## ICEVENTURE

# The Enterprise Blockchain Study 2018

## Study of Enterprise Blockchain operating costs

### Abstract:

The Blockchain is considered to be a leading future technology with a high potential for disruption.

Thus, we observe an increasing number of publications praising a number of use cases for example in e.g. finance, energy, and logistics, and the (cost) benefits of the new technology and an interest from our customers in a valuation. Also, a number of consortia started to work on industry specific solutions and many PoCs are underway. There is hardly any corporate that does not have a Blockchain PoC.

The white spot however is the cost side of operating a Blockchain and the value add in specific. Costs are significantly more important in the Enterprise context compared to the start-up case which look for new business models. This is due to the fact that in the narrow context of an Enterprise Blockchain, the prioritization of features is different. It shifts away from full decentralization and often aims to comply with an IT replacement logic or to transform processes into the digital.

We have calculations about the energy usage of Bitcoin, the best known public Blockchain application, which are very high. But what does this mean for the above listed use cases and the Enterprise context where the Blockchain software architecture can be more flexible in the but requires many transactions and low latency?

Thus, the benefits/costs of an Enterprise Blockchain are not fully understood. It is known that different consensus mechanisms show different cost behavior, but the open question is which one (increasing/constant/decreasing). Then there is the question of storage and scaling issues. This is important and needs clarification, because there are existing technology solutions dealing with multidata/user situations like Software as a Service (SaaS), albeit with a different implementation (central vs. decentral) which means costs vs. benefits for features are decisive in order to decide for or against an implementation.

Also, it is known that costs differ between a fully public Blockchain, and private e.g. Enterprise Blockchains or solutions by consortia. But details of the technical differences are unexplored.

So far only costs for prototypes (PoCs) are known for certain (explored) mostly influenced by IT talent costs. In addition, we could identify some rough operating cost calculations derived from analogies with similar use cases and some academic papers.

Thus, to our best knowledge there is no public and validated study on the subject of costs of Enterprise Blockchains and a view on total costs of ownership.

#### Outcome of the study:

Aim of the study is to provide a comprehensive overview of technical features of Enterprise Blockchains, available data on Blockchain operating costs for Enterprise use cases, a cost estimate for operating a Blockchain and to derive models estimating the ongoing operating costs. The focus is on Enterprise Blockchains. It will also include and overview of consortia and service providers as well as selected startups to facilitate the selection.

#### **Target group**

CIOs/CDOs, or decision makers or project managers of companies thinking of / or currently doing an PoC of an Enterprise Blockchain project. Every stakeholder interested in Blockchain technology

#### **Research approach:**

Desk research about available cost data to operate a Blockchain

Review of existing academic studies

Interviews/emails with e.g. developers, stakeholders like trial versions or prototypes and consortia

Indirect cost estimate base on own proprietary economic model making use of market data

Comparison with existing technologies

## Structure of the study

- 1. Introduction
  - a) Motivation for the study
  - b) Organization of the study
  - c) Methods and sources
  - d) Overview of sources

## Part I – individual cost drivers of a Blockchain at the current state of technology

- 2. Overview on Blockchains, definitions and cost aspects under examination
  - a) Market overview and emerging questions
    - i) Why companies are so excited about Blockchain
    - ii) A comparative timeline of Blockchain and SaaS
    - iii) Overview on Blockchains, definition of an Enterprise Blockchain for this study and the handling of DLTs
    - iv) Changes in technology shifting from public to Enterprise Blockchains
    - v) The Scalability Trilemma
    - vi) The question of an Enterprise Blockchain architecture
    - vii) Where is the Enterprise Blockchain placed in the company processes and relations?
    - viii) Defining a cost framework the breakdown of technological aspects and the cost side
  - b) Cost drivers in Enterprise Blockchains variable costs and fixed costs
    - i) Variable Costs of a Blockchain
      - Consensus Protocols as key driver of the operational costs of the Blockchain Most extensive list of consensus mechanisms in development and currently available
      - (2) Smart Contracts
      - (3) Storage costs of the ledger
      - (4) Costs due to transaction speed needs, scaling up, and hardware
    - ii) Fixed Costs Other relevant cost categories for Enterprise Blockchains
      - (1) Cost of development (PoC, Prototype, Production), setup and deployment(a) PoCs and prototypes
        - (b) Cost of hiring Blockchain specialists and the question of a Blockchain talent gap
      - (2) Costs due to maintenance
      - (3) Costs due to security
      - (4) Costs due to regulation needs
      - (5) Costs due to compliance requirements
      - (6) Costs due to uncertainty and risks (errors/legal/safety)
      - (7) Tentative Key Performance Indicators
  - c) Summary and conclusion of chapter two

