Exploring Pitfalls for Defence and Security by Narratives on Quantum Technologies

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ABSTRACT

Quantum technologies have clear potential for defence and security applications. However, the development of these applications can be hindered by pitfalls that can come with narratives about how we see quantum technologies. In this work, we build upon a previous exploration of how three common narratives hinder the democratization of quantum technologies. In this paper, we present these three narratives and discuss the pitfalls they cause for developing and applying quantum technologies for defence and security.

For the narrative of quantum computing as a threat, we examine the phenomenon of threat inflation, which exaggerates the potential risks of quantum computers and can create a sense of urgency that is not necessarily warranted and may lead to rushed or poorly considered policy decisions. For the narrative of quantum mechanics as incomprehensible, we discuss how this leads to decision-makers often offloading their responsibility by claiming they cannot understand quantum mechanics, leading to the pitfall that these decision-makers do not have meaningful engagement with experts in the field. For the narrative of quantum technologies as an arena for geopolitics, we explore the pitfall of prematurely closing down potential constructive international collaboration due to overprotectionism.

Our work emphasizes the importance of critically examining the three narratives and adopting a more nuanced approach to discussing quantum technologies. By doing so, we aim to empower decision-makers and researchers in defence and security to arrive at a more even and realistic assessment of the potential and threats of quantum technologies for defence and security.

Keywords: quantum technologies, geopolitics, narratives, democratization

1.0 INTRODUCTION

With their transformative potential, Quantum Technologies (QT) have garnered significant attention in recent years, especially in defence and security. The promise of quantum computing, quantum communication/cryptography, and quantum sensing have led to what some have dubbed a "quantum gold rush" [1], with a surge in investments and research aiming to harness these technologies' advantages. However, the discourse surrounding QT is filled with narratives that can shape perceptions, influence

decisions, and determine their development and application trajectory. While some of these narratives are rooted in genuine concerns, others can be misleading or overly simplistic, leading to pitfalls in applying QT in defence and security.

Narratives are crucial in shaping the public's and policymakers' understanding of complex scientific and technological advancements. We focus on three dominant narratives related to the democratization of QT [2]: the portrayal of quantum computing as an imminent threat, the belief that quantum mechanics is inherently incomprehensible, and the framing of QT as a new battleground for geopolitical dominance. Each narrative offers a unique perspective on the quantum landscape but also brings potential pitfalls. Understanding these narratives is essential, not to discard them, but to ensure they are grounded in reality and advance QT responsibly for societal betterment and security.

Given the global implications of these narratives, especially in the context of defence and security, their relevance extends to international alliances such as NATO. Article 2 of the North Atlantic Treaty emphasizes the development of peaceful and friendly international relations and the strengthening of free institutions. As NATO STO focuses on generating and applying state-of-the-art knowledge for defence and security in our increasingly complex sociotechnical societies, the interplay between democracy, technology, and value contexts emerges as a central concern. Different value contexts, whether they view democracy as an instrumental or intrinsic value, can shape the way narratives are constructed, interpreted, and acted upon. In a recent paper we delved [2] into the aforementioned narratives concerning the democratization of QT, exploring their implications under different theories of democracy and the underlying value contexts that influence them. In this study we highlight potential pitfalls associated with these narratives and emphasize the need for a nuanced discourse on QT. By critically examining these narratives, we hope to foster a balanced understanding that aids decision-makers and researchers in defence and security in making informed choices about QT's trajectory.

1.1 Theories of Democracy and Value Contexts for Democratization

The democratization of technology is a complex concept influenced by different theories of democracy: deliberative, participatory, and representative. Deliberative democracy advocates for informed discussion among stakeholders before making technological decisions, ensuring collective reasoning. Participatory democracy emphasizes direct public involvement in shaping technology, aligning it with the broader public interest. Representative democracy, on the other hand, relies on elected officials to make informed technological decisions on behalf of the public, ideally after consulting experts and considering public opinion.

Balancing public participation in technology, especially in sensitive areas like defence and security, is challenging but crucial for upholding democratic values like transparency and broad participation. While it may be practical for for-profit organizations to treat democracy as an instrumental value, public and international organizations should aim to adopt democracy as an intrinsic value. This nuanced approach strengthens democratic institutions and ensures that various stakeholders have access to advancements in science and technology.

