Evaluating the Use of Amy Webb’s Methodology as Technological Forecasting Tool for the Disruptive Innovation

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Abstract

Technological forecasting has been widely acclaimed in recent years by management practitioners as respond to the highly competitive global environment. On the other hands, disruptive technologies are being praised as a technological innovation which allows revolutionizing how society trades and interacts. However, before it can become mainstream, the use of forecasting methodology in any future study with high validity is required to make a better decision for the future of this technology in the disruptive innovation context. The core objective of this thesis is to evaluate Amy Webb’s Methodology use to forecast the future of disruptive technologies. The methodology has been used by Future Institute for 10 years to aid in the forecasting of several emerging technologies and released for public in 2016. As a start, I reviewed the forecasting methodology of Amy Webb presented in her Book “The Signal Are Talking”. Moreover, an evaluation model has been developed based on a literature review to guide the evaluation process at end of this thesis. Next, forecasting “The Future of Blockchain” is used as a context to examine our forecasting methodology. Six steps funnel are applied as a concrete framework on how to find a trend and take actions based on a strategical foresight. Finally, several characteristics of an ideal forecasting process are used as instruments to benchmark the use of Amy Webb’s methodology to forecast the future of a disruptive innovation.

Keywords: Forecasting, Blockchain Future, Future Scenarios, Strategical Foresight, Trends analysis, Evaluating criteria, Validity.
“First of all, I would like to thank my supervisor, Marko van Eekelen for his advice and input over the last couple of months, he has guided me with invaluable feedback to accomplish my work. He used to review my thesis progress, give his suggestions and made corrections. Many thanks also to Dr. Harald, my second supervisor, he also invests some time to review my work. Writing this thesis and completing my master would not have been possible without my family support also during the past six months. In particular, I am indebted to my wife Haif, for her constant moral support and inspiration during the whole period of this master.”
## Contents

Abstract .......................................................................................................................... 2

Acknowledgements ......................................................................................................... 3

1. Introduction .................................................................................................................. 6
   1.1. Future Studies Background ......................................................................................... 6
   1.2. Research Context ......................................................................................................... 6
   1.3. Problem Statement .................................................................................................... 7
   1.4. Research Questions ................................................................................................... 7
   1.5. Research Design ....................................................................................................... 7

2. Framework for Evaluation ............................................................................................ 9
   2.1. Overview .................................................................................................................. 9
   2.2. The Attributes of An Effective Methodology .............................................................. 9
   2.3. The Evaluation Criteria .......................................................................................... 11
   2.4. Validity & Generalizability Criteria .......................................................................... 12

3. Forecasting Methodology Explained ........................................................................... 13
   3.1. Six-Steps Framework for Future ............................................................................... 13
   3.2. Methods & Tools in The Forecasting Process .......................................................... 14

4. The “Future of Blockchain” As Case ......................................................................... 17
   4.1. Scanning the Fringe ................................................................................................ 17
   4.2. Identify the Trends Patterns .................................................................................... 25
   4.3. Validating the Trends Patterns ................................................................................ 29
   4.4. Estimating the Trend Arrival ................................................................................... 32
   4.5. The Future Map of Blockchain ................................................................................ 39
   4.6. A Strategical Foresight for Action ....................................................................... 46

5. Evaluating the Forecasting Methodology .................................................................... 48
   5.1. Data Collection ........................................................................................................ 48
   5.2. Processing Tools ...................................................................................................... 49
   5.3. Forecasting Methods ............................................................................................... 50
   5.4. Forecasting Bias ...................................................................................................... 51
   5.5. Data Output ............................................................................................................. 52

6. Validity & Generalizability ......................................................................................... 54

7. Discussion & Conclusion ............................................................................................ 56

8. References ................................................................................................................... 60
   8.1. Academic peer reviewed references ....................................................................... 60
   8.2. Other references ..................................................................................................... 63
1. Introduction

1.1. Future Studies Background

In recent years, the interest to study the future of emerging technologies from various methodological perspectives has been increased especially the case with disruptive technologies. The high interest in the academia was derived by the market as the impact of strategic decision-making increases, *Coates L, et al. (2001)*. Leaders at the corporate and industry levels are always looking for a tool or a guided process to evaluate and adapt the concepts made by researchers to discover, examine or propose possible futures of a technology. In case of disruptive technology e.g. blockchain, the organizations need to stay engaged to minimize surprise and catch up with continues technological competitiveness. On the other hands, research on forecasting the future is extensive and includes studies that have tested alternative methods to determine which ones are most effective in this field.

1.2. Research Context

Novel innovations are one of the basic means of surprising competitors or of disrupting the ways of how things work. In the past, the source of disruptive innovations was limited to a number of tech giants and some national laboratories. In these days, the number of these sources increased dramatically everywhere and decision makers are concerned with the high impact of disruptive technology that could trigger unexpected sequences in economy and society. Based on this fact, technological forecasting methods are harnessed to create a strategical plan to minimize surprises caused by the disruptive technologies. The current concerns are not to predict an accurate path of a technology future but rather to create a well-argued believes of the potential futures and use them as a tool to minimize the unexpected surprises. Understanding this problem means we should pay attention to the forecasting methodologies that used to identify the disruptive technology trends driven by market demand. In this thesis, we discuss the ideal characteristics and criteria of a good forecasting methodology and use them as instruments to evaluate an existing methodology to examine its ability to forecast disruptive innovations.
1.3. Problem Statement

Because there is no concrete method to ascertain directly the truth of future anticipation before its defined realization time. The knowledge that concerning futures of disruptive technology can be nothing else than well-argued or well-justified beliefs, though we cannot construct our arguments based on ‘truly’ justified or ‘truly’ argued beliefs, *Kuusi et al. (2015)*. However, some futures studies present a linear progression of recent developments, weak signals, and trends that justify only high probability future scenarios without considering other facts that point in another direction. This is the case with traditional forecasting methods. It is argued that these types of one-sided justifications do not deserve the name ‘Futures Research or Study’. We should base our futures studies on the ‘whole picture’ of relevant futures and trend analysis using a ‘sound’ scientific method, *Kuusi, O., Cuhls, K., & Steinmüller, K. (2015)*. The forecasting methodology of Amy Webb is well known in the market and designed to identify the trends in science and technology based on the whole picture of the future. However, at the time of this writing, there is no evidence that the whole picture generated by Amy Webb’s methodology can provide a meaningful value for the disruptive technology field. For this purpose, we need also a common understanding or conceptual knowledge to evaluate the forecasting methodology and its generalizability to forecast the future of any disruptive technology.

1.4. Research Questions

While the first part of my paper is to forecast the future of blockchain using the approach of *Webb, A. (2016)* methodology, the main focus of the second part is to address the following concern: Does the approach used in the forecasting methodology of *Webb, A. (2016)* meets the requirements of a scientific future research with consistent reasonings or appropriate methods to forecast the future of a disruptive technology with high validity results? In other words, does this methodology serve as instruments for futurists to forecast the whole picture of a disruptive technology?

1.5. Research Design

The purpose of this thesis is to assess the forecasting methodology of Amy Webb using a case in the disruptive technology field. This includes the associated research goal, evaluation, analysis, and finally the generalizability. In this respect, it is argued that the research design for methodology
testing using a case has at least five components Løkke, A. K., & Sørensen, P. D. (2014). The main components of my research design are explained in Table.1.

<table>
<thead>
<tr>
<th>Research Part</th>
<th>Purpose</th>
<th>Action</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Goals</td>
<td>State the point of departure: Problem statement, Context, and research questions.</td>
<td>Selecting the forecasting methodology, a case to test the methodology and other conceptual analysis for evaluation and validity.</td>
<td>Analytic strategy, “Future of Blockchain” as case, a framework for evaluation.</td>
</tr>
<tr>
<td>Pre-data Collection</td>
<td>Prepare for the analysis phase, working on the forecasting methodology itself.</td>
<td>Expand clarification of the methodology and future methods used in the forecasting process.</td>
<td>Minimum data/facts requirements for the process.</td>
</tr>
<tr>
<td>phase</td>
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<td></td>
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</tr>
<tr>
<td>Analysis Phase</td>
<td>Linking forecasting methodology with data.</td>
<td>Apply the Forecasting methodology, conduct the trend analysis (step 1-4), produce strategical foresight (step 5-6).</td>
<td>Findings relative to the forecasting methodology. The whole picture for “Future of Blockchain”</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Evaluating the forecasting methodology use for the disruptive technologies.</td>
<td>Compare the ideal attributes of a technological forecasting methodology with Amy Webb’s methodology.</td>
<td>Comments and conclusion on the approach’s ability to meet the evaluation criteria.</td>
</tr>
<tr>
<td>Validity &amp;</td>
<td>Evaluating the outcomes.</td>
<td>Discuss the factors that affect the validity of a forecast using six pragmatic criteria.</td>
<td>Comments and conclusion on the validity of the forecasts.</td>
</tr>
<tr>
<td>Generalizability</td>
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</tbody>
</table>

*Table 1: The elements of research design*
2. Framework for Evaluation

2.1. Overview

Many books and academia discussed the quality problems of forecasting methods when they are used as a practical activity by futurists. There is a lot of forecasting systems in the market and many of them are incapable of forecasting extreme scenarios those might be useful with disruptive innovation. The journals and future institutes such as the international Millennium Project, The European Journal for Futures Studies, The Committee on Forecasting Future Disruptive Technologies, and Task Force Standards’ (Taskforce zu Gütekriterien und Standards, TFS), have used their own platforms to discuss the good practice of a forecasting methodology. There is a lack of sharing the general understandings of ideal attributes for forecasting systems, especially in the case of disruptive technology. We will discuss the ideal characteristics of a forecasting methodology proposed by several future studies and use them as criteria for evaluating Amy Webb’s methodology.

