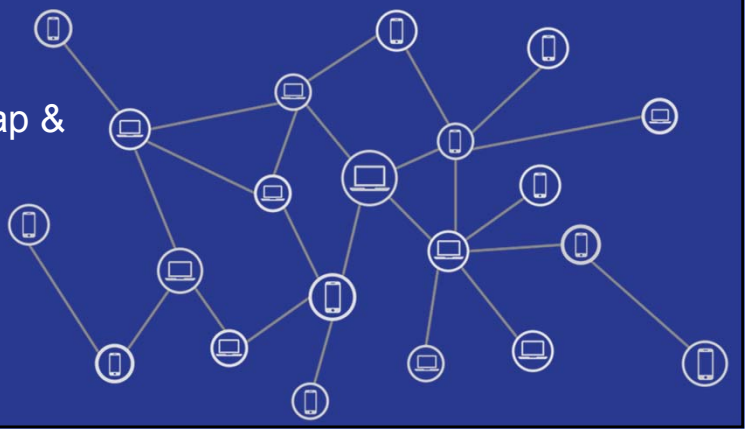
Sustainable & affordable introduction of novel antibiotics through blockchain technology



Brett Hahn, Isabel Koopmanschap & Hannah van Schoubroeck

June 5, 2019

Who are we?

Research Master's in Global Health (MSc)

VU VRIJE UNIVERSITEIT AMSTERDAM

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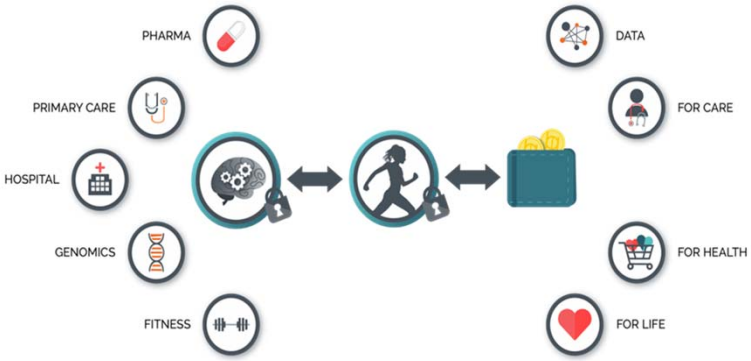
Our assignment:

- Create a framework by which the feasibility of a blockchain application in health care can be judged...



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MDR TB

- Multidrug-resistant tuberculosis (MDR TB)
  - resistant to *isoniazid* and *rifampin*

- Caused by the **misuse**, **mismanagement,** and **low-quality** of antibiotics:
  - Drugs are of poor quality
  - Health care providers prescribe the wrong treatment (dose or length of time)
  - Incompletion of full course of TB treatment

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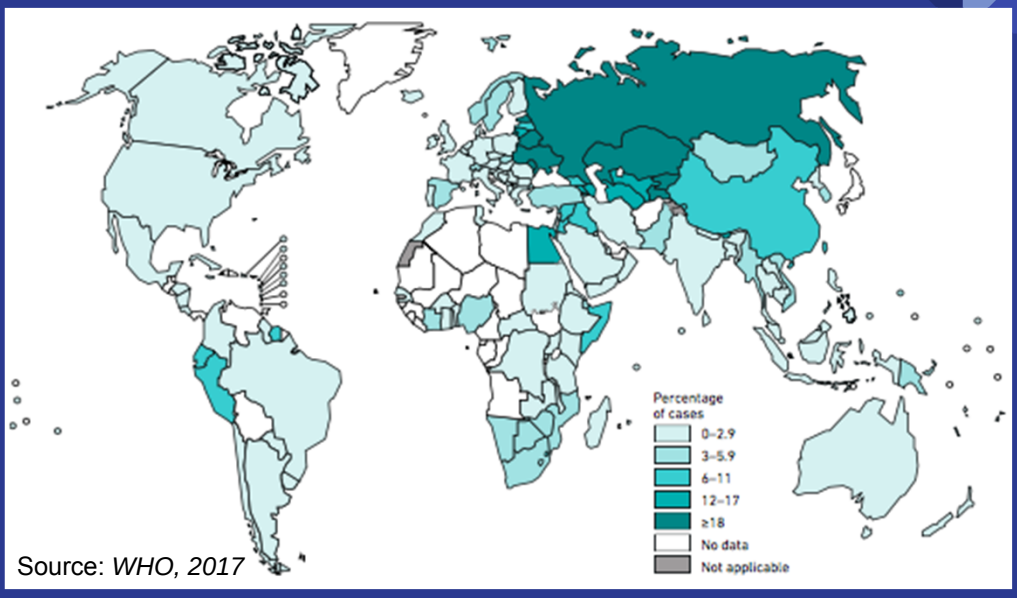
Percentage of *new* TB cases that are MDR TB



Source: *WHO, 2017*

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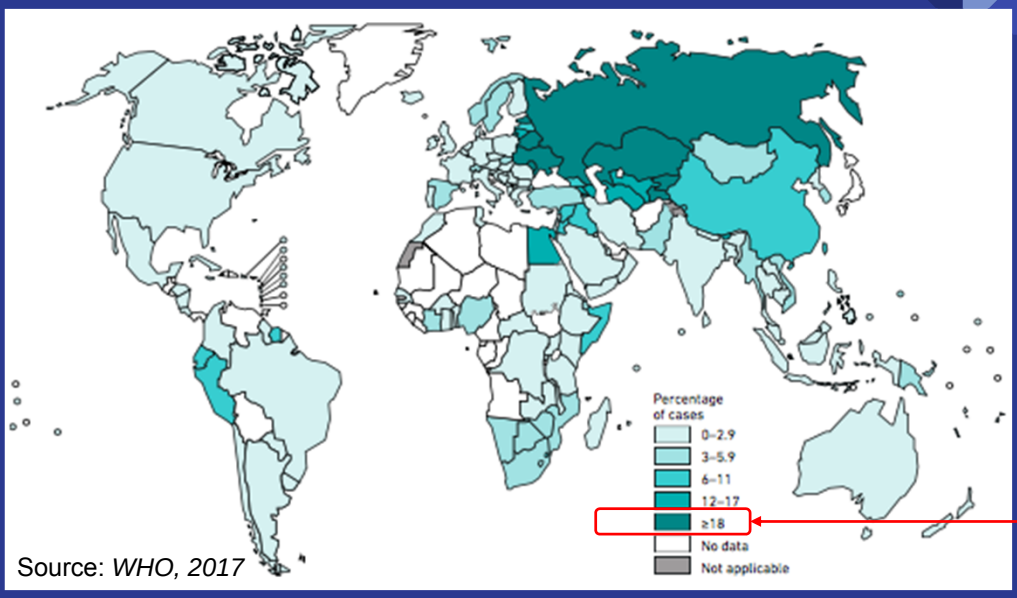
Percentage of *new* TB cases that are MDR TB



