



Quantum Risk Management Project

EFREI M2 Data & Artificial Intelligence

Explanatory document

November 2022

PHASE I: Quantum Use Case

Quantum Risk Advisory



Choose a Quantum Business Use Case

Title of the Quantum Use Case

Chose a brief title for your Quantum Use Case (Example: Quantum Machine Learning for Fraud Detection on HERMES application)

Description of the Quantum Use Case

Describe the objectives of the chosen Quantum Use Case

(Example: The Quantum Machine Learning for Fraud Detection Use Case aims to automatically detect any suspicious activity related to the application HERMES through a behavioral analysis of the provided transactional applicative logs extracted from the application)

Description of the intended Quantum Advantage

Describe the intended Quantum Advantage over current classical methods

(Example: Current Machine Learning algorithms are able to detect 95% of the fraudulent transactions on HERMES applications. The Quantum Machine Learning Use Case, aims to enhance those AI algorithms by achieve better detection rate results.)

Identify the Quantum Technologies

Quantum Hardware/Vendor	Quantum Architecture	Hosting*	Justifications (pros/cons)
IBM/Rigetti/D-Wave/Pasqal/etc.	Annealing/Superconducting/Cold atoms/etc.	On premises or Cloud	<ul style="list-style-type: none"> Pros: List the advantages of choosing this Hardware Cons: List potential issues related to this Hardware
Quantum Software/Vendor		Hosting*	Justifications (pros/cons)
Azure Quantum Development Kit/Classiq/etc.		On premises or Cloud	<ul style="list-style-type: none"> Pros: List the advantages of choosing this Software Cons: List potential issues related to this Software
Coding Language		Quantum libraries	Justifications (pros/cons)
Q#/Python/etc.		Qiskit/Pyquil/etc.	<ul style="list-style-type: none"> Pros: List the advantages of choosing this Coding Language Cons: List potential issues related to this Coding Language

*Hosting

- **On Premise** means the Hardware or the Software is hosted locally within the datacenters of the concerned company
- **Cloud** means that the Hardware or the Software is hosted within the datacenters of the concerned Vendor (Microsoft, Amazon, etc.)

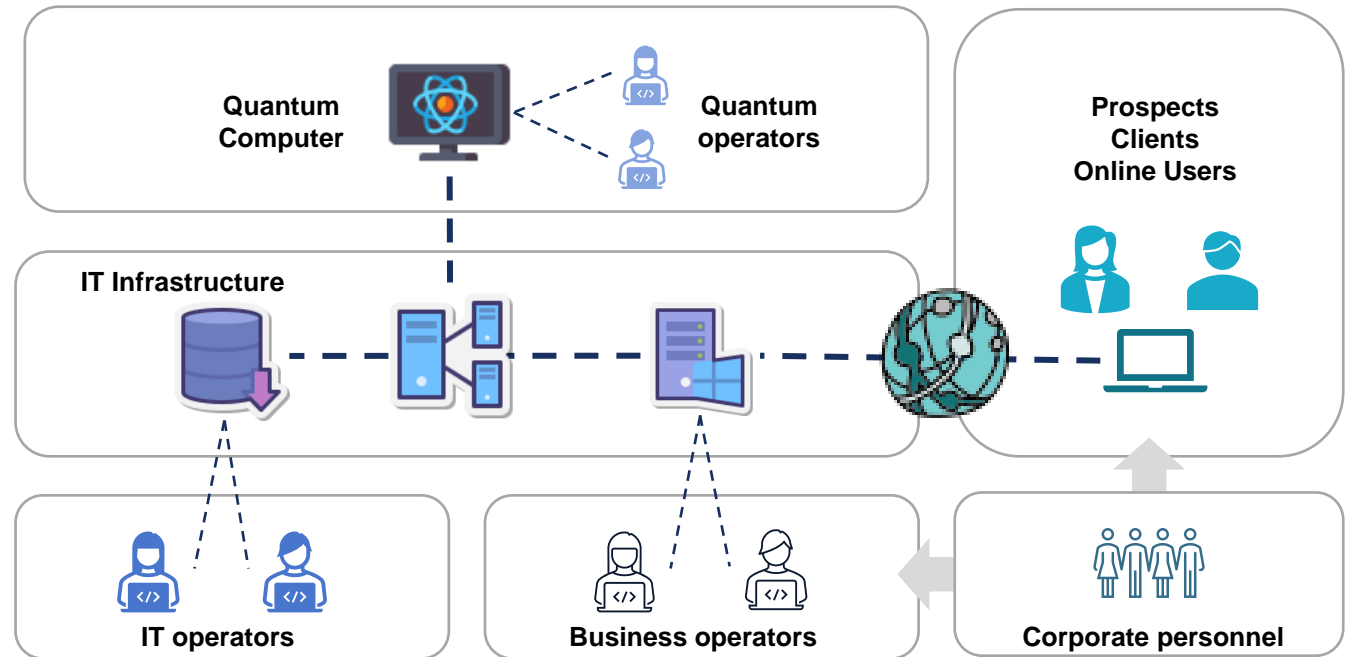
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Map the Target IT Infrastructure

