cut
- Gate Error Mitigation
- Hadamard Test
- Hybrid Module
- Mid-Circuit Measurement
- Orchestrated Execution
- Post-Selective Measurement
- Pre-Trained Feature Extractor
- Pre-deployed Execution
- Prioritized Execution
- Quantum Application Archive
- Quantum Application Testing
- Quantum Associative Memory (QuAM)
- Quantum Circuit Translator
- Quantum Classification
- Quantum Clustering
- Quantum Hardware Selection
- Quantum Kernel Estimator (QKE)
- Quantum Logical Operators
- Quantum Module

- Quantum Module Template
- Quantum-Classic Split
- Readout Error Mitigation
- Speedup via Verifying
- Standalone Circuit Execution
- Uncompute
- Unified Execution
- Unified Observability
- Variational Parameter Transfer
- Warm Start
- Wire Cut

## Qiskit

Found: 13 patterns

Patterns found:

- Basis Change
- Circuit Construction Utility
- Data Encoding
- Grover
- Hamiltonian Simulation
- Initialization
- Oracle
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Arithmetic
- Quantum Logical Operators
- Quantum Phase Estimation (QPE)
- Variational Quantum Algorithm (VQA)
- Variational Quantum Eigensolver (VQE)

Missing patterns (48):

- Ad-hoc Hybrid Code Execution
- Alternating Operator Ansatz (AOA)
- Amplitude Amplification
- Biased Initial State
- Chained Optimization
- Circuit Cutting
- Classical-Quantum Interface

- Creating Entanglement
- Dynamic Circuit
- Error Correction
- Function Table
- Gate Cut
- Gate Error Mitigation
- Hadamard Test
- Hybrid Module
- Linear Combination of Unitaries (LCU)
- Mid-Circuit Measurement
- Orchestrated Execution
- Phase Shift
- Post-Selective Measurement
- Pre-Trained Feature Extractor
- Pre-deployed Execution
- Prioritized Execution
- Quantum Amplitude Estimation (QAE)
- Quantum Application Archive
- Quantum Application Testing
- Quantum Associative Memory (QuAM)
- Quantum Circuit Translator
- Quantum Classification
- Quantum Clustering
- Quantum Hardware Selection
- Quantum Kernel Estimator (QKE)
- Quantum Module
- Quantum Module Template
- Quantum Neural Network (QNN)
- Quantum Singular Value Transformation (QSVT)
- Quantum-Classic Split
- Readout Error Mitigation
- SWAP Test
- Schmidt Decomposition
- Speedup via Verifying
- Standalone Circuit Execution
- Uncompute
- Unified Execution
- Unified Observability
- Variational Parameter Transfer
- Warm Start

- Wire Cut

## Target Project Analysis

Patterns found in target projects: 21

Patterns found:

- Amplitude Amplification
- Basis Change
- Circuit Construction Utility
- Creating Entanglement
- Data Encoding
- Grover
- Hamiltonian Simulation
- Initialization
- Linear Combination of Unitaries (LCU)
- Oracle
- Phase Shift
- Quantum Amplitude Estimation (QAE)
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Arithmetic
- Quantum Logical Operators
- Quantum Neural Network (QNN)
- Quantum Phase Estimation (QPE)
- Quantum Singular Value Transformation (QSVT)
- SWAP Test
- Variational Quantum Algorithm (VQA)
- Variational Quantum Eigensolver (VQE)

Missing patterns (40):

- Ad-hoc Hybrid Code Execution
- Alternating Operator Ansatz (AOA)
- Biased Initial State
- Chained Optimization
- Circuit Cutting
- Classical-Quantum Interface
- Dynamic Circuit
- Error Correction
- Function Table

- Gate Cut
- Gate Error Mitigation
- Hadamard Test
- Hybrid Module
- Mid-Circuit Measurement
- Orchestrated Execution
- Post-Selective Measurement
- Pre-Trained Feature Extractor
- Pre-deployed Execution
- Prioritized Execution
- Quantum Application Archive
- Quantum Application Testing
- Quantum Associative Memory (QuAM)
- Quantum Circuit Translator
- Quantum Classification
- Quantum Clustering
- Quantum Hardware Selection
- Quantum Kernel Estimator (QKE)
- Quantum Module
- Quantum Module Template
- Quantum-Classic Split
- Readout Error Mitigation
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- Unified Observability
- Variational Parameter Transfer
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- Wire Cut

## **Patterns Found Only in Frameworks (Not in Target Projects)**

3 patterns found in frameworks but not in target projects:

- Dynamic Circuit
- Function Table

- Schmidt Decomposition

## Cross-Framework Analysis

Common patterns between Classiq and PennyLane (14):

- Amplitude Amplification
- Basis Change
- Circuit Construction Utility
- Data Encoding
- Grover
- Hamiltonian Simulation
- Initialization
- Oracle
- Phase Shift
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Arithmetic
- Quantum Phase Estimation (QPE)
- SWAP Test
- Variational Quantum Algorithm (VQA)

Common patterns between Classiq and Qiskit (11):

- Basis Change
- Circuit Construction Utility
- Data Encoding
- Grover
- Hamiltonian Simulation
- Initialization
- Oracle
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Arithmetic
- Quantum Phase Estimation (QPE)
- Variational Quantum Algorithm (VQA)

Common patterns between PennyLane and Qiskit (12):

- Basis Change
- Circuit Construction Utility
- Data Encoding
- Grover

- Hamiltonian Simulation
- Initialization
- Oracle
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Arithmetic
- Quantum Phase Estimation (QPE)
- Variational Quantum Algorithm (VQA)
- Variational Quantum Eigensolver (VQE)

Patterns found in all three frameworks (11):

- Basis Change
- Circuit Construction Utility
- Data Encoding
- Grover
- Hamiltonian Simulation
- Initialization
- Oracle
- Quantum Approximate Optimization Algorithm (QAOA)
- Quantum Arithmetic
- Quantum Phase Estimation (QPE)
- Variational Quantum Algorithm (VQA)