Source: *WHO, 2017*

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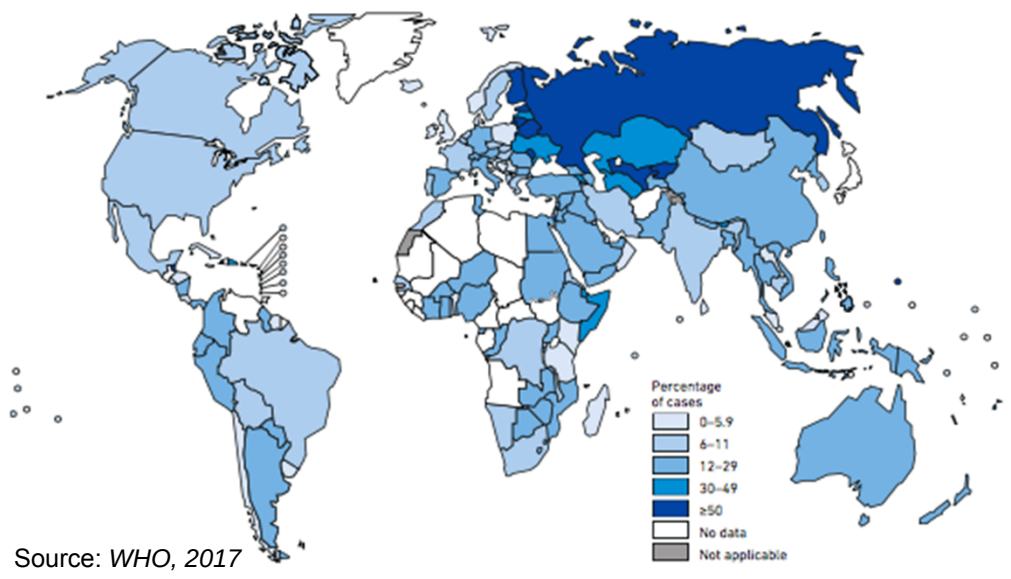
Percentage of *previously treated* TB cases that are MDR TB



Source: *WHO, 2017*

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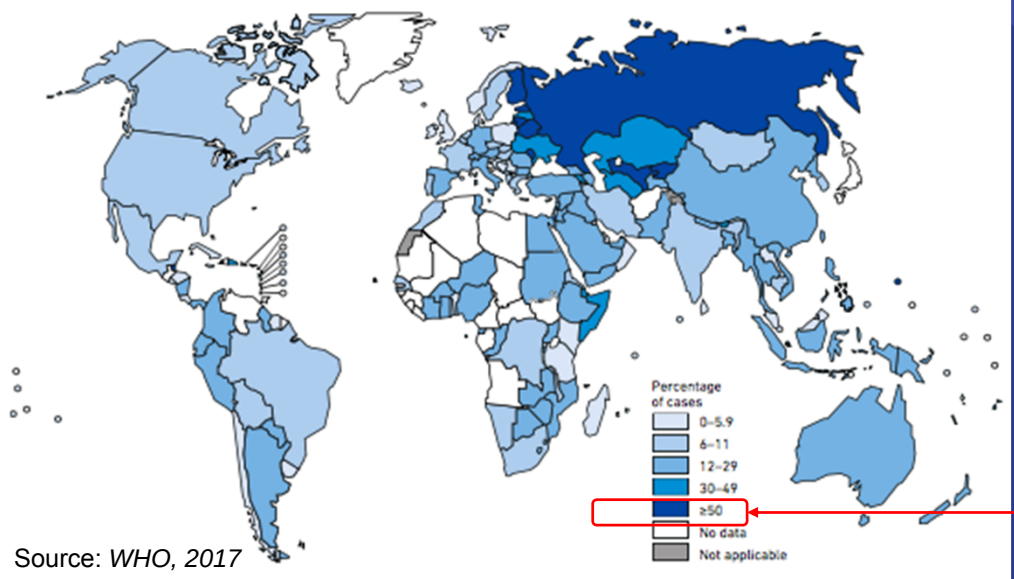
Percentage of *previously treated* TB cases that are MDR TB



Source: *WHO, 2017*

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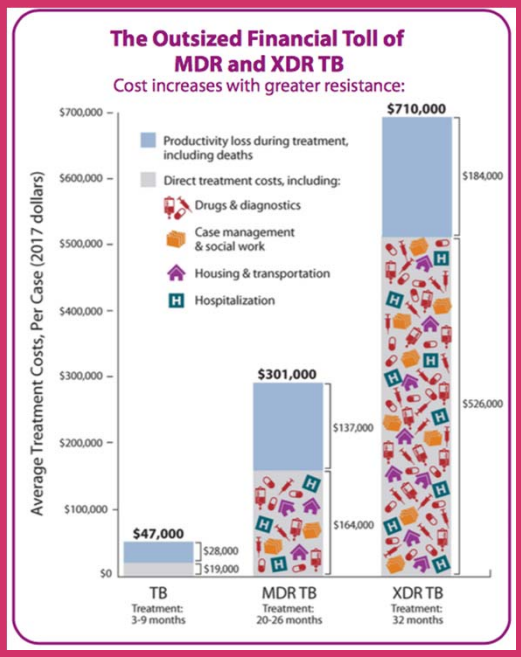