2.2. The Attributes of An Effective Methodology

The main factor of a successful forecast is the quality of data used as input. Data is the backbone of the forecasting methodology. Vanstons (2004) provided a useful discussion in this area. He identified the main characteristic of data credibility and defined many criteria to assess data types derived from expert opinions. The expert or futurist should be qualified to provide the required information for the forecasting methodology. A consideration for data bias, relevancy, completeness, diversity of expertise, and gathering techniques should be clearly mentioned in the methodology. Some argue that the future of a disruptive technology is too complex to use only traditional forecasting methods such as statistical techniques. We should depend on experts’ opinions as qualitative data sources besides the quantitative as well to generate the forecasts. A combination of these data sources in one approach will require a wider range of data gathering methods and increase the accuracy of the final product (in our case: future of x), Vanstons (2004).

The forecasting tools and models are an important factor also to an effective methodology. A combination of qualitative and quantitative methods will help to reduce bias and explore a range of possible scenarios of a disruptive technology. There are several types of forecasting
methodologies: intuitive methods, trend analysis, models and scenarios, Gentry, L. et. Al (2006). Intuitive methods focus more on expert opinion to forecast the future and typically from an expert have relevant knowledge to the same field. However, this type of methods is vulnerable to individual bias, which could be minimized by involving a panel of expert’s opinions in the process. Therefore, increasing the diversity of experts could help to increase the accuracy of forecasts. Trend analysis using historical data as input to gain a better insight into the possible futures. We assume that the future is a logical and linear progression of the present and we can extrapolate the trends using data at the fringe. Growth curve or S-curve (Kunznets, 1930) are used as technique to represent the trend path and when the technology is nearing maturity. Models methods on other hands claim that technology evolves as nonlinear progress because the future often follows complex, repetitive patterns (Porter et al., 1991). It is claimed that the old techniques will fail because the past can not be extrapolated to forecast the future of a technology. The last type is the scenarios methods which are used to understand the uncertain futures using a storytelling technique to explore how trends roll out into the real world. Creating a story using facts from fringe and perspectives of stakeholders will increase our understanding about the possible paths of a technology future. Backcasting is also an approach used with scenarios methods to explore alternative paths that lead to forming a concrete future, Holmberg, J., & Robèrt, K. H. (2000). Backcasting starts with all concluded possible futures and back to the current state at present to cast only the stakeholder’s concerns to build the preferable future. This will help to identify signpost, tipping points, enablers, and inhibitors of a trend moving toward the mainstream. Generally, when the potential impact of a disruptive innovation is relevant, scenario methods and backcasting are proposed as efficient strategy tool in uncertain and complex environments, De Reuver, M., Bouwman, H., & Haaker, T. (2013).

All above will be useless without assessing the data sources and expert’s perspective for what we call it: bias belief. The ideal forecasting methodology includes models or tools to reduce individual bias and other data sources bias. Skipping this process will produce blind spots and definitely will decrease the validity of final product (future of a technology). According to Faber et al. (1992a) ignorance is the main sources of the forecasting and individual bias, as result the outcome will be unreliable and causes disruptive surprises. Ignorance happen because the forecaster is unwilling to recognize some unknown outcomes or has no knowledge of his/her ignorance.
Identifying the best possible models and tools to collect the information and process them is only the first step to ensure successful forecasting outcomes. We should also consider presenting the output data in a clear manner after the processing phase to facilitate any further analysis. Several visualization methods that provide effective representing of the processed data are available. Visualizing the qualitative and quantitative data will help experts and crowd to recognize patterns, signals efficiently and effectively. Analysis tools for outputs in each phase should be also considered in the forecasting system. This includes escalating the signals, scenarios, and uncover the patterns from the collected data, Thomas, J. J., & Cook, K. A. (2006).

2.3. The Evaluation Criteria

Table 2 summarizes the evaluation criteria mentioned in the last section. We will use them as instruments to evaluate Amy Webb’s methodology by comparing our forecasting process with the ideal characteristics of a forecasting methodology use for a disruptive technology.

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria for Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information collection and data sources</td>
<td>The data that feed our forecasting methodology should be derived from diversity of experts and sources. It is better to have diversity of experts from different countries, educational backgrounds and different level of expertise. A diversity of qualitative and quantitative data sources like data from simulations, text mining, expert’s opinion and other data types. Involving the relevant historical data and current data as well, consideration to avoid data overload.</td>
</tr>
<tr>
<td>Combining multiple forecasting tools.</td>
<td>A combination of new and traditional forecasting methodologies that use both quantitative and qualitative techniques. A particular attention to use backcasting tools and novel methods to involve more participants opinions in the process.</td>
</tr>
<tr>
<td>Processing tools.</td>
<td>The system should incorporate tools that assess impact, threshold levels, and scalability; detect outlier and weak signals; and aid with visualization. Particularly we should measure the ability of the forecasting methodology to:track the trends, identify the enablers and inhibitors of trends arrival toward the disruptive or mainstream, the demand factors on the disruptive technology, signal detection methods, and link analysis tools.</td>
</tr>
</tbody>
</table>
The ideal forecasting methodology include models or tools to reduce the bias to give a complete insight of future and avoid false assumptions. The forecasting methodology should involve methods for escalating the signals, scenarios and patterns. Both qualitative and quantitative data should be presented in an intuitive format to make it useful for expert or team of forecasters for further analysis.

<table>
<thead>
<tr>
<th>Tools to reduce bias</th>
<th>The ideal forecasting methodology include models or tools to reduce the bias to give a complete insight of future and avoid false assumptions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data output.</td>
<td>The forecasting methodology should involve methods for escalating the signals, scenarios and patterns. Both qualitative and quantitative data should be presented in an intuitive format to make it useful for expert or team of forecasters for further analysis.</td>
</tr>
</tbody>
</table>

**Table 2. Six developed criteria to evaluate the forecasting methodology**

### 2.4. Validity & Generalizability Criteria

Basic meaning of validity is that the acquired knowledge of possible futures is valid and based on facts, hypothesis and well-constructed methodological approaches. Futurists must also distinct between high quality and low-quality outcomes of a future research. The suitable type of validity in future studies is the pragmatic (criterion) validity as discussed by Kuusi, O., Cuhls, K., & Steinmüller, K. (2015). This includes evaluating the quality of forecasting methodology from external validity perspective which focus more on evaluating whether the concluded future scenarios are well constructed or not. The definition of outcome validity as per Stanley and Campbell (1966) is the generalizability of a theory outcomes. In the futures study, it is means that there is sound reason to generalize the outcomes from present/past facts to futures relevant conclusion. Therefore, the results (e.g. in our case: future scenarios of blockchain) are supported by facts, perspectives and observations to uncover the megatrends, insights, weak signals etc. Moreover, the pragmatic validity increases if the relevant stakeholders (e.g. decision makers, or managers) can use it. For that purpose, Kuusi, O., Cuhls, K., & Steinmüller, K. (2015) suggested six validity criteria to check whether the selected forecasting methodology and results meets the minimum pragmatic validity criteria when comparing with other outcomes: [1] The number or scope of possible futures that might be relevant from point of view of acceptable futures or the vision. [2] The most relevant possible futures are identified. [3] All kinds of relevant facts are covered and interpreted by the identified futures. [4] Causally relevant facts are effectively interpreted with as few scenarios as possible. [5] The results are understood by more customer, actors, or decision makers. [6] The results or proposed scenarios are better understood by the key users/actors and they can benefit from them. We will use these criteria later in this thesis to validate the quality of our methodology’s outcomes.
3. Forecasting Methodology Explained

3.1. Six-Steps Framework for Future

The Forecasting Methodology used in this paper is developed by Amy Webb, the CEO and founder of Future Today Institute\(^1\). The Methodology involves six steps process using a systematic way to identify the “future of x”. The first part of forecasting method involves scanning the trends to discover the patterns and the last two steps inform a strategical foresight for action. A basic definition of trend described in chapter 2 of Webb, A. (2016 p. 32-33), as “a new manifestation of sustained change within industry, the public sector, or society, or the way we behave to each other”. The six steps funnel are illustrated below in Figure.1. This approach has been employed by many decision makers to examine the intersection of trends, perspectives of ecosystem players and regulatory environment - e.g. governments and consortia. First, we should visit the fringe of blockchain developments at the present, then find the hidden patterns and uncover the possible trends of blockchain. The trend analysis process includes calculating the ETA of blockchain (Estimate Technology Arrival) and direction: where is it heading and how quickly will arrive the maturity? The last step: probable, plausible and possible scenarios will be developed giving a use case to create a salient strategy at the present. In this paper, we will use some concepts like ‘foresight’ or ‘strategical foresight’ in the forecasting methodology and validity discussion. Foresight the future refers to similar broad concept of forecasting but focuses more on the pragmatic aspect of future studies and involve a systematic debate about all possible futures, Cuhls, K. (2003)

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3.2. Methods & Tools in The Forecasting Process

Historically, Hudson L (1967) introduced two different kinds of reasonings in the future study: Convergent or Divergent thinking or skill. Basically, the future studies focus on learning and on new insights to bring many different ends. In order to describe the functions of each methods used within any cognitive methods of learning, a terminology is used for this purpose. Amy Webb developed a concrete terminology throughout the forecasting process to use these complementary ways of thinking in each step. The terminology used for this purpose is: Flaring & Focusing, while flaring is sourcing inspiration, or bringing ideas from a variety of sources to produce the well-argued belief of many possible futures. Focusing is more on how to investigate these ideas to take a decision (Webb, A. 2016 p. 156-157). We may think that future research with its focus on ‘What-
If’ question, would be more biased towards flaring thinking; however, this is not the case with the forecasting methodology. We alternate between flaring and focusing to facilitate different way of thinking and get exploratory, creative results rooted in data and fact we collect. Moreover, we depend on probabilities, numbers and rational assumptions as well. There is a range of methods/tools used to foster the flaring or ‘out-of-the-box’ thinking and other methods applied also to foster the focusing thinking in the forecasting methodology used in this research. Table. 3 below summarize these methods used in each step in the forecasting process with its related reasoning or way of thinking.