- Elaborate a high-level Map exposing the main IT components and how the Quantum Computer interacts with them
- Get inspired by your company IT infrastructure but without revealing any confidential detail
- Show relevant business and IT actors operating the exposed workflow
- Optional: Detail the type of data flow between the different components



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Elaborate the RACI

	Quantum Software Engineers	IT Production Team	CISO	Actor 4	Actor 5
Create the Quantum algorithm	R	I	A	R, A, C, I	R, A, C, I
Process 2	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I
Process 3	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I
Process 4	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I
Process 5	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I
Process 6	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I
Process 7	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I	R, A, C, I

- List the main IT and/or Business processes of the concerned workflow presented in the previous slide
- List the main IT and/or Business actors involved in the concerned workflow presented in the previous slide
- Identify the RACI: Responsible (performs the operation), Accountable (responsible for the outcome of the operation), Consulted (Advise requested), Informed
- Example presented in first line

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PHASE II: Quantum Risk Assessment

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Risk Assessment Methodology (1/2)

1. Risk Identification:

- Risk Scenario: Identify a Threat Event related to defined Risk Categories
- Risk Scenario Syntax: Threat event description + Source of the threat event + Consequence of the threat event
- Risk Scenario Example: Coding error by software engineer resulting in erroneous outcome of the algorithm

2. Risk Evaluation:

- Probability Rating

Level	Probability Rating guideline
1	Slightly probable, may occur in the upcoming 10 years or more
2	Possible, may occur in the upcoming 5 years
3	Probable, may occur during a year or two
4	Highly probable, may occur at least once a year

- Impact Rating

Level	Impact Rating Guideline
1	Loss tolerated at service/project level Occasional dysfunction affecting some users
2	Loss tolerated at department level Occasional dysfunction affecting one service
3	Financial loss tolerated at company level Recurrent or long dysfunction affecting one service OR Occasional dysfunction affecting multiple services
4	Financial loss not tolerated at company level Recurrent or long dysfunction affecting multiple services

Risk Assessment Methodology (2/2)

2. Risk Evaluation:

- Risk Rating

		Threat Impact			
Level		1	2	3	4
Threat Probability	4	4	8	12	16
	3	3	6	9	12
	2	2	4	6	8
	1	1	2	3	4

2. Remediation Plan:

- Mitigation Actions: List the actions that can lower the Probability and/or the Impact levels of the identified threat event
- Example: Implement a double review on the algorithm code by another software engineer to prevent coding errors

Assess the Quantum Technologies Risks

Ref.	Risk Scenario	Probability	Impact	Risk Rating	Mitigation Actions
QT-01	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
QT-02	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
QT-03	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX

- Identify 3 Risk Scenarios related to inherent issues with the chosen Quantum Hardware, Software or Coding language
- Get inspired by the identified cons in Slide 4
- Rate the Probability, Impact and overall Risk according to methodology presented in Slide 9
- Identify mitigation actions that can lower the Probability and/or the Impact levels of the identified threat event

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Assess the IT & Cybersecurity Risks

Ref.	Risk Scenario	Probability	Impact	Risk Rating	Mitigation Actions
IT-01	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
IT-02	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
IT-03	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX

- Identify 3 Risk Scenarios related to integration of a Quantum Computer within an existing IT infrastructure and to the cybersecurity threats affecting the Quantum Computer
- Rate the Probability, Impact and overall Risk according to methodology presented in Slide 9
- Identify mitigation actions that can lower the Probability and/or the Impact levels of the identified threat event

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Assess the Human Resources Risks

Ref.	Risk Scenario	Probability	Impact	Risk Rating	Mitigation Actions
HR-01	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
HR-02	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
HR-03	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX