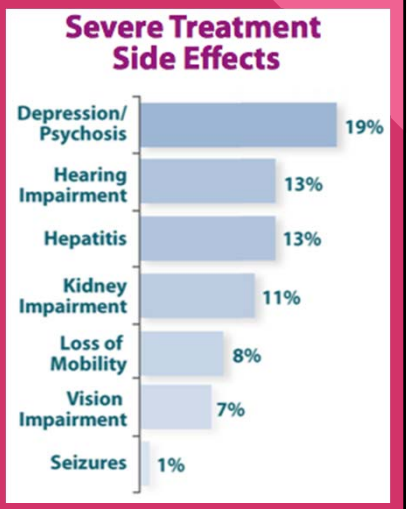

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*Could **blockchain** be a feasible solution for Country X's MDR TB problem?*

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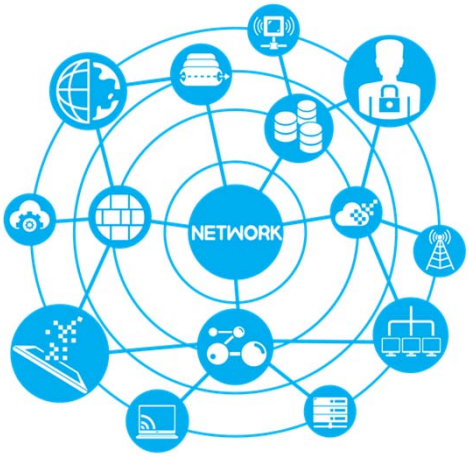
What is a Blockchain?

"*a **digital ledger** that is managed by a* **distributed network** *that uses **hashing** and **cryptography**.*"



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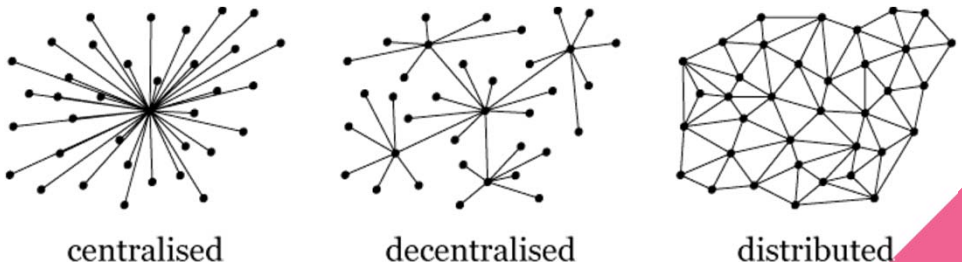
What is a Blockchain?

- The ledger is a digital logbook
- The distributed network allows peer-to-peer contact and eliminates the need for a trusted third party



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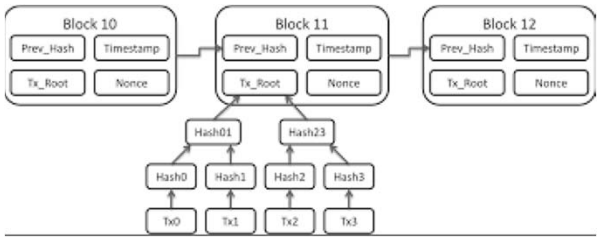
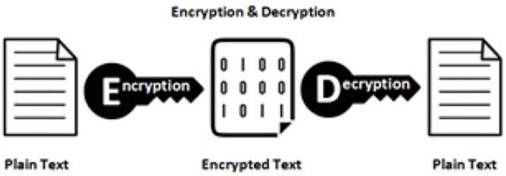
What is a Blockchain?

- Hashing
  - unique fingerprints for documents are put on the chain in blocks
- Cryptography
  - encrypt and decrypt information with public and private keys





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What is a Blockchain?

- "*a **digital ledger** that is managed by a **distributed network** that uses **hashing** and **cryptography**.*"

- Resistant to cyber attacks
- No central authority or trusted third party is needed
- Cost-effective
- No chance of fraud

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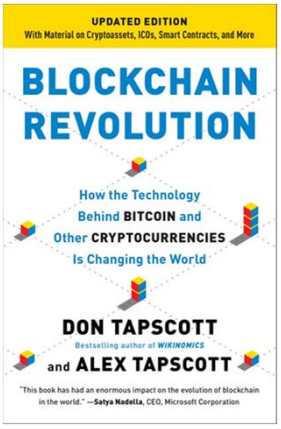
Methods

- Literature review
  - 15 articles and white papers
  - Books, movie clips and podcasts
- Expert interviews
  - Consultant on digital innovation in healthcare
  - IT researcher and lecturer
  - Student Team *Care Connection*



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Feasibility Criteria *for a suitable blockchain application*

Purpose	*Why are we applying this technology in the first place?*
Actor Participation	*Are all actors willing and able to cooperate in order to realize agreed upon objectives?*
Technical Infrastructure	*Are the necessary means by which this technology is conducted in place?*
Governance	*Does the governing ecosystem encourage transparency in a manner that fosters stewardship, collaboration, and incentives to act on common interests?*
Financial Sustainability	*Will the technology be able to go about creating value and continuing acquiring resources?*

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Purpose

Why are we applying this technology in the first place?
• **problem to be solved**
• **reason**