#### 3. Operating costs of an Enterprise Blockchain

- a) The question of Blockchain unit costs within the applied framework of total cost of ownership
- b) Costs for operating a Blockchain Variable Costs
  - i) Costs for computing power: consensus mechanisms
    - (1) Proof-of-Work
    - (2) Alternative consensus mechanisms to PoW (11)
      - (a) Overview of alternative consensus mechanisms and the state of development
      - (b) List of mechanisms and research on costs(i) Validation of alternative consensus mechanisms
      - (c) Comments on DLTs and their transaction costs as solution for Enterprise Blockchains
        - (i) Are DLTs the solution?
        - (ii) What data is available on DLTs and non-PoW Blockchains?
    - (3) Conclusions from the findings on the Blockchain consensus protocols
      - (a) The question of public versus private Blockchains
      - (b) The question of intra/inter-company Blockchain solutions
      - (c) Interoperability one Blockchain or many?
      - (d) Who pays the bill? And who gets paid?
  - ii) Storage cost
    - (1) A basic model of storage costs
    - (2) Available data on ledger costs
    - (3) Basic price observations and estimates
    - (4) Storing data on a Blockchain, technological and business considerations
    - (5) Database structure, performance, retrievability
    - (6) Can the storage question be solved?
    - (7) Implications of storage costs and proposed solutions
  - iii) Smart Contracts
    - (1) What is a smart contract?
    - (2) Technical considerations of smart contracts
    - (3) Cost factors
    - (4) Conclusion about the impact of smart contracts
  - iv) Costs due to transaction speed needs, hardware, and scalability
    - (1) Transaction speed needs and cost per transaction
    - (2) Scalability
    - (3) Hardware considerations
- b) Cost drivers of an Enterprise Blockchain project Fixed Costs
  - i) Costs for a development model prototype (PoC)
    - (1) Available market data
    - (2) A quick overview of necessary Blockchain development competencies
    - (3) Cost of hiring Blockchain specialists: Getting the talent
    - (4) Blockchain innovation and the talent gap

- ii) Maintenance the service contract
- iii) Security
  - (1) Security Risk Factors
  - (2) Security Risk Impact on costs
- iv) Costs due to regulation needs
- v) Compliance issues
- vi) Factoring in uncertainty: Development risk, security, legal and human errors
- vii) KPIs
- c) Summary and conclusion of chapter three

## Part II – Market observations of Enterprise Blockchains

- 4. Consortium solutions and startups, and their current performance data
  - a) The consortia landscape What kinds of consortia appear and in which sectors
    - i) Why consortia are appearing
    - ii) Funding of consortia
    - iii) Governance in consortia
    - iv) Blockchain frameworks used by consortia
    - v) Critique around known consortia
    - vi) What statements about costs can be derived from analyzing consortia
    - vii) Consortia as indicator of market structure needs
  - b) Enterprise Blockchain Startups
    - i) Industry sectors of Blockchain startups and identification of relevant startups
    - ii) Finances of start-ups
    - iii) Technology in use
    - iv) Business and revenue models of Enterprise Blockchain startups
    - v) Startups some cases
    - vi) Conclusion the question of BC operating costs
- 5. Overview of academic studies modeling/describing the costs of operating a Blockchain
  - a) Research activities on Enterprise Blockchains in general
  - b) Noteworthy publications
  - c) The academic view on costs in particular marginal cost development
  - d) Results from background talks with researchers
  - e) Conclusion about academic activities
- 6. Frameworks, service providers and BaaS another layer of Enterprise Blockchains companies

