Blockchain Applications to Life Sciences R&D

Final report (full)
Richard Shute
June 2018
- Executive Summary
- Preamble: Why this project was important?
- Brief Introduction to Blockchain
- Project Summary
- Feedback and Steer from the Cofl
  - EDUCATE
  - DEVELOP
- The High Priority Use-Case Themes
- Focused Situational Landscape
- Proposed Timeline for Future Activities
- Recommendations
- Communication Strategy
- Appendix
  - Business Case #1: EDUCATE
  - Business Case #2: DEVELOP
Executive Summary (1)

- Gartner Hype Cycle (2017) suggests that Blockchain technology is heading away from “peak hype” towards the “trough of disillusionment”.
  - This project maintains there is still High Potential for the use of blockchain tech in life sciences R&D.
  - Organisations that implement blockchain appropriately could gain both competitive and reputational advantage.
- The Pistoia Alliance (PA) Community of Interest has grown significantly since the Fall 2017 conference.
- The hot-spot areas where blockchain tech could benefit PA members are Data Sharing and Data Integrity.
- Progressing blockchain “education” along two tracks to accommodate different levels of prior knowledge is recommended.
- A hackathon to seed blockchain coding expertise and to demonstrate where blockchain tech is applicable within Pistoia Alliance members’ organisations is highly recommended.
- Initiation now of ONE pilot development project in the key Data Sharing domain is proposed.
  - A preliminary business case to support this project is included.
Executive Summary (2)

- Working up further use-cases in the “data” hotspot areas to generate further project business cases is proposed.
  - In the short-term, the Pistoia Alliance should take on co-ordination and management of the development of a blockchain-enabled Clinical Data Donation App, based on a prototype app from Pfizer.

- A market map/landscape summarising blockchain start-ups and other organisations has been developed. The map focuses on the Data Sharing & Data Integrity hotspots.
  - Key messages include: >40 orgs mapped; some use-cases areas are already crowded (e.g. genomic data; clinical data); some areas are sparse (e.g. pre-clinical and lead discovery); many start-ups claim a broad focus on “data”.

- A program of activities stretching out to at least 2Q 2019 and probably longer is proposed
  - It is recommended that a PA program manager is put in place.

- More direct engagement of The Pistoia Alliance with other global groups to ensure PA keeps connected across the blockchain-in-healthcare domain should be considered.
  - E.g. Hashed Health, PhUSE, Digital Identity Foundation
Preamble

Why this project was worth doing?

• Many eminent thinkers and doers state categorically that:-
  – Blockchain is bad (https://bit.ly/2IDO5XQ)
  – Blockchain is useless (https://bit.ly/2IBWUkS)
  – Blockchain is bad, useless AND dangerous!! (https://bloom.bg/2FnPekH)

• But other eminent thinkers/doers maintain that blockchain tech is already adding value in a number of industries, and there appear to be many use-cases where the technology not only has marked advantages but is already enabling new and more cost-effective ways of working. https://bit.ly/2LhUpSL

• Nevertheless, according to Gartner ...
“Blockchain is now past peak hype”

But ... Blockchain in Life Sciences

• “The direction of travel of Pharma/Biotech R&D is towards cross-organizational collaboration: The sharing of resources and insights across the borders of companies, government agencies and research institutes is central to the development of therapies.

• But organizations are often reluctant to share data for fear that it gets stolen.

• Blockchain offers the possibility for trust to be hard coded into the process of collaborative R&D in a way not possible before.

• More trust means more collaboration and, in turn, more productivity.”

And ... Blockchain as Part of a Digital Health Tech Vision

- “Healthcare is in an early experimentation phase with blockchain trailing industry sectors like financial services.
- Still, executives are recognizing its potential. When asked, “When do you expect that blockchain will be integrated into your organization’s systems?” 32% of healthcare providers and 48% of health plans said one to two years.
- Furthermore, 91% of health executives believe blockchain and smart contracts will be critical for their organization over the next three years.

➡️ The future is becoming abundantly clear ... blockchain will be critical to creating trust in the authenticity and accuracy of what is being shared.”

So … Blockchain Tech remains *High Potential* tending towards *Strategic*

https://blogs.msdn.microsoft.com/jmeier/2012/02/14/portfolio-management/

Ward and Peppard, “Strategic Planning for Information Systems.”
• “The Pistoia Alliance (PA) Board has given a clear steer on the need for the Alliance to be working in this area, or at least to have a position on blockchain in life sciences R&D.”