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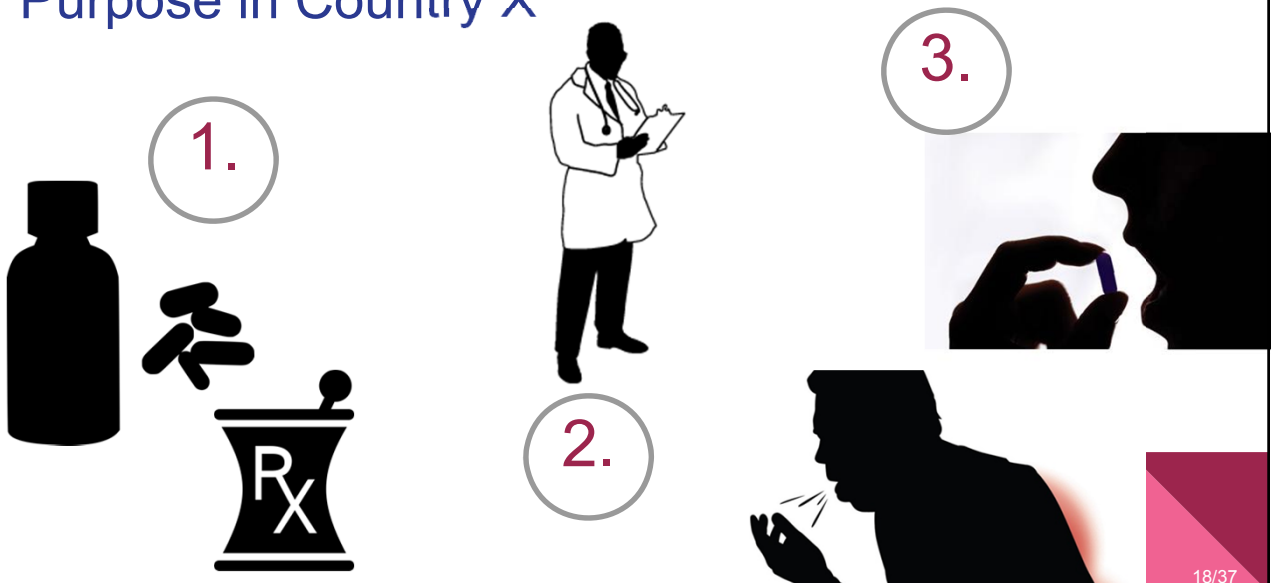
Purpose in Country X



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Actor Participation

Are all actors willing and able to cooperate in order to realize agreed upon objectives?
• **consensus**
• **cooperation**
• **accessibility**
• **added value**
• **acceptability**

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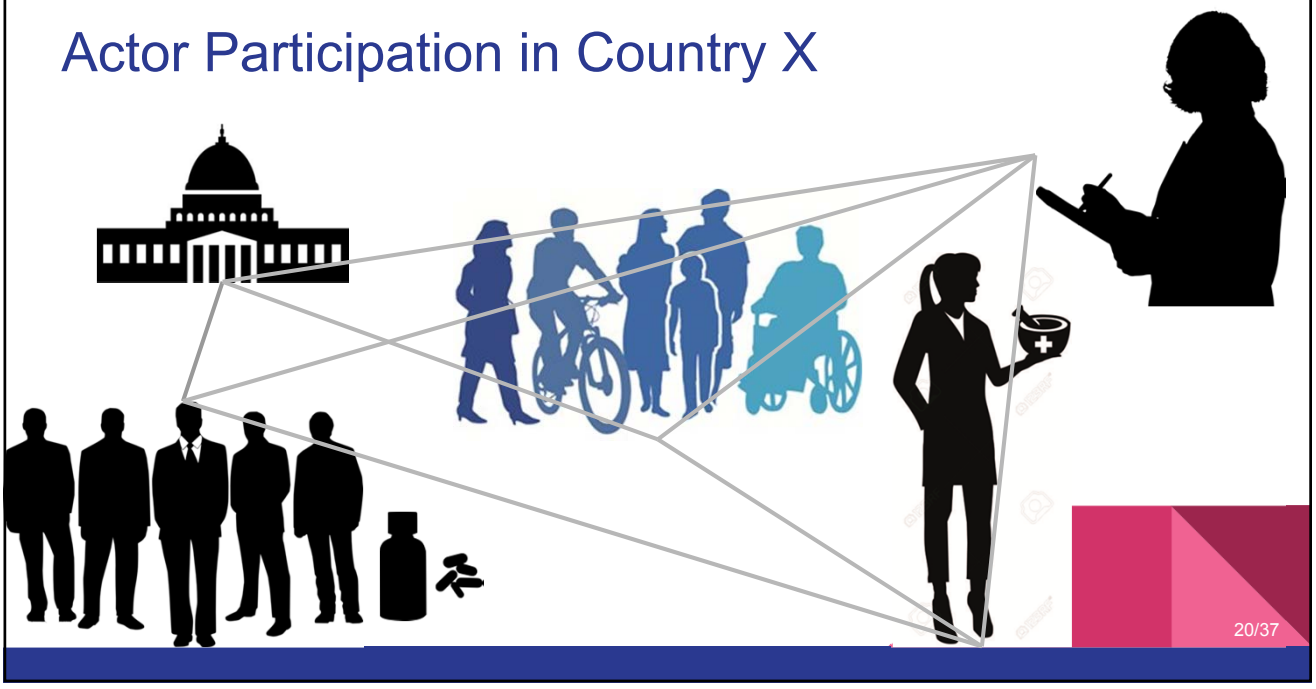
Actor Participation in Country X



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Technical Infrastructure

Are the necessary means by which this technology is conducted in place?