While the democratization of QT is a subject of study in itself, it is also closely linked to the practical implications these technologies have in the realm of defence and security. The narratives that shape our understanding of QT's democratization can also give rise to specific pitfalls that have real-world consequences for policy and security measures. For instance, the narrative that portrays quantum computing as an imminent threat can lead to 'threat inflation,' affecting not just public perception but also policy decisions in defence. Similarly, the narrative that quantum mechanics is 'incomprehensible' can result in decision-makers abdicating their responsibilities, leading to gaps in policy and oversight. Finally, narrative of QT as the arena for geopolitics can lead to unnecessary overprotectionist actions which have considerable associated costs in terms of missed opportunities for the positive outcomes of collaboration between different national actors. In the

following section, we delve deeper into these pitfalls, examining how they arise from prevailing narratives and provide historical examples to discuss what they mean for stakeholders in defence and security.

2.0 NARRATIVES AND PITFALLS

This section outlines the three previously identified narratives concerning QT and their impact on democratization. We also highlight potential pitfalls these narratives may pose for defence and security stakeholders. It's essential to recognize that the narratives discussed aren't exhaustive, nor are the pitfalls the sole consequences of these narratives. Narratives inherently present a mix of opportunities and risks shaped by their foundational arguments and contexts. What one stakeholder perceives as an opportunity might be seen as a risk by another, and these perceptions can vary based on time and context.

Consequently, narrative interpretations can differ among stakeholders. Our focus here is to illustrate how narratives that impede democratization can also present challenges for defence and security by creating pitfalls. The analysis underscores the importance of critically evaluating narratives for potential pitfalls when endorsing or promoting them.

The three narratives previously formulated are (i) Quantum Computing as a Threat, (ii) Quantum Mechanics as Incomprehensible, and (iii) QT as an Arena for Geopolitics. Quantum computing is often portrayed as a looming cybersecurity threat with the potential to break most encryption types. While the actual risk may be distant, the first narrative fuels policies which employ disproportionate actions and prioritizes security concerns over broader technological development and access. The belief that quantum mechanics is too complex for even experts to understand has limited broader engagement and inadvertently bolstered pseudoscientific claims. The second narrative restricts QT development to a niche group, hindering democratization and public discourse on its implications. QT is increasingly viewed as a geopolitical battleground, especially between major powers like the US and China. While emphasizing national security, the third narrative limits international collaboration, diverts research priorities, and hinders broader collaborative efforts in the QT domain.

2.1 Pitfalls for Defence and Security by Narratives

The first pitfall concerns the distortion of quantum computing's genuine risks due to threat inflation, which can precipitate premature and misguided policy decisions fuelled by undue urgency. The term "threat inflation" gained traction in the mid-2000s through international relations literature, with scholars like Chaim Kaufmann examining the Iraq War and democratic decision-making [3]. The portrayal of quantum computing as a significant threat to our digital infrastructure can amplify this inflationary threat perspective. This often blurs the distinction between the potential risks quantum computers pose to critical defence and security infrastructure and civilian digital systems, such as banking or smart-home platforms. This ambiguity sometimes prompts extreme viewpoints like "Should We Build Quantum Computers at All?" [4] in popular scientific discourse. Moreover, it may sway decision-makers towards endorsing cybersecurity policies that don't accurately reflect the actual threat landscape.

The second pitfall stems from the narrative that quantum mechanics is incomprehensible, allowing decision-makers to shift responsibility to select experts, thereby sidestepping meaningful engagement with the field. This often results in decision-makers having a limited grasp of the field's intricacies and a hesitancy to delve deeper. Given the complexity of QT, which encompasses diverse technologies like quantum computing, sensing, and communication, and is supported by a myriad of complementary technologies such as cryogenics, control electronics, and photonics, it's crucial to understand the 'quantum' essence across these varied domains. However, faced with this daunting task, many decision-makers might resort to saying, "I wouldn't understand even if I tried." While this may seem like a nod to the experts' proficiency, it ultimately allows decision-makers to distance themselves from the subject.