• Hence ... This project!

• But first, what is blockchain technology (BRIEFLY)?
A Brief Introduction to Blockchain Technology
What is a blockchain not?

- Any one, particular cryptocurrency
  - e.g. Bitcoin, ether, ripple, litecoin, etc.
- An enterprise database
  - Blockchains are not meant to store large amounts of information
- Totally private
  - Individuals are anonymous, but transactions are visible to all
- Always public
  - Private, permissioned blockchains could play a role in some use cases
What is “blockchain”?

- Blockchain technology offers a way for untrusted parties to reach agreement (consensus) on a common digital history.
- A common digital history is important because digital assets and transactions are in theory easily faked and/or duplicated.
- Blockchain technology solves this problem without using a trusted intermediary.

https://www.cbinsights.com/research/what-is-blockchain-technology/
The core value of a blockchain

• “The core value of a blockchain is to enable a database or ledger to be directly shared across boundaries of trust, without putting any single party in charge.

• A blockchain lets a group of actors achieve real-time reconciliation of validated, authenticated and timestamped transactions, without the cost, hassle and risk of relying on a trusted intermediary.

• The chain provides meaningful value when it’s maintained by consensus between multiple nodes, each of which is controlled by a party with different interests. This protects against individual participants (or small groups thereof) from corrupting or deleting past transactions.”

Blockchain tech’s high level value

**Transparency**
All blockchain participants are able to view data added to the chain, while the chain improves data integrity by being the single source of truth.

**Disintermediation**
By enabling transparency and trust, the blockchain can fulfil the roles that intermediaries traditionally provide.

**Trust**
Blockchain’s connected data blocks, and distributed validation structure establish trust between participants without them having to know one another.

**Auditability**
Blockchain data is immutable and everlasting, creating an exhaustive means of record keeping.
To blockchain or not to blockchain, that is the question?

Wüst, Karl, and Arthur Gervais. "Do you need a Blockchain?“

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**Diagram:**

- **Do you need to store state?**
  - No
  - Yes

- **Are there multiple writers?**
  - No
  - Yes

- **Can you use an always online TTP?**
  - No
  - Yes

- **Are all writers known?**
  - No
  - Yes

- **Are all writers trusted?**
  - No
  - Yes

- **Is public verifiability required?**
  - No
  - Yes

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**Paths:**

- **Permissionless Blockchain**
  - *e.g.* Bitcoin

- **Public Permissioned Blockchain**
  - *e.g.* Ripple

- **Private Permissioned Blockchain**
  - *e.g.* Multichain; Hyperledger-Fabric

- **Don’t use Blockchain**
Distributed Blockchain vs Centralized Traditional Database

- **Disintermediation**
  - Transaction Mgmt

- **Confidentiality**
  - Performance

http://www.multichain.com/blog/2016/03/blockchains-vs-centralized-databases/
BTW: *Thinking of trying a blockchain project?* Some must-do first steps*

1. Get on board early
2. Participate in a pilot
   - Helps to get folk up to speed and to understand how to work with blockchain tech
3. Come up with your own enterprise blockchain strategy
4. Never lock yourself into a single protocol
   - When at the “coding” stage, hedge by trying Ethereum, Hyperledger, Multichain, etc.

* According to the COO of Hashed Health: https://bit.ly/2GGaShn
THE PROJECT
# Blockchain Applications to Life Sciences R&D

## Overview

The Pistoia Alliance (PA) Advisory Board highlighted the need for PA to explore the blockchain potential in life sciences R&D.

- At the PA Boston Conference, Oct 2017, a blockchain breakout session with ca 30 attendees identified a number of possible areas of interest.
- Funding was secured for initial project idea development.
- Upon completion of these initial activities, PA members will be able to make an informed decision on a PA go-forward blockchain strategy.

## Objectives

Building on preliminary interest from PA Boston 2017 conference to:-

- Establish and grow the Col
- Gather input from Col members on their key needs around blockchain.
- Educate membership on blockchain
- Develop a plan of future blockchain activities (e.g. projects, education) for PA members to evaluate

## Scope

- This initial effort will deliver a PA blockchain strategy recommendation; the focus will be on Life Sciences R&D, where “R&D” = Pre-clinical; Early Clinical Development; and Clinical Phases 1-3.