- **energy demands**
- **storage capacity**
- **processing power**
- **security**
- **compatibility**

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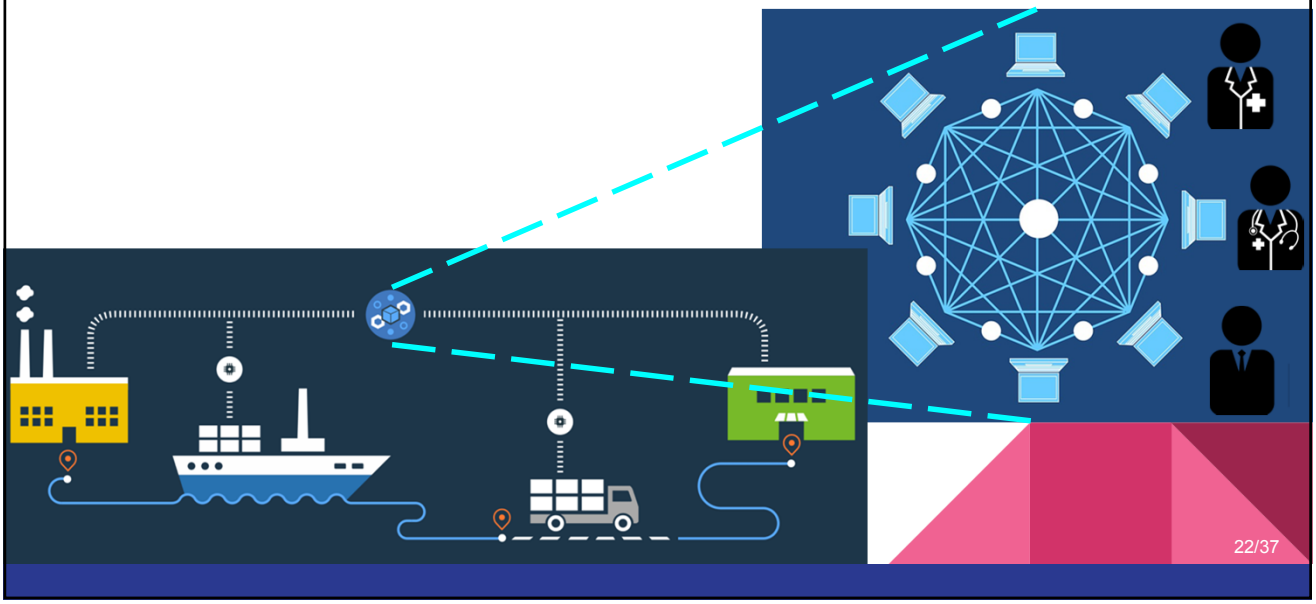
Technical Infrastructure in Country X



Governance

Does the governing ecosystem encourage transparency in a manner that fosters stewardship, collaboration, and incentives to act on common interests?
• **politics**
• **legislation**
• **transparency**

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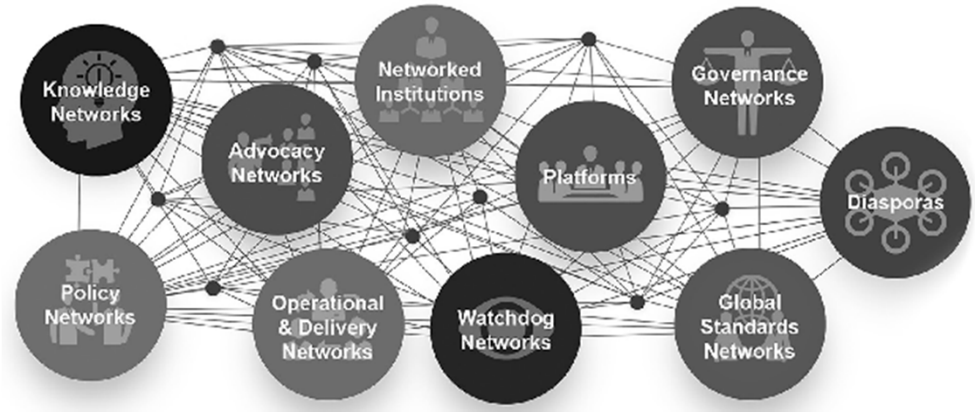
Governance in Country X



Source: *Blockchain Revolution*, 2016

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Financial Sustainability

Will the technology be able to go about creating value and continue acquiring resources?
• **funding mechanisms**
• **maintenance**
• **infrastructure and storage costs**
• **return on investment**
• **scalability**

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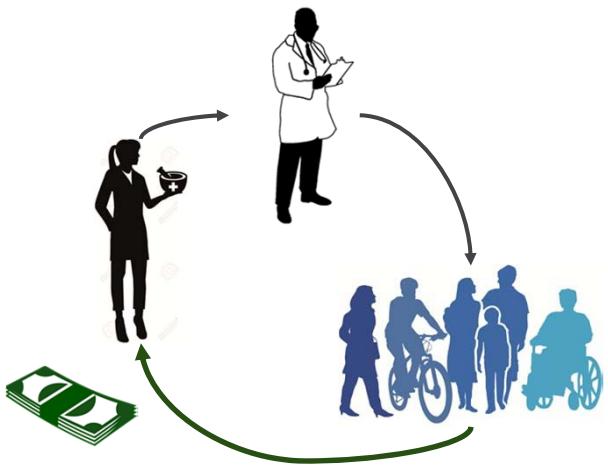
Financial Sustainability in Country X



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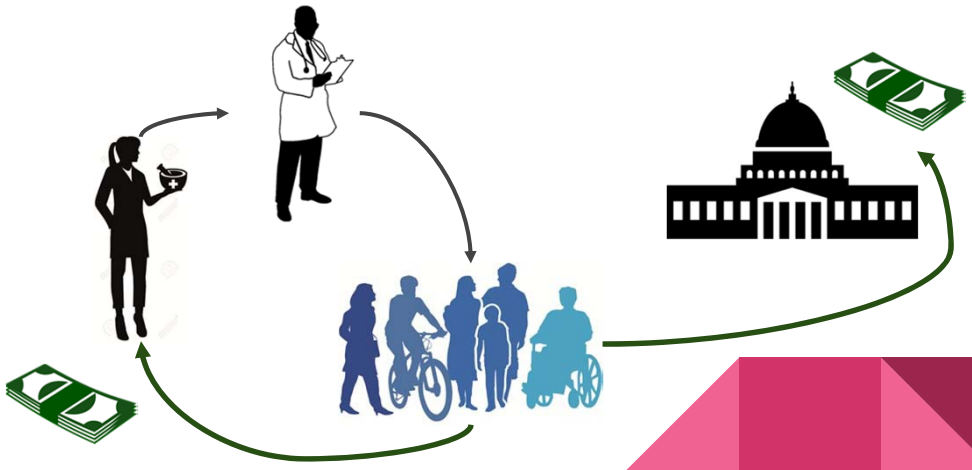
Financial Sustainability in Country X