<table>
<thead>
<tr>
<th>Type of Reasoning</th>
<th>Step#</th>
<th>Methods/Tools/Models</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flaring/broadening</td>
<td>Step1:</td>
<td>“Value Networks” or “Fringe sketch” developed by Webb, A. (2016)</td>
<td>A visualized network of nodes (e.g. organizations) and relationships between the potential players that benefit the entire ecosystem of the technology.</td>
</tr>
<tr>
<td></td>
<td>Finding Fringe of a technology developments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focusing /narrowing</td>
<td>Step2:</td>
<td>CIPHER Model. By Amy Webb(2016) as novel model.</td>
<td>Help to narrow and uncover what we learned in the fringe (Link analysis of all information we have collected)</td>
</tr>
<tr>
<td></td>
<td>Spot the patterns from step1.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flaring/broadening</td>
<td>Step3:</td>
<td>“Availability heuristic” by Amos Tevrsky &amp; Daniel Kahneman (1973)</td>
<td>Take the contrarian view, leave belief bias, and determine whether the patterns are really a trend.</td>
</tr>
<tr>
<td></td>
<td>Ask the right question.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focusing /narrowing</td>
<td>Step4:</td>
<td>ETA Method, S-curve for trend path (Kuznets,1930)</td>
<td>Calculate the arrival timing of technology.</td>
</tr>
<tr>
<td></td>
<td>The right timing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Create Scenarios</td>
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*Table. 3: Two ways of thinking and Future methods in the forecasting methodology.*

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4. The “Future of Blockchain” As Case

The forecasting methodology of Amy Webb has been selected with which to compare the developed evaluation criteria in section 3.3 considering the ideal characteristics of the forecasting methods. For this purpose, we should attempt to forecast and track a specific technology arena of interest to society and governments. As stated previously, the forecasting instructions will be applied to explore the “future of blockchain” as a case. Scanning the fringe of a disruptive innovation e.g. Blockchain, needs a special consideration to study the vast ecosystem of companies, civil society organizations and cross-border governments, Tapscott, D., & Tapscott, A. (2017, June). In the first step, I will focus on the big picture of what these stakeholders of blockchain ecosystem are doing instead of scanning the narrow interests of individual players. The result of the future forecasts will be validated against the criteria in section 3.4 to measure the generalizability of this methodology. Below are the instructions followed Amy Webb’s book: “The Signal Are Talking” Webb, A. (2016, chapter 4 to chapter 9). The first part (step1-4) involves finding the possible trends of blockchain at the present and the last two steps focus more on the strategical foresight to inform what action a decision maker should consider. I highly recommend reviewing the blockchain glossary article3 before going through the case below.

4.1. Scanning the Fringe

The emergence of blockchain started by a little-noticed paper released by Satoshi Nakamoto, the creator of Bitcoin, and laid the groundwork for the research of Peer-to-Peer Cash System and open the space of blockchain for other innovators. The inspiration for this work did not come from nothing, Satoshi watched the fringe and act accordingly at the time when the financial crisis of 2007-2008 is about to happen. Satoshi realized earlier how dangerous is to keep the power with trusted third parties, and bitcoin blockchain will be the most effective technology to eliminate any forms of central government. In 2009, the Bitcoin made its first fully functional appearance, now nearly a decade later, this cryptocurrency is still valuable than most people ever thought, and the blockchain is advancing even further incredibly.

3 Blockchain Glossary, https://blockchainhub.net/blockchain-glossary/
This groundbreaking research of Satoshi was the result of further researches and developments in the financial world, the very industry that Bitcoin was created to make redundant. The result, many of the world’s biggest banks joined the R3 CEV consortium, the development organization in the financial world with more than 100 members to build a distributed ledger with great benefits for all its members. At the time of writing, a group of seven largest banks in Europe is already working on developing infrastructure to operate a new trade finance platform called (Digital Trade Chain). The new platform formed by HSBC, KBC, Natixis, Société Générale, Rabobank, UniCredit, and Deutsche Bank, and the aim is to make trade payments more efficient across Europe. Recently, more European banks have plans to join in 2018. More important to notice in the fringe, is what Fortune 500 firms are building in partnership with many universities research groups, the project called Enterprise Ethereum Alliance (EEA) with a continuously growing network of around 150 members. Among the many notable members are Mastercard, Microsoft, Cisco, Wall Street bank of JB Morgan, ING, Cornell University, and Toyota Group. EEA is building an open-source platform to enable a mass adoption of blockchain, and has recently announced the first of its kind standards development to be utilized by corporations for blockchain scalability. The non-finance organizations world is also getting engaged: Hyperledger, a project that coordinated by Linux Foundation, and other IT companies such as IBM, Intel, Cisco, SAP and many tech giants, with a total of 230 participating companies. The project has recently announced different production-ready solutions, for instance, Hyperledger Sawtooth by Intel, Burrow, and Indy, and all added to Hyperledger repository joining the IBM open-sourced “chain code” known as Fabric for smart contracts.

Another important development in the fringe is what group of the electronics and tech giants, such as Bosch and IOTA, are currently doing. They are building a blockchain infrastructure for enabling what is called these days “Fourth Industrial Revolution” era, Umeh, J. (2018). A revolution that makes “bits and atoms” together and thrives off massive amounts of data to enable humankind to collectively find solutions to our many problems like securing IOT world. These companies have recently initiated an alliance called Trusted IOT Alliance with other members like CISCO, BNY, Skuchain, Foxconn and Ethereum research lab ConsenSys, Vigna, P., & Casey, M. J. (2018). US government is also interested in this trend, funding a blockchain builder Factom to develop an IoT security solution, it is an evidence that this technology gets a noteworthy vote of confidence from
US government. Context Labs in Cambridge is achieving a similar work, building an open-data API for various industries to share data generated by IoT devices.

Global Phenomenon:

Trends, as per Amy’s theory are a signpost to the future. Governments and organizations must track them to create their preferred future. At the time we have a clear idea about the features and characteristics of this trend, a really big trend and not a macrotrend or discontinuity, we must be aware of how the future of technology is invariably shaped by external sources of change. Many wisdom governments such as Estonia, United Kingdom, Singapore, Dubai, China and EU countries understand this fact earlier and ventured out to the fringe. They took an early action to monitor the trend and engage in researches, conferences and opportunities to leverage the blockchain and its applications. More than 100 projects are being conducted in more than 50 countries around the world. IBM reported that nine in ten governments invest in Blockchain projects by 2018. Jun, M. (2018).

From the fact that the highest authority in our world is held by governments that possesses control to either suppress or expand a particular phenomenon, it worth nothing to scan the fringe of the cross-border impact of blockchain. Many solutions like identity verification for citizens, and electronic voting systems based on blockchain are being built in many countries including Ukraine, Estonia, and Australia. In a concrete example the case with BitFury, a startup based in Amsterdam is currently working on many projects with Georgian and Ukrainian governments to harness blockchain in pilot projects in state registers, public services, social security, public health, and energy, Smerkis, V. (2017). Georgia and Honduras attempted also to introduce blockchain technology to manage land registers. The United States is working to incorporate blockchain technology to record and share medical information, and the UK is pursuing research and development to apply blockchain technology to public services especially for customs. they running against the time to finalize this project soon as new Customs Declaration Service (CDS). Brexit is the reason behind these developments in UK, they need now to manage 363% increase in customs declarations with Europa, Botton, N. (2018). This implementation will motivate other governments to start seriously consider the use of blockchain for customs as the collaboration is required for blockchain customs border. China has great fringe to mention as well, Although the
government has banned Bitcoin all throughout September of 2017, it becomes now at forefront of the technology behind it by establishing hugely ambitious projects for e-government, Hou, H. (2017, July). China also announced a plan to build a “Blockchain city,” based on blockchain technology. Matrix AI Network, a Chinese open-source blockchain built with AI techniques and supports ML services and smart contracts, recently become the sole partner for China’s trillion dollars “One Belt One Road” initiative. (OBOR) project will be the largest infrastructure project that connects China and Asia to Europe and Africa maritime trade routes, the plan is to invest three trillion dollars in collaboration with 65 countries located on Silk Road. Matrix AI will act as the primary platform in both AI and blockchain for One Belt One Road initiative. The speed of developments of blockchain in EU is astonishing. A group of 22 European nations has announced a new partnership known as Blockchain Commission, to play a leading role in the development and roll-out of EU Digital Single Market, Digital Single Market. (2018). The commission has recently launched the EU Blockchain Observatory and Forum in partnership with ConsenSys startup for Ethereum. UK continues to collaborate within the digital applications and signed also the Digital Single Economy. This collaboration will help these countries to be ready for the roll-out of any systems based on blockchain methods and exchange knowledge as well.