## Deliverables

- A focused, Life Sciences R&D-targeted overview of current blockchain arena.
- A proposed PA blockchain strategy, including a prioritized set of blockchain-focused activities (e.g. high value use cases, educational webinars, workshops, pilot implementations, etc.).

## Key Dates / Milestones

- Project Start: Feb 27, 2018
- Project End: May 31, 2018
- Kick-off poster at PA European Conference, London: Mar 14, 2018
- Tentative Col f2f at BioIT, Boston, May 2018

## Threats / Opportunities

- Outputs from Boston 2017 Conference no longer apply.
- Nascent Col does not engage
- PA plans duplicate other group’s activities

## Success Criteria

- Regular Col meetings conducted.
- Poster presented at March 2018 PA Conference
- Focused blockchain situational analysis report delivered.
- PA blockchain strategy proposal presented for membership review.

## Key Stakeholders

- Alastair Binnie - BMS (Sponsor)
- Alex Simmonds - BMS (Champion)
- PA Board
- Community of Interest (Col)

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Visit [https://ip3.pistoiaalliance.org/subdomain/main/end/node/1841](https://ip3.pistoiaalliance.org/subdomain/main/end/node/1841) to join the interest community; or contact Richard Shute: richard.shute@pistoiaalliance.org
Project objectives

- To build on preliminary interest from PA Boston 2017 conference and ...

- Establish and grow the Community of Interest (CoI)
- Gather input from CoI members on their key needs around blockchain.
- Educate interested parties on blockchain technology
- Develop a plan of future blockchain activities (e.g. projects, education) for PA members to evaluate

- To propose an initial strategy opposite blockchain technology for the Pistoia Alliance
The fundamental project components

- Support
- Educate
- Develop
The fundamental project components

- Identify discrete activities focused on educating the CoI and other Alliance members in matters blockchain-related.
- Include a blockchain in healthcare “landscape” analysis to identify key companies who are active in this area.

- Identify a set of real industry problems and use-cases that could warrant blockchain-enabled solutions being developed.
- Build on the set of “use-cases” from the Boston 2017 PA Conference.
- Prioritise a small number (no more than 3) of these ideas into a high priority set to be further worked up into potential full project ideas.
Project Timings

**MARCH**
- SUPPORT
- EDUCATE
- DEVELOP
- London Poster

**APRIL**
- BRAINSTORM + SHAPE
- PROPOSE
- FINALIZE
- Interim Materials

**MAY**
- FINALIZE
- Publishing
- Interim Materials

**JUNE**
- SUPPORT
- BRAINSTORM + SHAPE
- PROPOSE
- PUBLISH
- Final Report
Community of Interest (CofI) Metrics

- Size of CofI at project start = 45
  - From PA Conference, Oct. 2017 blockchain breakout session
- Size of CofI at project end = 85
  - Project distribution list grown from PA March 2018 Conference Poster & Birds of a Feather + onward recommendation + personal contacts
Getting Cofi Engagement & SUPPORT

• Face-to-Face
  – PA Conference, London March 2018: project kick-off poster & birds of a feather table

• Teleconferences
  – 3 in total

• Key Feedback Mechanism: Surveys
  1. High Level Use-Case Themes
     • Still live: https://www.surveymonkey.co.uk/r/DSLZM58
  2. Steer on way forward
     • EDUCATE and DEVELOP Proposals
PROGRESSING “EDUCATE” AND “DEVELOP”
A project & Cofl challenge

>> The knowledge continuum

- Broad range of understanding in this community about blockchain tech and its possibilities
  - Some know a lot, but want to know more
    - **EDUCATE**: Want in depth training on blockchain coding and system development
    - **DEVELOP**: Can home in on suitable use-cases already
  - Many know a little
    - **EDUCATE**: Want more introductory training: “Blockchain 101+”
    - **DEVELOP**: Can’t yet identify what “good” use-cases are
  - Quite a lot in the middle!