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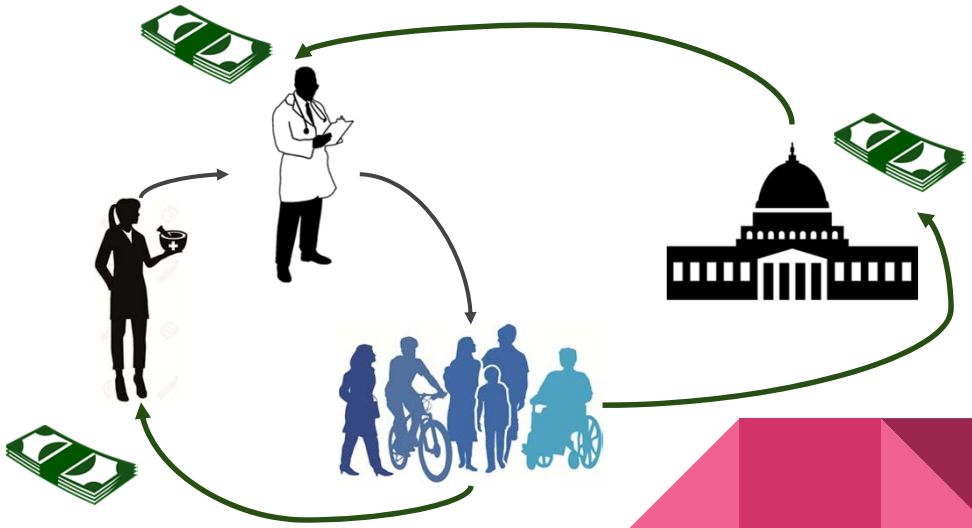
Financial Sustainability in Country X



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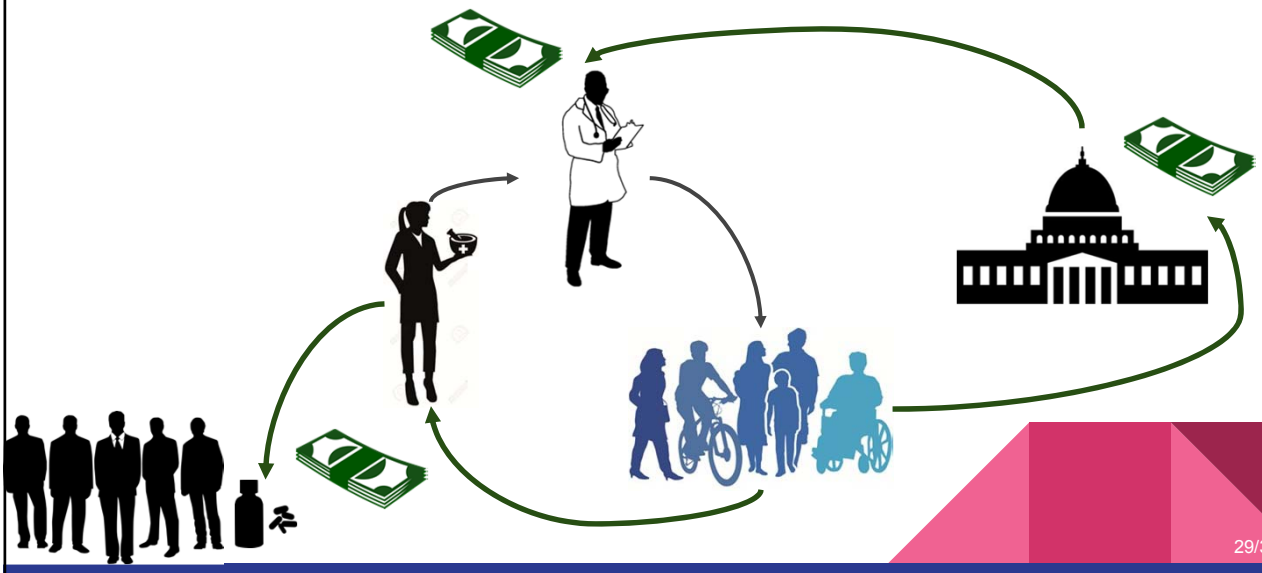
Financial Sustainability in Country X



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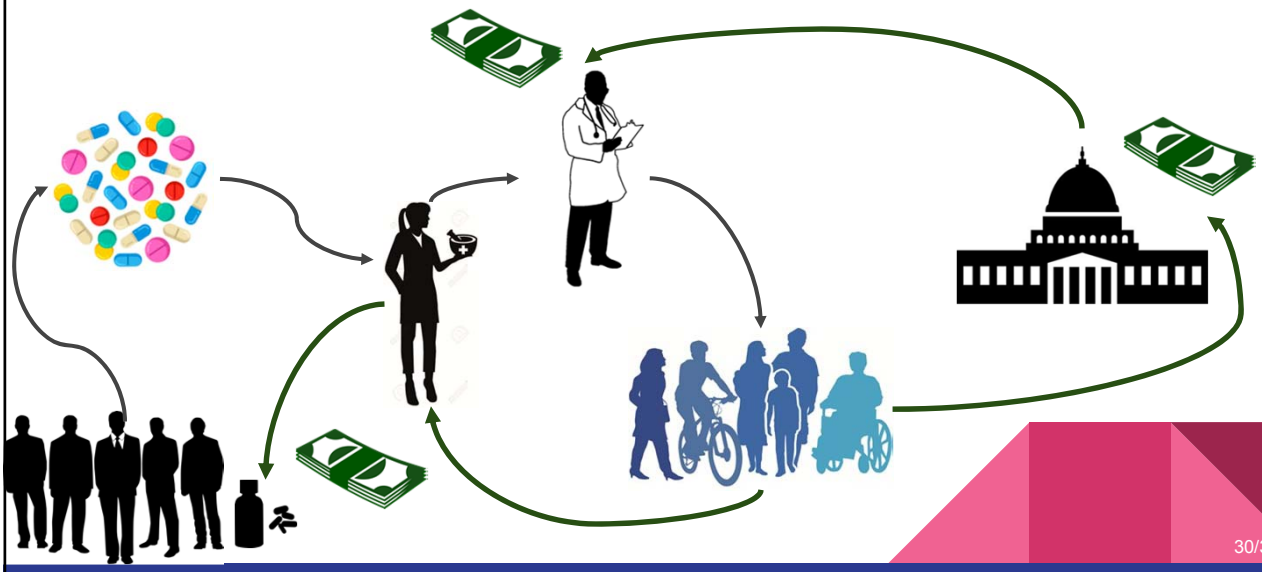
Financial Sustainability in Country X