*Developing World, Noteworthy Fringe:*

Although the great news and innovations of blockchain in developed worlds are appealing, but the most inspired will be the potential impact in the developing world. It is interesting for fringe thinkers to see how people of many developing world have high interest in blockchain. The paradox here is that while most of activities and actions are happening in civilized world, most (Google) searches on blockchain technologies are taking place in developing world, as we can see in the chart below in the case for Ghana and Nigeria.
The developments in Africa is perhaps more interesting, Bitland is initiative platform in Ghana using blockchain bitcoin to support the local authorities in undocumented areas lacking land titles. M-Pesa, a mobile innovation in Kenya which successfully furnished banking services to the poor people using blockchain mobile money, there are now 39 countries with the same form of mobile services for unbanked individuals. BitSoko is also another Kenyan company that uses an Android-based Bitcoin wallet to reduce the high transaction costs of other mobile money platforms. 

Dubai also joined recently the club and plan to become fully blockchain city by 2020 as part of Smart Dubai project. The rapid expansion of mobile technology in developing countries increase the hope of the investors in financial fields with mobile money solutions. Blockchain entrepreneurs are hoping that the spread of cryptocurrency mobile money solutions such as M-Pesa, will make no demand on proofs and banks to further help marginalized communities in developing countries.

Beyond the commercial arena, social innovation organizations such as non-profits and non-governmental organizations are embracing blockchain for humanitarian and philanthropic efforts. At the time of writing, UN World Food Programme (UN WFP) has successfully implemented the first blockchain pilot in Middle East where the world facing the biggest refugee crisis in history. They provide a voucher system to ensure that financial help surely reach its destination in the most difficult contexts such as Azraq camp in Jordan, Vigna, P., & Casey, M. J. (2018). This project aimed to disburse financial support using Ethereum to those in need in Jordan, as result a new initiative in Pakistan is built for same purpose. UNICEF and a startup called 9Needs worked on similar project to support transfers and financial tools in Serbia and other developing countries, del Castillo,
M. (2017). UN plans for doing the same partnership with another five to ten startups and according to Higgins, S. (2017) report, seven UN agencies are exploring and plan to use blockchain technologies to support their operations.

“Giving the current state of the world around us, we should define the future of the technology broadly, to predict what is possible”, Webb, A. (2016). At the time of writing, the scandal of Cambridge Analytica and Facebook bring some serious questions about the integrity of democracies in the digital age. Presidential Election in 2016 to Brexit cause concerns about how people seem to fall prey to blatant disinformation, many futurist thinkers have consensus that it is time to rethink about the data we producing. From these facts, tracking of our identity reveal angst in developed countries, in contrast, developing countries have exact the opposite case: too little identity data available for their citizens. there are around two billion people without any official proof or form of ID, this also includes more than 65 million refugees and this will lead to greatest risk factor toward human trafficking, Niforos, M., & Ramachandran, V. (2017). A financial technology entrepreneur J. Edge was the first mover to tackle this problem by creating a blockchain-based system called ID2020 to store the developing world’s children identities to protect them against vulnerability of child traffickers. Edge partnered UN and 50 tech companies to harness blockchain and solve the ID challenges. like Estonia, Indian government is groundbreaking example toward this trend also. India launched a system called Aadhaar, the biggest digital records for their citizens, and still attached to a massive, centralized database (1 billion IDs) where they can control. Similar efforts in Estonia which is in the same track to build digital ID system and interface it to wide variety of national services. The government is piloting blockchain based services with Nasdaq to harness the technology in their election using smartphones. Other example from Ukraine, the country will use E-vox for local elections. Just like bitcoin cannot be double spent, these systems ensure that no vote can be double checked.

The Value Network of Fringe

Amy Webb discussed several “Guiding Questions” as framework to create what she call it: Value Network of nodes (e.g. organization, countries, and individuals) and relationships of all what we found in the fringe. Who will be impacted? Who will gain or lose? Who will see this as a starting point to something bigger and better? The answers reveal a fringe sketch with nodes and connections, Webb, A. (2016). By asking those questions, we can build a general sense of nodes
and relationships as we can see in Figure 3 below. There are different periodic circles represented, now and later on in the long-term future. The center of this sketch represents what I think the early adopters and other related development, the potential adopters and developments plotted further away. Blue Circles are the direct answers of Amy’s guiding questions “WHO” whereas the red nodes are the hottest topic (wild card events) which in my opinion, will impact the diffusion of blockchain. Mapping and connecting the nodes in the fringe will reveals the blockchain ecosystem and a set of organizations and relationships to investigate at the fringe.
Figure 3. The fringe network of blockchain
4.2. Identify the Trends Patterns

The network value discussed in the previous section is a group of what I think are an interesting spot at the fringe that is directly or indirectly adjacently related to the future of blockchain. The second step of Amy’s methodology is to dig more and observe what we found in the fringe and create the connections which aim to forecast the future of a technology. A concrete process of observation and analyze in a systematic way is used to identify the patterns of the signals from the fringe, Webb, A. (2016, p85). Zooming out the fringe will be important also to observe other sources of change and what stockholders of the ecosystem are trying to do, that will help us to uncover more patterns. But how to bring the hidden patterns to the surface? Amy Webb introduced a model called CIPHER, a pattern identifier analogy to decrypt and find the hidden patterns in this process.


(C) Contradictions. Identifying the trend when two things succeed or fail together, in this case, they both will track the opposite direction, or when things go in the same direction, the reverse case will be true. An example of the recent technological advancements in our car such as Wi-Fi speaker, that distract us and causing more accidents. While the logic is that these advancements would dictate that the opposite is true - fewer accidents.

(I) Inflections. When something suddenly happens to motivate the acceleration in emerging development and research.

(P) Practices. When a new emerging technology threatens an old orthodoxy of a product design, a mindset of people, or habit.

(H) Hacks. When someone is creating the off-label design of something which becomes more useful for people, more intuitive and easier to use.

(E) Extremes. When people or organizations are truly pushing boundaries to break new ground or pursuing a research or idea no one else have ever attempted before or they are theorizing a new way to build, explore, see, manipulate, or replicate something that already exists.

(R) Rarities. When something is unusual or unique that seems meaningless for people, but actually solve fundamental human issues and support some elements of society.
Now, let “reverse-engineer” the blockchain developments for almost a decade and CIPHER the nodes and connection from the fringe network discussed in the previous section. In this section, I spot only the patterns that I believe will shape blockchain trends and impact its mass adoption.

*The Emergence of Stewardship: Collaboration is The Key:*

A “Stewardship” means that a group of organizations are collaborating, identifying common interests and creating incentives to act on them. This term used initially by *World Economic Forum* in their White Paper to discuss the early emergency of stewardship amongst multi-stakeholders of Internet ecosystems, *Tapscott, D., & Tapscott, A. (2017, June).*

Blockchain emerged in the wake of financial crisis and the revolution of Bitcoin, creating an *(I) Inflection* among the financial institutions around the world, those who find themselves continually barraged by external innovations they are often unable to internalize. Many futurists recognized parallels between Bitcoin’s emergence and the software development witnessed during the early days of the Internet era, sensing a similar enthusiasm for a new, decentralizing architecture, *Iansiti, M., & Lakhani, K. R. (2017).* The result, a group with hundreds of biggest financial firms and tech companies are working together to build blockchain based platform such as R3 CEV and Ripple. These developments will lead us to one notable pattern in the fringe that is not technological in nature: A growing number of organizations that are looking to develop blockchain solutions as part of consortium, alliances, and networks in many arenas. The finance and non-finance corporates around the world, to me, appeared to *truly push boundaries to an (E) Extreme to create new* open source, standardized versions of blockchain for many arenas and enter the blockchain ecosystem easier. Hyperledger, Trusted IoT Alliance, EEA, and other consortiums of organizations that are invariably collaborating for the blockchain protocol that forms the basis of the financial services industry of the future and common standards for Fourth Industrial Revolution.

A cooperative process of many stakeholders’ dialogue and collaboration can go a long way in helping new technological systems develop in a socially beneficial manner. Exactly like the early days of “Internet of Information” era when many consortiums agreed on standards like TCP/IP and HTTP, to make the Internet more scalable and readier for prime time, *Tapscott, D., & Tapscott, A. (2017, June).* With blockchain, it is clear that this industry-wide collaboration among the players of blockchain ecosystem is also critical to speed the adoption and scalability of blockchain. From
my point of view, this trend is a favored way of gathering wider momentum for blockchain to agree on standards to build economies of scale with greater efficiencies.

*Disrupting the Old Governor Dominance*

It is a robust functionality of this technology that has caught the attention of biggest governments in the world, as we can clearly notice at the fringe network: EU, China, India, US, India and other countries around the world are running pilots or *Practices* in many arenas. This is because blockchain is “a new emerging technology threatens an old orthodoxy” of government services for identity, voting, supply chain, health and many more services that traditionally provided by nation-state. Ultimately, there will no doubt be of great value of this trend to adopt blockchain on much quicker and in a wider scale. However, while western governments continue to lead the world in blockchain mass adoption, awaiting more standardization and other formal oversight bodies such as ICANN and W3C for Internet era, their dominance is now being challenged by new strong players from Asia and developing countries, *Tapscott, D., & Tapscott, A. (2017, June). The Internet revolution and other technological innovations were distinctly dominated by western governors and organizations, however, with blockchain era, we reach a staggering *Rarities*: many developing countries from Asia and Africa are currently leading this technological movement as we can notice at the fringe. We’re hearing of pilots and exploratory investigations into blockchain applications by government agencies worldwide, not just in the big economies of the United States, the European Union, Japan, and China, but also in countries as diverse as Dubai, Georgia, Sweden, Estonia, Mexico, Singapore, and Luxembourg. Joichi Ito said, “I do think there’s already a big push to make governance of blockchain non-American and international from the beginning because that’s one thing we learned from ICANN, that it’s hard to get out from under America once you get started as part of America.”, *Vigna, P., & Casey, M. J. (2018)*. Thus, for global adoption to occur the technological revolution should be international in nature. China, for example, has recently made blockchain a pillar of its economic strategy and is pushing the industry to collaborate on emerging standards. This will ensure that the incentives are adequate for distributed mass collaboration, that make the technology ready for prime time.