So how best to progress “EDUCATE” and “DEVELOP” to meet the different knowledge levels?
EDUCATE before DEVELOP?
Two proposals: *EDUCATE*

**What?**

1. For those at a “shallow” level of knowledge – a 2-3 hour, higher-level online webinar
   - Introduce blockchain technology: background, fundamentals, principles, different platforms etc.
     - Delivered by the [Fraunhofer Blockchain Lab](https://www.hyperledger.org/resources/training)

2. For those at a “deep” or “expert” level of knowledge – a 2 day hackathon event
   - Use Hyperledger trainers; pick a few simple operational use-cases; build small prototypes
     - [https://www.hyperledger.org/resources/training](https://www.hyperledger.org/resources/training)

**When?**

1. Online webinar: A.S.A.P. Early summer?
2. Hackathon: Coincide with PA Fall Conference
DEVELOP

• Started with the use case ideas from the Pistoia Alliance Fall 2017 Conference breakout session facilitated by Accenture.

• Ideas mapped against the Drug Discovery Value Chain
  – see next slide

• Abstracted to a set of high level themes
  – see the following slide
<table>
<thead>
<tr>
<th>Target ID &amp; Validation</th>
<th>Lead Gen. &amp; Optimization</th>
<th>Pre-clinical Animal Studies</th>
<th>Phase 1: Safety &amp; ADME</th>
<th>Phase 2: Safety &amp; Efficacy</th>
<th>Phase 3: Safety &amp; Efficacy</th>
<th>FDA Review &amp; Approval</th>
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<tr>
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<td>Clinical Trials Data: Patient/Electronic Health Care Records</td>
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<td>2</td>
<td>eNotebook: Preclinical study data - the evidence notebook; everything captured as part of the development of a drug goes into this ‘book’</td>
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<td>3</td>
<td>Providers/Payers/CROs/Partners: We should think about providers/payers - they want to use blockchain to work with Pharma.</td>
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<td>4</td>
<td>Clinical Trials Process: Medication adherence - giving them crypto currency for being adherent to their drug regimen: Focus on clinical trials</td>
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<td>Clinical Trials Process: Sharing information back</td>
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<td>6</td>
<td>Data Sharing: Expose data to CRO. Microcontracts for data?</td>
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<td>7</td>
<td>IP: Attorneys like it for the immutable record longitudinally for a particular researchers work efforts - “who is it that actually came up with this idea”</td>
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<td>Data Integrity: Small companies send data to big companies - we do that now ... has the data been massaged?</td>
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<td>9</td>
<td>Clinical Trials Audit: If you could make auditing redundant - apply blockchain into the process - that would be great</td>
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<td>10</td>
<td>IP? Can be used in defensive postures; when someone has changed something ... then you can directly intervene</td>
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<td>11</td>
<td>FDA Submission: Diagnostic development company - they need patient data involved for their FDA sub</td>
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<td>12</td>
<td>Training: R&amp;D Auditing folks need to have training .... HIPPA training, etc. Track records</td>
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<td>13</td>
<td>Clinical Trails (Audit): Digital Identity; validating that physicians/healthcare professions are who they say they are.</td>
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<td>14</td>
<td>Clinical Trials Process: Accelerate study start-ups</td>
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[https://drive.google.com/open?id=1b0HdhHIRQ24yQqUzM6japK_sF-vJo1Lr](https://drive.google.com/open?id=1b0HdhHIRQ24yQqUzM6japK_sF-vJo1Lr)
Higher Level Use-Case Themes:

- Digital Identity
- Clinical Trials Process
- Clinical Trials Audit
- Boston 2017 Use Cases
- FDA Submission Support
- eNotebook
- Working with Suppliers: Contracts
- Training Records Mgmt
- Data Integrity
- Data Sharing
- IP
**DEVELOP : The Survey**

- Survey Monkey on *higher level* use case themes
  
  [https://www.surveymonkey.co.uk/r/DSLZM58](https://www.surveymonkey.co.uk/r/DSLZM58)
  
  - Find the higher priority areas in R&D that people believe could be ripe for blockchain-enabled solutions
  
  - Even for those with only shallow level of knowledge
Survey results to date

- 24 respondents so far (25 June 2018)
  - Would like still more
  - Survey publicised via Pistoia Alliance LinkedIn group

- Understand that folk may be reluctant to vote, even on higher level themes if they do not yet understand the topic sufficiently.
  - All the more need for “EDUCATE” to progress soonest!