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*Could **blockchain** be a feasible solution for Country X's MDR TB problem?*

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Purpose in Country X

1.

2.

3.

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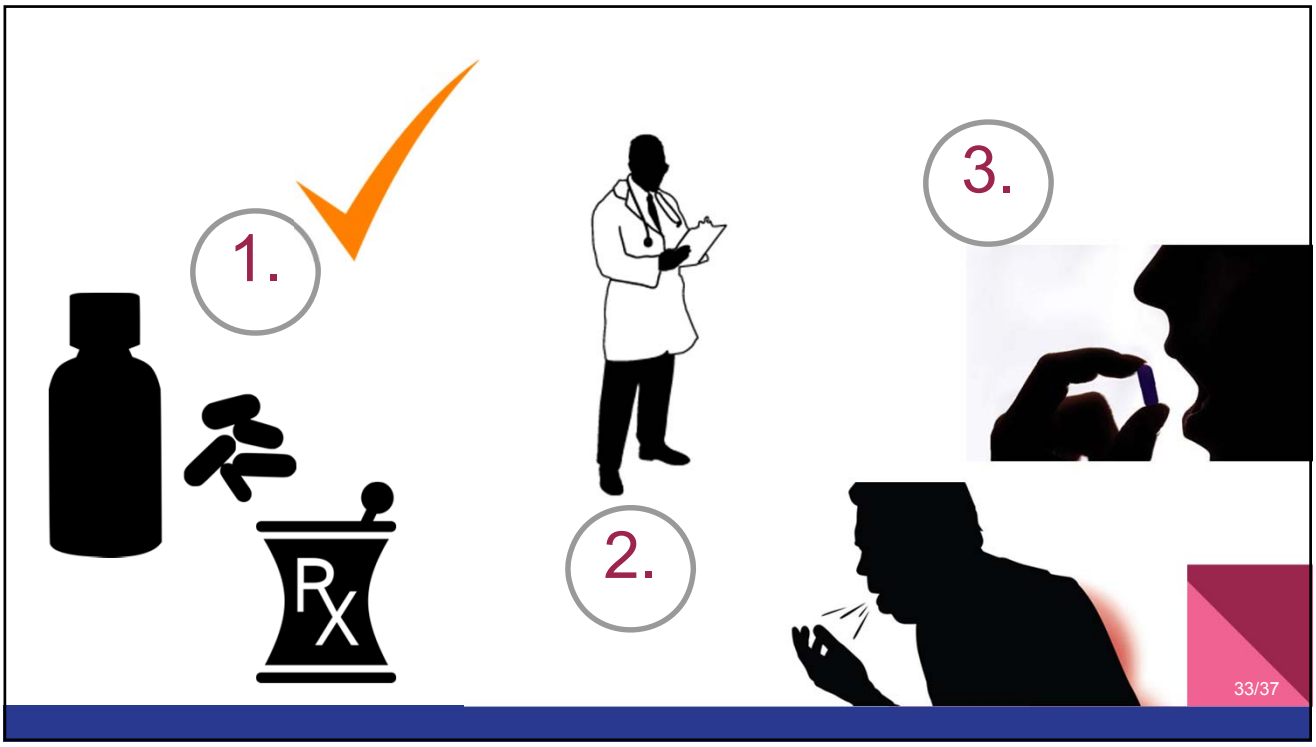
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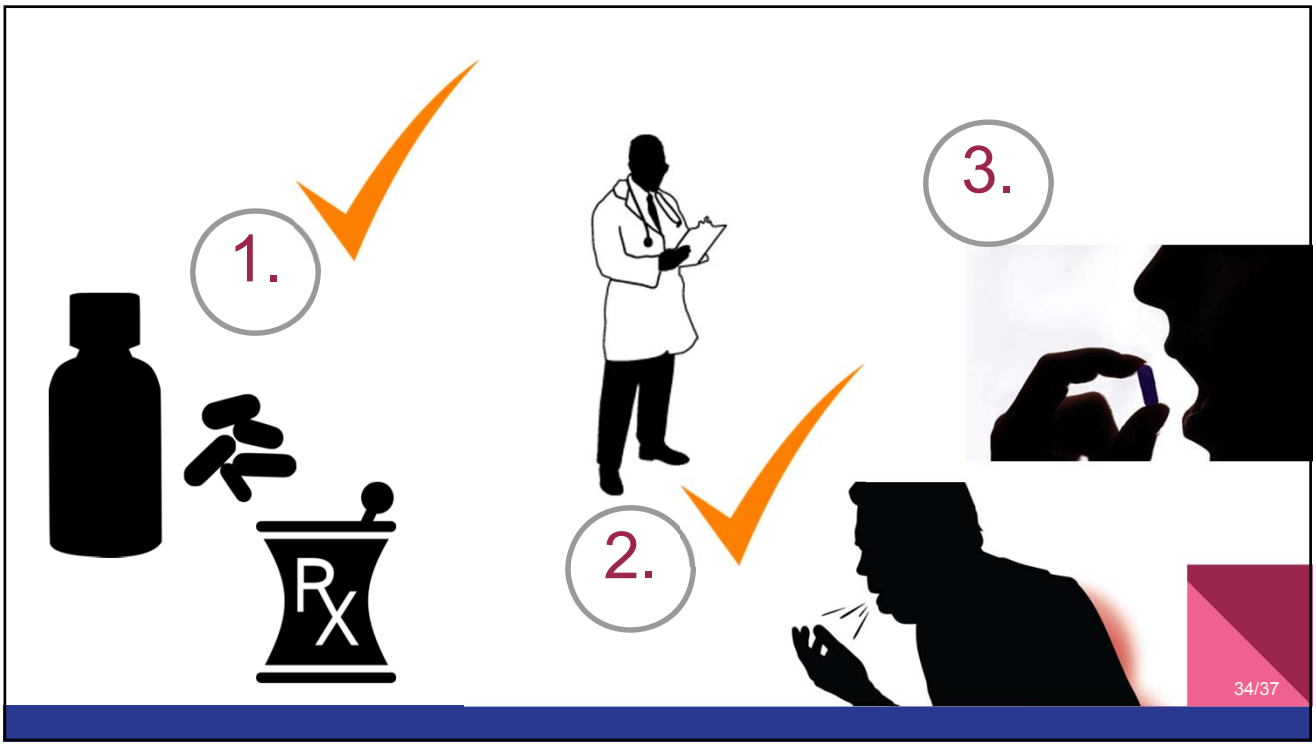
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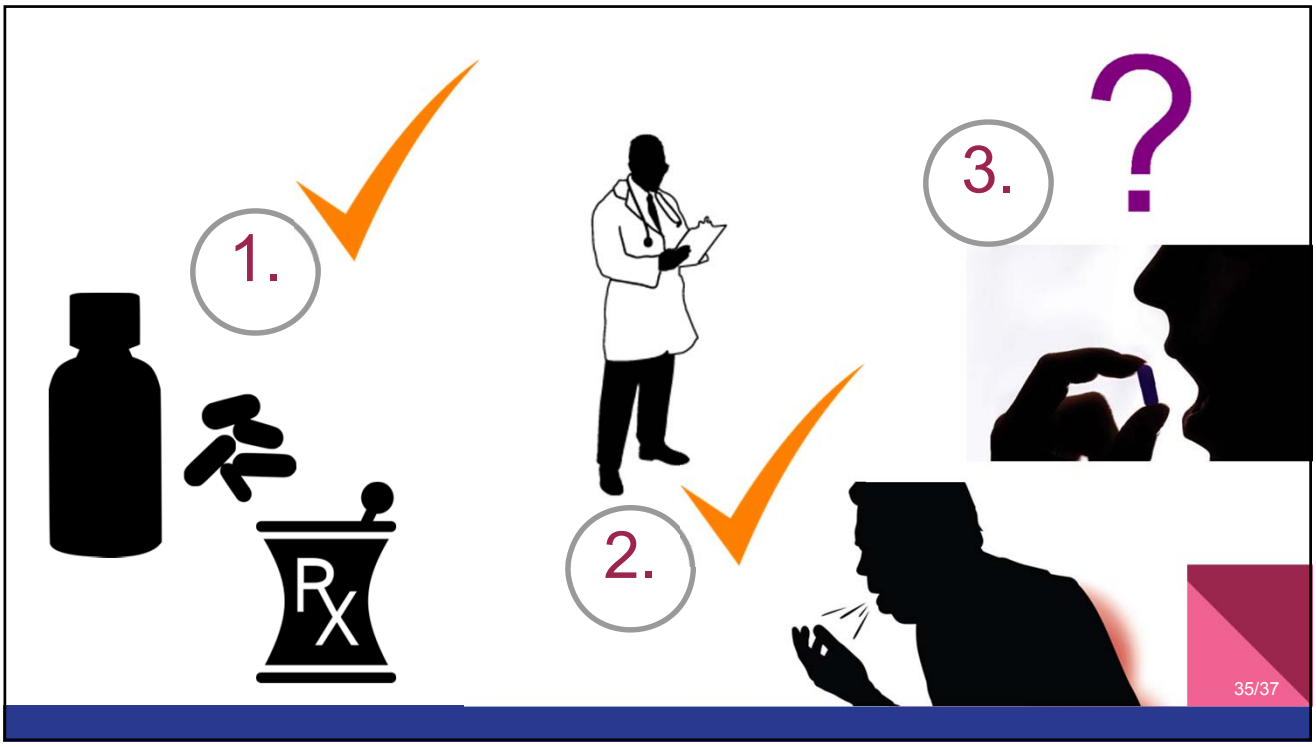

Pilot project: using blockchain technology for safe and effective use of zoliflodacin for MDR gonorrhea in Kenya

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Acknowledgements

Remko van Leeuwen (AIGHD)

Guus ten Asbroek (AIGHD/Vrije Universiteit)

Cees Hesp (PharmAccess)

Sjoerd de Man (Windesheim)

Eva Piller (Lost Lemon)

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Evaluation Criteria *of a successful blockchain application*

Speed	*end-to-end automation inherent in the technology*
Security	*person-to-person trust is not required as trust is designed into the network architecture*
Efficiency	*increased productivity and reduced waste frees up excess resources for reuse*
Simplicity	*improved understanding of underlying patterns and processes made possible by ease of collection and analysis of data*
Predictive Capability	*strengthened predictive capability of various events made possible by new pattern recognition and data analysis*
Scalability	*potential to actively expand technology without loss of functionality*
Health	*improved health outcomes, direct or indirect*

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