

# Quantum Computing

Quantum computers have much more calculation capabilities than classical computers.

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# Technology Impact Cycle Tool

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## Impact on society

What impact is expected from your technology?

### What is exactly the problem? Is it really a problem? Are you sure?

Quantum computers can be very useful in many ways, one way it could benefit society it could calculate complex calculations which could not be executed on a classical system. One way it could harm society is the decryption power of a quantum computer is much better than a classical system. This could be a security issue.

### Are you sure that this technology is solving the RIGHT problem?

Yes, quantum computer can execute complex calculations which were not possible before. Such calculations could be the most optimal shape of an airplane wing. These simulations cost a lot of calculating power.

### How is this technology going to solve the problem?

Quantum computers work with so called qubits, we can be in both states of 0 and 1. Classical systems can only store information using bits which can only be one and zero.

### What negative effects do you expect from this technology?

Due the huge improvement of calculating power, quantum computers are excellent at decrypting information.

### In what way is this technology contributing to a world you want to live in?

Quantum computers can do complex simulations which can improve technologies overall.

### Now that you have thought hard about the impact of this technology on society (by filling out the questions above), what improvements would you like to make to the technology? List them below.

Quantum computers should only be accessible for scientific purpose only. So computers cannot be used to harm society but only can improve them.

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## Hateful and criminal actors

What can bad actors do with your technology?

### In which way can the technology be used to break the law or avoid the consequences of breaking the law?

Quantum computers have a lot of computation power. This technology makes it possible to decrypt important information.

### Can fakers, thieves or scammers abuse the technology?

Yes, they can decrypt important information.

### Can the technology be used against certain (ethnic) groups or (social) classes?

No, everyone could be vulnerable by this technology.

### In which way can bad actors use this technology to pit certain groups against each other? These groups can be, but are not constrained to, ethnic, social, political or religious groups.

Quantum computers can crack important codes of information which could harm anyone.

### How could bad actors use this technology to subvert or attack the truth?

Quantum computers can crack important codes of information. No confidential information is safe.

### Now that you have thought hard about how bad actors can impact this technology, what improvements would you like to make? List them below.

The quantum computers should only be used for scientific purposes.

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## Privacy

Are you considering the privacy & personal data of the users of your technology?

**Does the technology register personal data? If yes, what personal data?**

No, it does not

**Do you think the technology invades the privacy of the stakeholders? If yes, in what way?**

No, it does not

**Is the technology is compliant with prevailing privacy and data protection law? Can you indicate why?**

Quantum computer has a lot of computation power compared to classical systems. It could have the potential to decrypt important information.

**Does the technology mitigate privacy and data protection risks/concerns (privacy by design)? Please indicate how.**

Quantum computer has a lot of computation power compared to classical systems. It could have the potential to decrypt important information.

**In which way can you imagine a future impact of the collection of personal data?**

Quantum computer has a lot of computation power compared to classical systems. It could have the potential to decrypt important information. Personal information can also be decrypted by this technology.

**Now that you have thought hard about privacy and data protection, what improvements would you like to make? List them below.**

Quantum computers should only be available for scientific purposes only.

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## Human values

How does the technology affect your human values?

**How is the identity of the (intended) users affected by the technology?**

It does not have a major effect.

**How does the technology influence the users' autonomy?**

The technology does not make any decisions. The user has full control over what this technology can be used for.

**What is the effect of the technology on the health and/or well-being of users?**

it has little to no effect.

**Now that you have thought hard about the impact of your technology on human values, what improvements would you like to make to the technology? List them below.**

I would not change anything regarding human values of this technology. The user is in full control of this technology without any background negative effects.

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## Stakeholders

Have you considered all stakeholders?

**Who are the main users/targetgroups/stakeholders for this technology? Think about the intended context by answering these questions.**

**Name of the stakeholder**

Companies

**How is this stakeholder affected?**

Could be used for innovation of certain products or services.

**Did you consult the stakeholder?**

No

**Are you going to take this stakeholder into account?**

Yes

**Name of the stakeholder**

Governments

**How is this stakeholder affected?**

This technology could improve certain services.