- Survey will stay live for AT LEAST another month:-
  https://www.surveymonkey.co.uk/r/DSLZM58
Survey Results To Date*

Highest priority themes:-
- 1. Data Sharing
- 2. Data Integrity

* 25th June 2018
“It’s all about the data!”
Types of R&D data

- **Quantitative**
  - Measurements, counts and results
    - Screening data
    - Clinical data
    - Statistical analyses
  - Raw and refined

- **Qualitative**
  - Non-numeric
    - E.g. genome data, IDs
  - Metadata
    - Add context, e.g. Active vs Inactive
  - Chemical structures, cell and medical images
  - “Information”, e.g. reports, SOPs, presentations

Optimally stored in relational databases, e.g. Oracle

Can be stored in traditional db’s but also in enterprise information management systems, e.g. OpenText, Sharepoint
So how do I store R&D data on a blockchain?

• Quick answer ... Right now, probably best not to try! Why?

• Two main issues with current blockchain tech
  – Speed
    • Transactions cannot be processed fast enough to make blockchain-enabled R&D data processing feasible
  – Capacity
    • Blocks have a finite size and even with recent tech advances, that capacity is comparatively small (MBs not GBs and definitely not TBs)

• Conclusion: There are ways to store data itself on a blockchain – sharding and swarming – but this only suits certain types of data: e.g. non key-operational, final docs, archives, etc.

• Recommendation: Store metadata on-chain and “data” off-chain
  – Better fit also with local data regulations, e.g. HIPAA, GDPR, etc.

Two proposals: DEVELOP - A Sooner Track & A Later Track

1. Sooner Track
   - Keep the momentum going
   - Two use-case ideas were proposed:
     - *Big Data Sharing*
     - *Data Donation* - in the context of clinical trial data
   - The clear majority of the CofI surveyed indicated that both use-cases should be pursued by PA as possible pilot projects.

*Big Data Sharing* – “Controlled Collaboration 4 Scientific Data (CC4SD)”: Has been worked up into a preliminary business case for consideration by the PA Board to support as a full-blown project (see following slide).

   - *Strongly recommend to take this forward as a pilot project immediately.*

The *Clinical Data Donation App*: This idea should be taken on by the Pistoia Alliance to co-ordinate and develop into a full business case with contributions from other interested PA members (see later slide).
“Controlled Collaboration 4 Scientific Data – CC4SD”
Benefits of CC4SD

- To data suppliers/providers:-
  - Better, more open, controlled but secure access to their data leading to better chance for the advancement of science, scientific knowledge and insight.
  - Low cost
  - Low barrier to adoption: all the components would be readily available
    - NB: It is assumed at this stage that the original data owners will fund the deposition of their data, suitably enhanced with the blockchain comms software, on an accessible but securely controlled and permissioned, probably cloud-based, repository.
  - Improved collaboration and partnering; easier to find new collaborators & partners.
  - Opportunity (if desired) to receive remuneration each time “their” data is used.
  - Much reduced likelihood of data misuse.

- To data users/consumers:-
  - Access to “real” data that they would not normally be able to get at.
  - Open up possibilities for identifying new potential collaborators.
The Clinical Data Donation App

- PA can provide PM, project office, legal framework, etc. to enable the project to progress so enabling PA members to collaborate without having to put all this cross-business overhead in place.
  - For PA members this facility is already available
  - C.f. The HELM project
Two proposals: **DEVELOP - A Sooner Track & A Later Track**

2. **Later Track**
   - Extension of **EDUCATE**
   - Run a half day, face-to-face workshop, preferably at the Fall Pistoia Alliance Conference using the two highest priority themes from survey (= Data Sharing & Data Integrity) to identify and grow blockchain-suitable use-cases.
     - Costed business case for this workshop is included.
     - Propose facilitation by the [Fraunhofer Blockchain Lab](#).
       - Same group recommended to give the EDUCATE webinar
   - Work up highest priority use cases (no more than 2) into more detailed business cases.
   - Submit business cases to PA Board by end Q4 2018 to consider supporting as full-blown project(s).
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FOCUSED SITUATIONAL LANDSCAPE