The fringe reveals also that the countries have varying levels of certainty around the potentials that this technology could have on public and private sectors. However, if we zoom out again to have
a more narrative look at the blockchain developments in these nations, we can conclude succinctly that “Governments like The Blockchain but not The Bitcoin”. It is another (E) Extreme that these countries “are currently theorizing a new way to build, explore, see, manipulate, or replicate something that already exists” A. Web (2016). This means that governments are interested more on what some researchers call it: Blockchain 3.0 applications. This generation of Blockchain has emerged for specific real-world problems like securing IOT world, land titles, National Identity Systems, voting, and several public services. On other hands, this is another clear (I) Inflection, the third generation of Blockchain are emerged and developed by many consortiums to overcome the key issues of the original blockchain (Blockchain 1.0 or Bitcoin) and Ethereum (Blockchain 2.0), with regard to transactions issues and power consumption. Another noteworthy trend here is that while a number of countries like China, India, Russia, and UK that have either banned or introduce strict cryptocurrency regulations. People would think that this trend will impact the blockchain future negatively, however, the truth is that these countries are among of the vocal proponents of blockchain as we can clearly recognize from the fringe developments, it is an astonishing (C) Contradiction. The tough stance on digital currency does not stop the rising trend of exploring and implementing the technology for many governmental services, this reveals that blockchain is still evolving rapidly beyond the financial world and cryptocurrency.

Social-Good Blockchain & The “Toothbrush Test”

The term 'toothbrush test’ is a great guideline to make sure a new product or service will become a new norm and critical to our daily workflow. As mentioned in the last section, the blockchain futurists are most inspired by the potential impact of this technology in the developing countries considering the high figures of unbanked and unregistered populations. That’s because it’s not just the matter of powerful technology for privacy and maintain people’s data, but it is matter of changing a way of life, build trust in countries which is a vital step for building social capital. There are 80 million of refugees, 2.4 billion without official ID and almost the same number for unbanked population in Asia and Africa. Connecting these figures with the fact that blockchain is evolving rapidly in the developing countries, reveals how blockchain is inconspicuously becoming the “toothbrush” these communities cannot leave without. This will support the assumption discussed in the fringe that blockchain will move beyond the hype to mainstream soon in these countries, as the technology delivers increased
efficiency and reliability to the people that need it most. In more concert example, the case with M-Pesa, ID2020, and WPS for refugee discussed in the fringe network. These intuitive projects are a great evidence that blockchain has the enabling conditions for its mainstream in micro-level of society and particularly in the developing world. Beyond the commercial arenas, the social innovation organizations and non-profits organizations like United Nations bodies, are creating clever (H) Hacks in the humanitarian sector, by harnessing the technology to create off-label solutions for feeding and securing millions of poor people around the world. An example mentioned in the fringe is the use of Ethereum as voucher for refugee as part of World Food Program. M-Pesa also leverage rapid expansion of mobile usage in the developing world and create off-label usage of blockchain-based systems for mobile money. This trend expands to 39 countries with 271 deployments of mobile money services and aim to overcome the expensive banking system in Africa and other developing countries, Zambrano, R., Seward, R. K., & Sayo, P. (2017). These examples show how we can create off-label solutions for humanitarian and philanthropic in many underdeveloped countries to enable their economies and give billions of people their first chance into the economic opportunities available for developed world.

4.3. Validating the Trends Patterns

After steps one and two of Amy’s methodology, we have trend candidates by applying CIPHER as patterns identifier and casting a wide fringe network of blockchain developments. Now it is important to investigate deeper on knowledge and assumptions we have, asking a critical question and challenging what Amy call it: “our biased beliefs”. The reason is that when the trend comes wrapped in a catchy phrase, such as: “blockchain for everything”,” The disruptor of everything”, the entrepreneurs, leaders and investors will leap to a decision which may not accurate and assume that this technology will jump across industries, organizations, and scale at the same way of e.g. Internet. Under this situation, researches and futurist thinkers would heavily weigh their judgements on more recent information or similar situations - e.g. comparing the beginning of Internet with blockchain - to conclude a result making our opinions biased toward that trend. Shredding a potential trend and challenging the knowledge and assumptions is the third step of Amy’s forecasting theory, A. Web (2016). Many concepts and
terminologies of individual bias introduced and discussed implicitly on how to avoid data sources bias. She developed an inclusive method in form of quidding questions to mitigate these sources of bias and answering these questions (as stated in her book, chapter 6) will definitely help the futurist to avoid what she calls it “belief bias” and as result will increase the validity of the forecast. This process needs a deliberate disagreement to move our past belief bias about a technology, or having contrarian points of view, by answering this question: “What would have to be true in order for blockchain to prove out as a manifestation of sustained change within society, industry, or the way we behave toward each other?”. In order to answer this question, we should break the big concepts down into smaller parts and see if we could prove each one wrong, and poke holes in our hypothesis, Webb, A. (2016). As I discussed in the last section. Blockchain technology is slowly creeping into many people everyday lives and becoming a vital piece of it in some use cases. From WFP for refugees and remittances with M-Pesa in Africa to Identity solutions supported by UN and other governments like Estonia and India, blockchain’s influence can already be observed today in those people daily lives. Blockchain is under construction to change the fundamental operations of many systems and will be mass adopted globally across many arenas such as IOT, energy, smart cities, government services and other operations of our infrastructure. Remittance by itself proves how much the financial benefits can blockchain makes in the daily lives of people in developing world and so for Ethereum based vouchers for thousands of people in the middle east and Asia. The significant role of blockchain on securing 8 billion of our distributed IOT devices around the world as per IBM report, is another example on how this technology can affect our everyday life. Generally, I argue that the new generation of Blockchain 3.0 (beyond the currency applications) will definitely increase “people’s anticipation and their on-demand, experience in other unusual arenas” Amy Webb (2016). It is worthy to mention that even if blockchain is not the ultimate solution for some of these arenas, or failed in Proof of Concept phase in other arenas, it surely changes the behavior of many of us and the way of thinking, allowing many organizations, governments, and individuals to understand the problematic model of centralized norms. Amy Webb (2016) discussed also about whether this technology is seamless and easy to use that alleviates frustrations connecting people to services or product. It is argued that the concepts behind cryptocurrency and blockchain perhaps technically too complicated for mass adoption. However, it was also true for Internet era that the technical details of new technologies are not of interest of public
audience, Swan, M. (2015). For instance, it is not important for people sending an email to know about TCP/IP protocol. To overcome the “bias belief” we should make sure that the basic human needs being addressed for individual and society. Or, in other words, does this technology solve any human-centered challenges? From my point of view, the answer is: Trust, that is a vital social resource, the real lubricant of all human interaction, Vigna, P., & Casey, M. J. (2018). The financial crash of 2008 revealed what we know about the financial institution’s confidence game at that time. The scandal of Cambridge Analytica and Facebook also make us realize the failure of first and second generation of the Internet. Large corporate is simply taking control of the information while the core objective of Internet 1.0 was to build decentralization Net by share data directly. The real problem was a failure of trust. When that trust was broken, the impact on society was devastating. With Internet 2.0 era this failure was clear, giving the power to social media giants like Facebook and turn them into entrenched monopoly power. The core protocol of Blockchain holds promises to resolve the problems of trust with Internet era and enabling the community to control the exchanges of value and track transactions without a central intermediary like banks, The Truth Machine, Vigna, P., & Casey, M. J. (2018). To reduce our bias belief, we should consider the factors that make blockchain present a persist and sustained change within its ecosystem and not only a timely trend. In other words, does blockchain creates partnership opportunities with organizations that to benefit from long collaboration rather than compete with each other? Webb, A. (2016 chapter. 6, p.104). As stated in the last section, blockchain technology incentives new trend amongst big financial institutions and tech giants in the worlds to collaborate together in form of consortia and alliance – both allies and competitors. That are important signals but also a daunting task to build a new operating system for our global digital economy. However, some consortiums and alliances raise challenges because each company member has shareholders’ interest to work on and business priorities to meet. Initially, IBM for example was building a closed-loop business with hosting services of blockchain to feed the interest of its own. This fact will guide us to next concern whether the blockchain platforms that are controlled by a consortium and an alliance of the world’s biggest financial and tech corporations be incentivized to act in the interests of public? It’s worth nothing to mention that the members of early internet consortia realized the fact that the online global economy will never be powered by the closed loop internal networks or “Intranets” of the early days of networking business. It won through fully
open Internet made by TCP/IP protocol, *(Cerf, 2018)*. Although some platforms developed by these organizations, like Hyperledger Fabric, will ultimately be of a great value to the ecosystem of blockchain adoption. However, what so far done by consortiums seemed to be forming a model that more oriented to a permissioned type of blockchain. But the general public believes on the permission-less blockchain, that Satoshi Nakamoto aimed to build and it is incumbent upon all ecosystem players to ensure that the control over blockchain future should be a representative of broad-based interests.