**Did you consult the stakeholder?**

No

**Are you going to take this stakeholder into account?**

Yes

**Did you consider all stakeholders, even the ones that might not be a user or target group, but still might be of interest?**

**Name of the stakeholder**

Scientists and Universities

**How is this stakeholder affected?**

Quantum computers can be used for scientific used for executing very complex calculations which are not possible on a classical system.

**Did you consult the stakeholder?**

No

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Are you going to take this stakeholder into account?

Yes

**Now that you have thought hard about all stakeholders, what improvements would you like to make? List them below.**

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## Data

Is data in your technology properly used?

**Are you familiar with the fundamental shortcomings and pitfalls of data and do you take this sufficiently into account in the technology?**

Quantum computers have powerful decrypting capabilities. In this way it could be possible to obtain encrypted data. The technology itself does not obtain data, but makes might make it possible for other techniques to access the data.

**How does the technology organize continuous improvement when it comes to the use of data?**

The technology does not make use of continuous feedback.

**How will the technology keep the insights that it identifies with data sustainable over time?**

This technology itself does not gather or use data. However makes it possible to decrypt information.

**In what way do you consider the fact that data is collected from the users?**

There is no data collected from the user.

**Now that you have thought hard about the impact of data on this technology, what improvements would you like to make? List them below.**

The technology itself does not use any data. However, it has powerful decrypting potential. Quantum computers could be used to obtain data, but require no data to operate. I would suggest to keep it this way.



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## Inclusivity

Is your technology fair for everyone?

### **Will everyone have access to the technology?**

No, it is very expensive to operate a quantum computer. This is due to cooling and reducing the thermal noise. Quantum computers can only operate at 0 Kelvin (-273.15).

### **Does this technology have a built-in bias?**

It is often mentioned the quantum computer is going to replace the classical computer. However, this is not the case. Most likely we will see in the future hybrid systems, which contain both classical and quantum machines.

### **Does this technology make automatic decisions and how do you account for them?**

No, this technology does not make automatic decisions.

### **Is everyone benefitting from the technology or only a a small group?**

#### **Do you see this as a problem? Why/why not?**

Only few will be able to operate a quantum computer due its high running cost. examples are: cooperations, companies and governments.

### **Does the team that creates the technology represent the diversity of our society?**

This technology is being developed by many countries and companies.

### **Now that you have thought hard about the inclusivity of the technology, what improvements would you like to make? List them below.**

It is not possible yet to make this technology more accessible to everyone. However, public ownership could be a possible solution so everyone can use a quantum computer.

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## Transparency

Are you transparent about how your technology works?

*This category is not applicable for this technology.*

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## Sustainability

Is your technology environmentally sustainable?

**In what way is the direct and indirect energy use of this technology taken into account?**

No it is not, quantum computers are only operational at a very cold temperature, which costs a lot of energy.

**Do you think alternative materials could have been considered in the technology?**

No, I haven't thought much of the hardware related to quantum computers.

**Do you think the lifespan of the technology is realistic?**

Yes

**What is the hidden impact of the technology in the whole chain?**

If everybody can get a quantum computer there will be a lot energy consumption.

**Now that you have thought hard about the sustainability of this technology, what improvements would you like to make? List them below.**

Quantum computers should be used only when necessary.

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## Future

Did you consider future impact?

### What could possibly happen with this technology in the future?

Quantum computers can complete computation which would take supercomputers years.

### Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one utopian scenario.

An utopian scenario would be that scientist can do more complex solutions to solve what was to be believed unsolvable. Technological innovation would thrive in this scenario.

### Sketch a or some future scenario (s) (20-50 years up front) regarding the technology with the help of storytelling. Start with at least one dystopian scenario.

An dystopian scenario would be that basic encryption does not stop a quantum computer for safely securing data. Hackers, who utilize a quantum computer, would thrive in this scenario.

### Would you like to live in one of this scenario's? Why? Why not?

Yes, quantum computers can benefit scientific research and help humanity advance further.

### What happens if the technology (which you have thought of as ethically well-considered) is bought or taken over by another party?

Quantum computers can endanger encrypted information transmission and storage. No data is secure this way.

### Impact Improvement: Now that you have thought hard about the future impact of the technology, what improvements would you like to make? List them below.

Quantum computers should only be owned by governments or scientific organisations.