... OR “MARKET MAP”
# Blockchain in Health & Life Sciences

## The Platform Landscape

### Supply Chain
- Gem
- Guiding Eagle
- BlockPharma
- Chronicled
- modum

### Clinical Trials
- Stratumn
- BlockChainHealth
- PointNurse

### Decentralized App
- HealthComBix
- Ipseity Solutions
- The BlockRx Project

### App Dev Studio
- Hashed Health

### Consortiums

### Healthcare Platform
- pokitdok
- SimplyVital Health
- Gem

### Healthcare Records Management
- Gem
- Guardtime
- MedRec
- BlockChainHealth
- Pryv

### Health Record Ownership and Exchange
- BlockchainHealth
- YouBASE
- Patientory
- BronTech

### Blockchain Infrastructure

#### Identity and Authentication
- Blockstack
- uport

#### Data Records
- Factom
- Stratumn
- Monax
- Bitcore

#### Software Development
- Tierion
- TAN
- Chain
- MultiChain

#### Identity Services, KYC/AML
- ShoCard
- KYC-CHAIN
- Blockscore

#### Public Blockchain
- Bitcoin
- Ethereum

#### Private Blockchain Providers
- Hyperledger
- Chain
- MultiChain
- blockco

#### Sidechains
- Blockstream
- RSK

#### Storage
- storj.io
- Filecoin
- IPFS

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Diagram courtesy of Accenture.
# Blockchain in Health & Life Sciences

## The Platform Landscape

<table>
<thead>
<tr>
<th>Supply Chain</th>
<th>Clinical Trials</th>
<th>Decentralized App</th>
<th>App Dev Studio</th>
<th>Consortiums</th>
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<tr>
<td>Gem</td>
<td>stratumn</td>
<td>HEALTHCOMBIX</td>
<td>Ipseity Solutions</td>
<td>Hashed Health</td>
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<td>GUIDING EAGLE</td>
<td>BLOCKPHARMA</td>
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<td>The BlockRx Project</td>
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<td>CHRONICLED</td>
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## Business Processes or High Level Use-Cases

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<th>Healthcare Platform</th>
<th>Healthcare Records Management</th>
<th>Health Record Ownership and Exchange</th>
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## Blockchain Platforms & Infrastructure

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<th>Blockchain Infrastructure</th>
<th>Data Records</th>
<th>Software Development</th>
<th>Identity Services, KYC/AML</th>
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<tbody>
<tr>
<td>Public Blockchain</td>
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There’s a lot of activity out there!

From list of 120 healthcare ICOs: https://bit.ly/2HGaNyR, pre-November 2017
Landscape Analysis Focused on “Data”

• **In Scope**
  – High priority use-case themes
    1. *Data Sharing*
    2. *Data Integrity*

• **Out of Scope**
  – Blockchain infrastructure, protocol and platforms
  – Distributed Application (dApp) development "services" organisations
  – Lower priority use-case themes
    • Digital Identity; Clinical trials audit; FDA submission report; eNotebook etc.
  – Processes or use-cases that already have multiple entrants
    • E.g. electronic health records (EHR); medicines supply chain
Landscape Analysis Key Messages

- 43 Companies/Organisations/Consortia identified in the “Data Sharing/Integrity” space.
  - [https://drive.google.com/open?id=1tHd4rV94l2MfYE-tX9fFM-YNhzWC03QR](https://drive.google.com/open?id=1tHd4rV94l2MfYE-tX9fFM-YNhzWC03QR)

- Scoping which companies to include was difficult
  - LOTS of start-ups in the blockchain-enabled electronic health records (EHR) arena; many of these talk about sharing patient data.
    - Included 16 in the map (somewhat subjectively!)—those that seemed to be more clearly focused on data sharing back to R&D

- Some areas rich with start-ups
  - E.g. Genomic data; Clinical data (see bullet above)

- Some areas sparse
  - E.g. Pre-clinical, especially Lead Discovery

- Many companies claim a broad focus on “data”
  - Potential applicability “Across the Value Chain”
    - E.g. Document timestamping; sample management and supply chain; Internet of (Laboratory) Things; etc.

See also here for another list of biomedical blockchain initiatives: [https://github.com/HD2i/biomedical-blockchain](https://github.com/HD2i/biomedical-blockchain)
Food for thought?