4.4. Estimating the Trend Arrival

We discussed how trends are signposts to the future and we now can identify them using CIPHER method. However, identifying the trend is not the end of forecasting the future of a technology. We need to recognize where the trend is now along its developments path and evaluate how quickly is evolving to take the correct action earlier, *Webb, A. (2016 chapter 7. p.110)*. This step will afford a competitive advantage for the decision makers to identify the position of a trend and estimate a reliable arrival timing for the future of a technology. CIPHER the fringe as we have seen in section 4.2 reveals that the interest in blockchain technology continues unabated among organizations and governments with noticeable progress. However, the maturity timelines are still uncertain, this is because the estimation of a trend arrival is subject to the events in its path, like phone GPS *Amy Webb* argued. It will give us the first initial estimation of arrival time for a destination then this will decrease or increase if we slow down or speed up for some reason (events along the route). That is why tracking trend’s path and its evaluation is tricky when a technology reaching its mass in the marketplace. To estimate trend arrival, the same math will be used here that our phone GPS uses to calculate the time of arrival:

\[
\text{ETA (ESTIMATED TREND ARRIVAL)} = (\text{distance} \div \text{speed}) +/-(\text{events along the route}).
\]

The “distance” and “speed” refer to the internal advancements of a technology, additionally, we also consider the external variables that may affect the speed of a trend and therefore influence how society and business operate. In other words, we look out for “events along the route” *Amy Webb (2016, chapter 7, p.112)*. In this case, we can replace the previous equation to be like this:

\[
\text{ETA} = (I \text{ or Internal Tech Development}) +/-(E \text{ or External Events}).
\]
Estimation the blockchain timing need first to discuss the variables and facts that affect blockchain acceleration rate and its mass adoption.

The Internal technology development(I) or the advancements of blockchain’s development is the main driver of blockchain trend movements. Like other technologies, the evolution of blockchain from one phase to another – moving from Proof of Concept phase to prototype or from pilot to production – depends on its internal developments. The S-curve illustrated in the figure. 4 is often used by many technology futurists to describe a trend’s timing from fringe to its mainstream, and more importantly to identify the current positioning of a technology which could help to learn the lessons of past failures and successes, Webb, A. (2016). The movement of the blockchain trend as we will see, emerges between these waypoints with significant R & D advancements as result of a partnership between organizations, or active early adopters of blockchain.

![Figure 4 The Adoption S-Curve of Blockchain](image)

Calling the period between 2009 and 2014 where all solutions are bitcoin-based, a new era of blockchain technology began in 2015. More mature businesses using blockchain have entered the Proof-of-Concept phase with a hundred blockchain use cases. The explosion of ICO funding boost the developments and fueled interest in this technology, this attracts many early adopters to
embrace blockchain landscape, Holotiuk, F., Pisani, F., & Moormann, J. (2018). Moreover, approaching blockchain 3.0 applications opens the space to go beyond bitcoin and explore other arenas where blockchain looks primed to transform. We discussed already the rise of blockchain consortiums and alliances which act as ‘hybrid’ vehicle for collaboration to build open/public blockchain like Ethereum protocol and private/permissioned blockchain platforms. Deloitte Research Center estimated that there are more than 40 consortiums to date, most of them are focusing on the financial use cases, Deng, A. (2018).

Several consortiums are currently building platforms or what we call it ‘the blockchain’s infrastructure’ on which the blockchain applications will be developed to create its ecosystem. The leading camps of blockchain platforms at the time of writing are Hyperledger with its platform called Fabric, Ethereum Enterprise Alliance (EEA) and R3 CRV Corda. R3 consortia is focusing on financial world use cases while Hyperledger and Ethereum are exploring both financial and non-financial use cases as well. It is argued also that the lack of standardization and D-apps utilities would curb the progress toward the production and then to mass adoption of blockchain, (see more info about D-apps in appendix1). For this reason, these group of companies are working hard to develop decentralized blockchain protocols similar to internet protocols such as TCP/IP, HTTP, SMTP etc., Credit Suisse, Blockchain 2.0 (January 11, 2018). That are an important internal developments (I) to consider in this discussion.

On top of blockchain protocols, D-Apps are developed and a considerable progress toward this direction is done. That definitely will create a tremendous excitement among the stakeholders of blockchain ecosystem. So other early adopters are barreling ahead with piloting even though for time being the market has low interest as per Gartner CIO survey of 2018. We can hear about projects that are moving to pilots’ phase and just few cases to production. For instance, the case with UN, Bitfury, and Nasdaq projects. Bitfury is running a pilot for the governments of Georgia and Ukrainian, Nasdaq is piloting a voting system in Estonia. At the time of writing, UN headquarters also called other UN employees after the success of WFP to work on multiple pilots with governments like Norway on similar projects. Many pilots discussed in the fringe are an evidence that blockchain applications are now deployed by government entities around the world, but none are in full production with enterprise world.

Analyzing the extraordinary developments of these consortiums and crypto space will help us to map out what is the current state of blockchain in curve adoption, Miraz, M. H., & Ali, M. (2018).
World Economic Forum and Deloitte research center estimated that the years 2015 and 2016 are the years of ideation and proof of concept or building the evidence. My impression is that many blockchain use cases moved already beyond prototype phase to pilot or testing phase, but as mentioned, almost none are in full production as we can see in figure 5. As discussed before, wider ecosystem stakeholders of blockchain are beginning to involve themselves in blockchain projects. I expect that the next stage will be for governments and organization to implement blockchain applications next to the current legacy systems as first step before moving to full-scale production.

![Diagram](image)

*Figure 5, The current position of blockchain developments in trend trajectory.*

The internal developments of blockchain technology helps us to locate the current position of its trend in the S-curve path, however it is important to look for both part of ETA equation, as many organizations do not often look at the two together, *Amy Webb (2010)*. The next parts will focus more on the events and factors which are inhibiting or accelerating the blockchain growth rate.
Blockchain Adoption Roadblocks

To calculate where a trend is on its trajectory, we have to overcome our own belief biases which confirm the existence of future scenarios before we believe in its plausibility, Amy Webb argued. We have to calculate a trend’s ETA = (I) with (E). S-curve helps to visualize the blockchain adoption trajectory and the current position of its trend. However, S-curve does not illustrate the external events or barriers along the route or the roadblocks in the trend path that affect the technology’s evolution in a long-term scenario. This is the case with Gartner curve as well as we will see later in this section. To estimate the time of arrival we should consider the events as variables that impact the maturity of this technology. The more critical the variables, the bigger the roadblock, and the more time take the trend to reach its mainstream. We must look for example at social and cultural factors that slowed down the blockchain ecosystem adoption. Moreover, other factors create many barriers that need to be overcome before the tremendous value of this technology can be realized. Infosys, Breaking Barriers (2017).

Soon after Satoshi Nakamoto’s breakthrough, the general public caught on and began exploring the space of decentralized ledgers. It appeared as though that blockchain was a tech trend rapidly ascending the S-curve toward production point and entering widespread adoption throughout the mainstream society as discussed in the last section. However, there is a number of factors which stood to impact the sustainability of blockchain trend, and from my point of view, lack of knowledge and familiarity with this technology is the biggest hurdle in its trend path. First of all, it is necessary to shatter the misconception between blockchain and bitcoin or cryptocurrency in general, Jenks, T. (2018), argued that “This will help to remove the sometimes-negative undertones of Bitcoin and allow blockchain to stand on its own, which will lead to an increase in willingness to utilize the technology,” according to Bitcoin Magazine (Lielacher, 2018). Bitcoin is a poor store of value because of its volatility, and that reflects changes in the perceived levels of acceptance among the governments as we stated previously. Lack of awareness is even among leaders and CIOs who know the difference between bitcoin and blockchain, but not its value. Danielle Uskovic, head of digital & social marketing for Lenovo Asia Pacific, told Tech Revolution that “blockchain is an emerging technology that every global leader needs to have on their radar”. “The industry suffers from a confusion of terminology and unrealistic expectations. I believe that many parties in the industry lack a thorough understanding of the technology. There has been a lot of
hype with regards to the utility that Blockchain can realistically provide in different industries and use cases.” Author, G. (2018).

In their recent CIO survey, Gartner, the world's leading research and advisory company, reveals that we still far away from blockchain maturity and the main reason is the lack of familiarity with this technology. “Blockchain has complicated concepts”, said David Furlonger, vice president and Gartner Fellow. "It is critical to understand what this technology is and what it is capable of today, compared to how it will transform companies, industries and society tomorrow." The report points out also that the value proposition for blockchain remains poorly articulated and not clearly visible to the business (Gartner CIO Survey, “Blockchain Status 2018: Market Adoption Reality”). Gartner survey is based on hundreds of CIOs opinion about the blockchain status, and the last report pointed out that a considerable number of projects failed or started just as experiment in 2018. “This is the case when a technology has not fully formed at the convergence point”, Amy argued. Blockchain is still being developed and improved by a wide array of heavy-hitter corporations and governments, a futurist will easily notice from the facts that the technology is not heading fast to maturity point, instead dipping back toward a second convergence, Amy Webb (2016, p.119). Indeed, this view is broadly consistent with my argument about the blockchain is being developed beyond the cryptocurrency and that will change the trend path considerably. Beyond these badges, there are still incentives sustaining blockchain future and increase in funding for blockchain pilots as we have seen from fringe. Tech giants, financial institutions and governments around the world, are still paying top dollar to build out the commercialization future of blockchain and more focusing on application beyond bitcoin. But it should be clear for some early adopters that blockchain technology trend is still evolving, it is a gradual process after all, that required time and now it is immature in its implementation. There are many causes of these outcomes, and “the rapid rate of blockchain evolution is one of them” said Ray Valdes, Gartner Fellow. It was noticeable that blockchain moved in rapid fashion from POC to Piloting phase as we illustrated in S-curve progress with regards to the internal technology advancement. However, the results of Gartner survey contrast with the general view of the technology entering the maturity in rapid fashion. Gartner concluded that blockchain is “massively hyped”, as a result, false starts in blockchain implementation and calculating the timing wrong, and rash decisions will cause a complete refusal of this innovation and low interest. That are the core objectives of step four of
Amy Webb’s methodology which informs decision makers on the correct time of when to take advantages of the first movers and when to wait for further developments.