The final pitfall we introduce here arises from the narrative framing QT as a geopolitical battleground, which risks prematurely curtailing valuable international collaborations due to heightened protectionism. The North Atlantic Treaty's Article 3 emphasizes the importance of both individual and collective efforts to bolster defence against armed attacks. This creates a nuanced challenge: determining collaboration partners for QT's defence and security applications while preparing for QT's commercial era. Both the EU and the US have initiated protective measures, with the EU enforcing investment screening and export controls, and the US's DoD expanding technology protection plans under the NQIA to encompass early research phases. Balancing values like security and prosperity, which can sometimes clash, necessitates a comprehensive understanding of technology development policy decisions. Given the rising emphasis on technology sovereignty among NATO members, the geopolitical narrative surrounding QT demands careful management to harmonize the obligations of Article 3 with individual national policies.

2.2 Historical Contexts for Pitfalls

To contextualize these pitfalls, historical examples offer valuable insights. The first pitfall, related to threat inflation, can be exemplified by the "missile gap" narrative that John F. Kennedy, a US senator back then, propagated in the late 1950s. This narrative led to policy decisions based on inflated perceptions of threat rather than accurate intelligence, thereby skewing defence priorities. Another example for this pitfall is the millennium bug or the year 2000 problem, where an inflated expectation of potential harm caused overpreparation which ended up costing somewhere between $40 billion and $300 billion [5], [6] which in inflation adjusted terms correspond to over $50 billion to $500 billion.

The second pitfall, concerning the abdication of responsibility due to the perceived incomprehensibility of quantum mechanics, finds a parallel in the era known as the "Crypto Wars." During this period, stringent export controls were imposed on cryptographic algorithms, largely due to policymakers' limited understanding of the technology. This led to policy goals that were not only unattainable but also counterproductive. In the end, the policies had to be abandoned as they envisioned cryptographic algorithms similar to military equipment, which effectively made implementation of such export control policies rather difficult. The end of "Crypto Wars" era also led to a better understanding of cryptography and the paradigm that is usually referred to as zero trust architecture today.

The third pitfall, which involves the risk of prematurely ending international collaborations due to geopolitical narratives, is illustrated by the space race between the US and the USSR. This competition consumed vast resources and overshadowed potential areas for cooperation. However, the Apollo-Soyuz Test Project of 1975 demonstrated that such competition was not the only path; meaningful collaboration was possible and beneficial for both parties. There are opposing views on the topic, however, it might be argued that the space race narrative postponed the signing of the Outer Space treaty (signed 1967), which paved the way for peaceful collaboration in space missions.

These historical examples serve to underline the real-world consequences of succumbing to misleading narratives, emphasizing the need for a nuanced understanding when shaping policies related to defence and security in the realm of QT. As illustrated by the pitfalls and examples above, the interconnections between narratives naturally extend to the pitfalls they engender. Both experts and significant entities, such as NATO STO, play dual roles in both propagating and challenging prevailing narratives. A reflective examination of which narratives to endorse and how to position oneself in relation to them is crucial to sidestep the potential pitfalls and risks they introduce.

3.0 CONCLUSION

The narratives surrounding QT play a pivotal role in shaping their development, application, and perception, particularly within the defence and security sectors. In this paper, we investigated the potential pitfalls

arising from three dominant narratives: the portrayal of quantum computing as an imminent threat, the perception of quantum mechanics as inherently incomprehensible, and the framing of QT as a geopolitical arena. While these narratives stem from genuine concerns, they can inadvertently introduce pitfalls, such as threat inflation, decision-maker detachment, and the premature curtailment of international collaboration. These pitfalls can not only misguide policy decisions but also obstruct the broader democratization and development of QT.

Understanding these narratives is essential, not to discard them, but to ensure they are grounded in reality and advance QT responsibly for societal betterment and security. For stakeholders in defence and security, especially within the NATO alliance, a critical evaluation of these narratives is paramount. This ensures that QT's development and deployment align with both defence priorities and broader societal goals, all while considering the underlying value contexts that influence their interpretation and action. As the QT landscape continues to evolve, it is incumbent upon decision-makers, researchers, and other major stakeholders to navigate these narratives with discernment and responsibility. By doing so, we can harness QT's potential in a manner that ensures policies and decisions resonate with the actual landscape of QT, strengthening free institutions, and fostering peace and prosperity for all those committed to QT's development.

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