- Identify 3 Risk Scenarios related to company personnel and their competencies affected by the introduction of a Quantum Computer
- Rate the Probability, Impact and overall Risk according to methodology presented in Slide 9
- Identify mitigation actions that can lower the Probability and/or the Impact levels of the identified threat event

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Assess the Project Risks

Ref.	Risk Scenario	Probability	Impact	Risk Rating	Mitigation Actions
PJ-01	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
PJ-02	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX
PJ-03	XXX	X	X	X	<ul style="list-style-type: none"> • XXX • XXX

- Identify 3 Risk Scenarios related to Quantum Computing project (in term of Cost, Time and Objectives)
- Rate the Probability, Impact and overall Risk according to methodology presented in Slide 9
- Identify mitigation actions that can lower the Probability and/or the Impact levels of the identified threat event

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Elaborate the Risk Profile

Risk Heatmap

		IMPACT			
Level		1	2	3	4
Probability	4				
	3			QT-01	
	2				
	1				

- List the Risk Scenarios References on the Risk Heatmap

Risk Analysis

Elaborate a simple and straight-forward analysis explaining the disposition of the Risk Scenarios on the Heatmap and provide justification for the highest risks and describe briefly the prioritization of the related remediation plan

APPENDIX

Quantum Risk Advisory



QRM Project overview

Phase 1

Building a Quantum Computing Use Case for your company

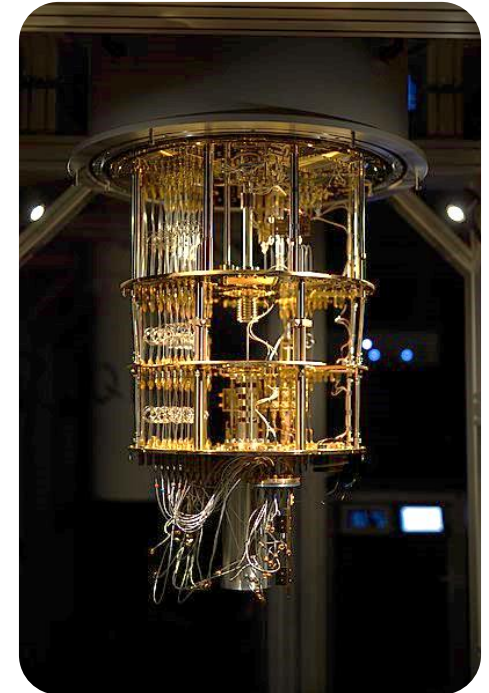
- ✓ Choose a Business Use Case
- ✓ Map People, Process & Technologies
- ✓ Identify the Quantum Hardware, Software & Coding language
- ✓ Describe the Quantum algorithm and its potential advantage
- ✓ Etc.

- 4 Team members per Group, 1 Template per group
- Deadlines: 7 Novembre 2022, 29 Novembre 2022

Phase 2

Assessing the Risks of the Quantum Computing Use Case

- Assess the Quantum Technology Risks
- Assess the IT & Cybersecurity Risks
- Assess the Human Resources Risks
- Assess the Project Risks
- Elaborate a Risk Profile



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About QuRISK



Paul Chammas

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Technology & Cybersecurity Consultant and Auditor with more than 13 years of experience mainly for Financial Services.

- ❑ Professional experience:
 - ✓ Co-founder at CLARICE & QuRISK
 - ✓ Manager at Marsh Risk Consulting
 - ✓ Senior Consultant at Deloitte (IT RISK FSI)
 - ✓ Consultant at Beijaflore (Risk & Cyber)
- ❑ Diplomas:
 - ✓ *Masters in Quantum Computing Technologies at UPM*
 - ✓ *Advanced Masters in Technology Management at HEC Paris*
 - ✓ *Network & System Engineering at EFREI Paris*
- ❑ Certifications:
 - ✓ *ISACA CISA CRISC*
 - ✓ *ISO 27005*
 - ✓ *IHEDN Economic Intelligence*
 - ✓ *MIT xPro Quantum Computing Fundamentals*

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The foundation of our vision and objectives is to help organizations **Adopt Quantum Technologies Safely**, by managing their threats while embracing them as emerging technologies and harvesting their applications into competitive advantage.



Thus, we aspire to become a leading **Quantum Consulting & Risk Management** company in the years to come!

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