Estimate the arrival time

Calculating the timing of a trend arrival and tracking its trajectory is a difficult task when it comes to a technology that might reach its critical mass in the market. Gartner’s latest technology hype cycle has confirmed that blockchain is going to enter the “trough of disillusionment” but still remains in the peak of expectations region, Mirza, M. H., & Ali, M. (2018). They estimate 5-10 years’ timescale before it enters its mainstream (see figure. 6). However, it is argued that S-curve does not represent or visualize the events (E) and internal developments (I) along the way, Webb, A. (2016, chapter 7. p116). Gartner gives a reliable timing of arrival by surveying a wide range of experts in the market, but without any consideration for the facts discussed earlier in this section. We should recalculate the timing giving that blockchain is heading to another tipping point by entering many arenas beyond the cryptocurrency. We should also consider the roadblocks and the internal developments that inhabit or accelerate the adoption of this technology.

The future of blockchain is not clear. Some believe that the public blockchains or permission-less type will converge to one worldwide public blockchain like the Internet. While others believe that many private blockchains will remain, and just a few public blockchains will co-exist (World Bank Group, 2017). Today, an interoperability barrier exists although the internal developments (I) of blockchain are astonishing and many platforms are being developed to solve this issue, OECD.
The reason behind the interoperability issues is that the blockchain is evolving in many different ecosystems (Underwood, 2016) and consist of different networks with different policies, (Illgnier, 2017). I conclude that the blockchain will reach maturation earlier than what estimated with Gartner (5-7 years from 2018) giving the facts discussed earlier in this section. I argue a shift in classification from “5 - 10 years” to “2- 5 years” to reach maturation for many permissioned based blockchains. Whereas the tipping point for public blockchain (permission-less) to hit the mainstream market will be within “10 – 15 years” to be more mature technology like the open Internet. The reason is that the level of uncertainty is relatively high within the consortia and alliances about their ability to connect many blockchains in one standard protocol (interoperability issue) as short-term goals.

4.5. The Future Map of Blockchain

Our focus until this point of Amy’s forecasting methodology on how to interpret the trend signals and estimate its time of arrival. We discussed also the internal developments and external factors affect the trend’s motion on the adoption S-curve. The logical next step in the forecasting process after determining where a trend is on its path, “is to follow a concrete framework to generate scenarios that provide the strategists and decision makers with various possible futures of a trend”, Amy argued in her book, Webb, A. (2016, chapter. 8, p123). Creating the scenarios will help to inform a strategy to take a decision at present and set a course of actions for an emerged trend. Next, we need a “Pressure-Testing” for our strategy considering the implication of our actions, Webb, A. (2016, chapter.9). The last step of Amy’s forecasting theory is to ensure that the strategy is extensible and the desired future is achievable. The scenario method or simulating of possible futures of an emerged trend, is one of the methods that widely used in the Foresight methodology as we will discuss later. Scenarios are “storytelling” to illustrate visions or aspects of probable, possible and plausible futures, to reveal the options we have and their potential consequences, Webb, A. (2016, chapter. 8, p125). Scenarios are also tools to have more insight about the facts using a formula “If this, then that”, and create hypothesis to interpret how an emerging technology trend will impact governments, enterprise and entire society, (Tankersley, 2018).
**Future Cone: A Framework for Scenarios**

Scenarios were first utilized by corporations like the case with Shell in the 1970s as the planning became more complex and to create a competitive advantage for oil shock happened in the market. Scenarios have since been harnessed as a tool for industry to analyze the competitive decisions and take the right strategic foresight for a technology, *Hanson RT, Reeson A, Staples M* (2017). Therefore, scenarios help decision makers to consider the range of futures and understand the course of actions by giving a distance from the present and open the alternatives futures, *Godet and Roubelat* (1996, 166). When organizations, governments and other stockholders of blockchain ecosystem want to understand the emerging future of this technology and its implications, scenarios are a powerful tool to simulate the impact of different strategical decisions. Those in charge of making decision will inevitably want to find out which one of these future scenarios will happen if we consider the information we have at present, *Amy Webb* (2016). The last two steps of Amy’s forecasting instructions are focused more on how to create alternatives of future scenarios by using a technique of storytelling and contextualize the facts we acquired (Internal developments & external factors) and the perspectives of all blockchain stakeholders. We can also frame our human emotion to understand the implication of our action; what we think strongly will or cannot happen in the future, what we fear might happen and what we would like to happen. I will adapt the following formula to develop the possible scenarios for blockchain future: IF [Facts, Perspective, Framing] ... THEN [OUTCOMES].

The first part – IF[Facts/Perspective/Framing]- helps to examine the intersection of trends in many levels such as technology development, human behavior, and government environment. While the second part - THEN [OUTCOMES] is used mainly for strategical foresight to set a strategy that makes the most sense and identifying emerging opportunities and risks, *(Tankersley, 2018)*. The purpose of future scenarios is to envision all possible scenarios and outcomes that will help us to make an informed strategy to take a decision at present. It is not to forecast something will happen as many futurists emphasized, ”The outcome is not an accurate picture of tomorrow forecast, but better strategical decisions about possible futures (Foresight)”, *Daum* (2001).

It is useful to distinguish three categories of future scenarios (adapted by Amy Webb and other researchers in the future studies). The first one: Possible Futures, this class of futures includes all that we can possibly imagine ‘might happen’ no matter when it will come. They could involve
knowledge which we do not acquire yet or might also involve a violation of the accepted principles or physical laws at the present. The second category of future scenarios is *Plausible Futures* which encompasses what ‘could happen’ according to our current analysis and scanning of fringe. *Plausible futures* can be concluded from the current understanding of physical laws or human interaction systems. The last class contains ‘most likely to happen’ future scenarios, and stem from the current trends that will continue without a considerable change, barring a wild-card event or unpredictable disaster. This category called *Probable Futures*. For instance, it is unlikely to imagine a probable future scenario that the blockchain players will relinquish their legacy systems, and adopt blockchain technology overnight. However, they will begin to shape gradually its ecosystem by creating consortiums, alliances and networks, moreover, they will test new platforms within the short-time frame. The three categories described above are focused on our cognitive knowledge and the data we are scanning at the fringe. However, some futurists consider a new class in their studies that help to set what we call them: *Preferable Futures*. By contrast to the previous futures classes, this will concern about what we ‘want to’ happen and what we feel emotionally will happen rather than cognitively, *Amy Webb* (2016), so it is more subjective than the other categories.

I will briefly discuss the mostly utilized framework in the future studies called *Future Cone* (used in our forecasting methodology also) to visualize all proposed ‘P’ futures (*Possible, Plausible, Probable, and Preferred*) of blockchain future and the related scenarios.

*Figure. 7, The future cone, this illustration used in Voros (2003), p.16*
‘P’ Futures of Blockchain:

The *Probable Future* scenarios as illustrated in figure. 7 are the smallest subset of possible futures. These scenarios are based on the continuation of the blockchain trend at present, and called “business-as-usual”. This area presents the linear projection of the present or current trend, and tend to describe what *most likely to happen* within a short time frame, *Amy Webb* (2016). Based on our analysis in step one to four, we can imagine a scenario, where blockchain remained private and closed within separate platforms such as Hyperledger and Corda while the tech giants and consortia are working hard on blockchain commercialization and interoperability matters. Generally, we can predict that within one to two years, a serious weeding of blockchain projects in the financial world as result of acting in wrong time and overestimation the effect of blockchain in short term and fail to meet the long-run needs and standard business benefit models. However, others who understand the fringe of blockchain and its transformational potential beyond Bitcoin in long-term will continue to forge ahead.

However, the nature of technological trends especially the case of blockchain with an unwieldy number of variables and external factors, may not continue from the current trends based on the analysis of fringe at present. Focusing on probable futures which considered as “most likely to happen” may lead us to a poor indicator of where our trend is headed afterward. *Herman Khan* (1982) is one of the most famous futurists argued that:” The most likely future isn’t” and stated also “The most surprising future is one which contains no surprises”. Futurists note that it is more important to focus on the critical factors and developments of the trend which could move trends in different directions, *(Marcus, 2009)*. Therefore, I will argue that *Plausible* futures are what we should focus on when we create our scenarios of blockchain trend and its strategical foresight. *Plausible* futures are characterized to have a relatively clear pathway from fringe to future, additionally, they are consistent with our knowledge acquired from our analysis of science and technology, *Bengston, D. N.* (2018). I will include also “wild-cards” or “disruptive events” scenarios (low probability but with high impact events), this should creat a huge benefit when a trend is for a disruptive technology like blockchain is diagnosed, *(Bell 1997)*.

Considering the facts mentioned on the fringe and perspectives of blockchain ecosystem players, we can imagine many plausible scenarios using the trend elements discussed in step 2 section 4.2.
One of the plausible scenarios is to imagine that many blockchain ecosystem players or platforms (such as Hyperledger and Ethereum) will be able to collaborate in an open standard but within a specific business purpose. Supply Chains, for instance, involve passing goods across many parties and we can imagine a scenario where many governments will deal with standards and smart contracts for this purpose. This means we will end up with an ecosystem of specialized chains, and utility chains in parallel. Although we will probably experience some dead potatoes because of inflation and deflation of bitcoin bubble in coming years as discussed earlier, blockchain players get excited because of the huge potential of blockchain.