- a) Overview of "pre-fab" Blockchain components
- b) Service Providers
  - i) Overview of consulting service providers
  - ii) Blockchain Impact assessment by the service providers
  - iii) Industries served by service providers
  - iv) Number of PoCs / Blockchain projects by service providers
  - v) List with key technologies used by the service providers
- c) Overview of Blockchain Infrastructure Providers (BaaS)
- 7. Discussing Blockchain in context markets and costs of competitors
  - a) An extended view of cost of ownership in case of a Blockchain
  - b) Scenarios of Public Blockchains, private Blockchains and cloud services
  - c) List of alternatives to Blockchains to consider

#### 8. Cost considerations for various Blockchain use cases

- a) Finance
  - i) Inter-bank payments clearance
  - ii) Evaluation of the use case
  - iii) Structured finance
  - iv) Evaluation of the use case
- b) EV charging infrastructure: a decentral energy marketplace
  - i) The EV use case
  - ii) Energy charging Infrastructure now
  - iii) Network transactions requirements and necessary cost roof
  - iv) Evaluation of the use case
  - v) The Share & Charge case
- c) Supply Chain Logistic Use Case
  - i) Supply chain general description
  - ii) Qualitative aspects of the use case
  - iii) Evaluation
- d) Conclusion of the use case chapter
- 9. Conclusion Implications, future cost savings or alternatives
  - a) Findings of the Enterprise Blockchain Study
  - b) Discussing the findings
  - c) Proposal: Considering markets structures of companies for the Enterprise Blockchain use case
  - d) (relevant points to be added)

#### The agenda is shorter and representative of the final agenda of the study.

## Authors and availability:

**Planned publication/availability:** End November 2018 – exclusive customers; Early 2019 - general public.

Authors: Arnbjörn Eggerz (supervisor and author) and Timmothy Robb

## About Arnbjörn Eggerz

Arnbjörn Eggerz, the managing director of Iceventure has 10+ years of experience in business development, business consulting, new technologies (focus SaaS/Cloud technologies, battery technology) having worked on projects in Germany, Austria, Italy and Iceland.

Competencies and fields of service include SaaS, electrochemical energy storage, financial services (Fintech), innovation processes, digitalization and national/local innovation systems.

As part of the business activities he frequently edits reports about technology impact or the impact of major events on the economy. He blogs on <u>www.iceventure.de/blog.html</u> where examples of articles can be found. For example an analysis of Tradeshift, an introduction to the German ecosystem, the sale of Wunderkind and some coverage of the Euro crisis as well as the business model issues of second life use cases. He interviewed e.g. Philippe Botteri and Ari Helgason on SaaS. We have been reposted/featured by e.g. Blick Log (award winning German financial blog), Griechenlandblog and by Tradshift's Christian Lanng (on Twitter).

### About Iceventure

Iceventure offers business development and business intelligence on the German market for German and foreign companies and often deals with aspects around market entry questions.

The credo is that the 21st century with the raise of the network economy and data availability requires a new approach to consulting. It requires connected thinking combined with excellent analytics of sectors and drivers of dynamics as well as an understanding of propositions of individual actors and decision makers.

We are active in the field of SaaS/Cloud (10 years), digitalization and energy storage (business side) for 6 years. We also address topics of energy storage and digitalization like the use of Blockchain in grid connection scenarios or the effects of machine learning/digital twins for batteries.

An example of one of our activities: We are co-founders of the "Batteriestammtisch", a regular networking event on electrochemical energy storage in Munich and beyond. The meeting is now entering into the 5th year and its 16th appointment. Speakers (and guests) range from the industry and research (e.g. among others BMW, Audi, Wacker, Bosch, M. Braun, GE, TU Munich, LH Landshut, Ludwig-Maximilians-Universität Munich, Fraunhofer, SGL & ZAE).

www.iceseminars.eu/batteriestammtisch.html