- This analysis has focused on *Data Sharing* and *Data Integrity*.
- There are clear opportunities for the Pistoia Alliance to take a lead in some key areas of R&D.
  - E.g. Pre-clinical & Lead Discovery
- Other domains already have global groups and consortia focusing on the delivery of new pilots, prototypes and solutions.
  - E.g. Supply Chain, Electronic Health Records, Digital Identity, etc.
- It could be in The Alliance’s best interest to have more formal connection and engagement to these groups. This would enable:-
  - Better insight into what these other groups are doing
  - Better chance to influence where they are going and what they are doing
  - PA to be the voice of its members in these groups so removing the need for them all to be in every consortium
  - *How?* See Recommendations slide.
A few examples of these groups/consortia

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Focus</th>
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</thead>
<tbody>
<tr>
<td>Hashed Health and Hashed Health Labs</td>
<td>Broad healthcare focus; more targetted at the Clinical domain?</td>
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<tr>
<td>The Pharmaceutical Users Software Exchange Working Group</td>
<td>Understanding the qualities of BlockChain relevant to the Pharma setting and the example of use cases and applications.</td>
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<tr>
<td>Hyperledger Healthcare Working Group</td>
<td>Applications for blockchain technology in the healthcare industry; Clinical, Payer, etc.</td>
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<tr>
<td>Alliance for Clinical Research Excellence and Safety</td>
<td>Secure identity of patients and doctors participating in clinical trials</td>
</tr>
<tr>
<td>The Digital Identity Foundation</td>
<td>Blockchain-enabled cross-platform digital identity</td>
</tr>
<tr>
<td>The BlockRx Project</td>
<td>Blockchain-enabled supply chain management</td>
</tr>
</tbody>
</table>
• Executive Summary
• Preamble: Why this project was important?
• Brief Introduction to Blockchain
• Project Summary
• Feedback and Steer from the CofI
  – EDUCATE
  – DEVELOP
• The High Priority Use-Case Themes
• Focused Situational Landscape
• Proposed Timeline for Future Activities
• Recommendations
• Communication Strategy
• Appendix
  – Business Case #1: EDUCATE
  – Business Case #2: DEVELOP
Recommendations

• **Activities**
  – That the initial *EDUCATE* webinar goes ahead as soon as possible.
    • Opened up more widely to PA members and non-members
  – That the initial “Big Data Sharing” *DEVELOP* project is taken on, sponsored and funded by PA member(s).
  – That the events proposed to coincide with the PA Fall Conference in Boston are supported.
    • Hackathon and Use-case Workshop
  – That a communication/PR campaign associated with the findings of this project is set in motion.

• **Governance**
  – That a Pistoia Alliance sponsored Blockchain “Program” is established with a program manager and project manager(s) to manage and drive the above activities forward.
  – The program manager could be the link to other global groups and provide regular updates back to PA and the Cofi.

https://www.surveymonkey.co.uk/r/F7CS6HK
Communication Strategy

• Pistoia Alliance Members
  – Share full final report
  – Present to sponsor (BMS), members and to Cofl
  – Pistoia Alliance Newsletter update

• Members & Non-Members
  – Share final report slideset and business cases publicly
    • via IP3
  – PR around use-case survey?
    • Use Spark Communications
  – Advertise Boston hackathon (if supported)
  – Social media publicity
    • Pistoia Website Blog
    • LinkedIn blog

Thoughts?
And finally ...

“In the future all web applications are going to be following a blockchain structure.”

Dan Larimer

“The revolution will not be televised. It will be cryptographically time stamped on the blockchain.”

Dominic Frisby

“Words like ‘blockchain’ and ‘mining’ and ‘dis-intermediation’ are as alien to us now as ‘browser’, ‘website’ or ‘URL’ were 20 years ago. But in a few years everyone will be using them.”

Dominic Frisby

“The blockchain is the new website. Fairly soon, every company will have a blockchain, or be on a blockchain, or several ones, just as organizations are involved in many websites today.”

William Mougayar

“We should think about the blockchain as another class of thing like the Internet; it is a new organizing paradigm for the discovery, valuation, and transfer of all quanta (discrete units) of anything.”

Melanie Swan
ADDITIONAL SLIDE
Second Use-Case: Clinical Trial Patient Data

• Cf. Data Donation iPhone app
  – Simple utility that lets people choose baseline health app data they wish to donate, creates standardized files that researchers can understand, and lets them donate their data to project(s) of their choosing.

• A blockchain-enabled version would add extra security, allow more flexible contracts. Could enable micropayments for data use, could enable better feedback to patient if on clinical trial.

• Potential for a multi-tenant platform used by multiple Pharma, CROs, researchers, etc.

• Pfizer and Bayer are keen to progress this as a proof of concept
  – Munther Baara (Pfizer) has agreed to demo the data donation app (DDA) as it is currently, if people want.