As illustrated above, the Possible scenarios are the largest with a wide range of alternative futures. It may go beyond the limits of the Plausible futures considering “wild-card” scenarios also (highly unlikely with a low probability to happen) and “Black-Swan” events (unpredictable with devastating consequences), Taleb, Nassim Nicholas (2007). In this scenario, we can imagine the most radical unbounded futures, the best or worst cases ‘might happen’. This could be in our case, when blockchain will disrupt almost all the legacy systems of public and private sectors, achieve a high level of users’ adoptions, with a large scale to increase the trust in this technology. We can imagine with Possible scenarios is that the public blockchains converge to one worldwide blockchain by integrating and orchestrating multiple blockchains platforms together across one value chain. The governments and organizations provided a leadership by embracing a cohesive protocol to leverage the technology at its core. These go beyond the current trend where consortiums begin to find a way for standardization and governments around the world are intensively exploring blockchain opportunities. In contrast, we can predict another Possible scenario where the worst-cases have occurred with “black-swan” events, like the deadlock of Bitcoin after past bans instituted by China, the home of 80 % of miners, and DAO attack in June 2016, Siegel, D. (2016). The blockchain in this scenario might become tainted that there will be a loss of trust and faith in the institutions and governments that are seen to promote them. For instance, the issues related to voter anonymity using blockchain-based voting system. Exploring the Possible black swan events is useful to identify the growing potential points of weakness within blockchain and adapting the mindset of” prepare of the worst”.

We can place the future scenarios in a matrix and assign the level of importance/certainty to each scenario. The high level will be assigned for the scenarios that I think are more important for the
initial concern whether the blockchain is a hype or a real trend for the future like the Internet. I will assign high level of certainty for the scenarios that I think are accurate giving the facts discussed earlier in steps 1 to 4. Next, we will use the tool illustrated in figure 8 to inform the strategy that a decision maker should follow for an action or keep vigilant watch and revisit the fringe.

![Figure 8: Assigning the scenarios with two levels of certainty and importance, a visualization tool to inform the strategical foresight, Amy Webb (2016, chapter 8. p.131).](image)

<table>
<thead>
<tr>
<th><strong>Probable Scenarios</strong></th>
<th>Level Of Importance</th>
<th>Level Of Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S1</strong> Blockchain remained private and closed within separate platforms such as Hyperledger and Corda while the tech giants and consortia are working hard on blockchain commercialization and interoperability matters. The internal developments (I) discussed in section 4.4 did not produce the productivity gains that otherwise could with more supportive regulatory and standardizations.</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td><strong>S2</strong> In this scenario we can imagine that some countries like china continue to block bitcoin while others create their own digital cryptocurrency e.g. Ripple, which mean the death of Satoshi’s idea of one open cryptocurrency without any middlemen.</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td><strong>S3</strong> Other probable scenario is that several countries, organizations and consortia continue to provide leadership to the market in order to balance risks and accelerate research and developments with more pilots on blockchain applications (D-apps). All stakeholders realize earlier that the future of</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
blockchain lies in the ability to connect all blockchain networks (interoperability). However, this remains without any progression toward one open blockchain platform and standardizations.

### Plausible Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S4</td>
<td>Blockchain 3.0 as stated in sections 4.1 and 4.2 will unlock a set of scenarios to power new business models. In this plausible scenario we can imagine that the integration between blockchain, AI and IoT presents a significant amount of potential value to secure the world of IoT devices. Estimated number of IoT connected devices is 270 billion in 2027 and this will create tsunami of data threatening our society, Hanson RT, Reeson A, Staples M (2017). In this scenario we can imagine a person with IoT devices in his/her car, medical implants and house where blockchain can ensure that only authorized person can control/access the information. IoT devices in logistic companies and many governmental services e.g. supply chains, will feed with trusted data to blockchain powered DAO smart contracts.</td>
</tr>
<tr>
<td>S5</td>
<td>In this scenario we can imagine that the concept “unbanked people” in developing world is not existing anymore (explained in section 4.2). The astonishing achievements of UN and its projects to promote blockchain as technology for good, is the reason behind this trend. Many countries follow this trend, not only for banking services but also for lands titles and identity services, logistics and health services.</td>
</tr>
<tr>
<td>S6</td>
<td>In this scenario, the peak bodies of blockchain ecosystem establish Knowledge Networks to address the urgent need to increase the awareness among the decision maker and educate the people about this technology. As Result, the barriers to mainstream entry will be mitigated and the potential stakeholders will realize the misunderstanding between the reality of the core technology and bitcoin. One of the plausible scenarios is to imagine that many blockchain ecosystem players or platforms (such as Hyperledger and Ethereum) will be able to collaborate in an open standard, but within a specific business purpose. Supply Chains, for instance, involve passing goods across many parties and we can imagine a scenario where several governments adapt standards and smart contracts for this purpose.</td>
</tr>
</tbody>
</table>

### Possible Scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>S7</td>
<td>One of the possible scenarios is that the public blockchains converge to one worldwide blockchain by integrating, and orchestrating multiple blockchains platforms together across one value chain. The governments and organizations provided a leadership by embracing a cohesive protocol to leverage the technology at its core. These developments cause a shock to financial and non-financial institutions and governments alike, disrupting the industry and a successful large-scale D-apps will emerged to increase the adoption rate of users and organizations</td>
</tr>
<tr>
<td>S8</td>
<td>In contrast, we can predict another possible scenario where the worst-cases have occurred with “black-swan” events, like the deadlock of Bitcoin after past bans instituted by China, the home of 80 % of miners,</td>
</tr>
</tbody>
</table>
and another DAO attack like what happen in June 2016. The blockchain in this scenario might become tainted that there will be a loss of trust and faith in the institutions and governments that are seen to promote them. For instance, the issues related to voter anonymity using blockchain-based voting system or unethical practices with smart contracts. As results users and decision maker are no longer trust the technology.

| S9 | Many lead countries in blockchain such as China, US, UK, and Estonia start to act in a supportive manner and cooperate to manage cross-border data flows with respect to e.g. supply chin and logistic services. The organizations pay attention for the countries in Asia because of the fact that the center of economical gravity is currently shifting towards these countries (explained in section 4.2). | Low | Low |

Table 4. The future scenarios and their level of certainty/importance

4.6. A Strategical Foresight for Action

“If we feel that we have a full story about a scenario or 40-80 % of the required information to make a decision then we can inform the strategy” Amy argued. If we have 40 % or less of the information we should wait or ‘Keep Vigilant Watch’ until we have more descriptive scenarios, Webb, A. (2016, chapter.9 p130). The scenarios that are more important for blockchain ecosystem and fall within the cone of certainty will be the ones that can inform the strategy. The strategical foresight for blockchain usually focuses on the preferable scenarios which can overlap with any of the three categories of the future cone (figure. 7). The purpose of preferable scenarios is to help the decision managers to expand their visions about the reality and inform strategy for action. Next, a “Pressure-Testing” is required for the strategy considering the implication of our actions, Webb, A. (2016, chapter.9 p135). Below is my strategical foresight based on the probable, plausible and possible futures of blockchain. The customers of this strategy will be an ecosystem player, decision makers, managers or an organization that really need to know if this is the correct time to act or still need to wait in their strategical decisions with regards to blockchain technology.

Giving the facts discussed in table 4, there are many barriers to the adoption involved in getting this technology to TCP/IP levels of acceptance. Interoperability is key toward the technology maturity. The decision makers, organizations and individuals should think carefully about the risks in acting too early while the technology is still emerging beyond the financial arenas. We can clearly notice also how blockchain can be part of enabling framework of the Fourth Industrial Revolutions (as discussed in table 4, S4). This technology has supportive role for other emerged
technologies - like IoT, AI, big data systems, and cybersecurity products, rather than a disruptive role. In other words, I feel that this technology has arrived at the right time with these emerged technologies to accelerate them all and lead the digital transformations. Therefore, all ecosystem stakeholders should act now with regards to this trend and consider the supportive role of this technology for many emerged technologies. In general, blockchain is in its infancy if we look at the trend path discussed in section 4.4. Following the born of bitcoin in 2009, it became apparent that the potential of this disruptive technology will go beyond the field of cryptocurrency and many proofs of concepts started in 2015. As a decision-maker you should be aware that in order to move blockchain from POC phase to mainstream, a collective effort is needed among all stakeholders.
5. Evaluating the Forecasting Methodology

Now, let reverse-engineering the forecasting methodology using the evaluation criteria developed in section 3.4 to benchmark a forecasting system in the disruptive innovation field. We discussed six categories and several criteria of each category. The objective of this evaluation is to measure to what extend Amy Webb methodology meet the ideal attributes of a forecasting methodology for disruptive technology.

5.1. Data Collection

The data are the backbone of the whole forecasting process. The forecasting methodology should have clear arguments to guide the futurists on how to understand which information to collect and what sources should use. The first key characteristics of a good collection process as per our evaluation framework, is to use credible data which in result will increase the probability to get better forecasts. Additionally, we should consider data prioritization and filtering to includes also more relevant inputs for our forecasting process. The “Comparative Relevance” is also an important concept especially when attempting to forecast the future scenarios of a technology with disruptive nature. It is a difficult task because the best signals might not be acceptable for the mainstream and the measure of relevance in this case is to what extend it affect the future of a disruptive technology, directly or indirectly, Vanston (2004).

Now looking back to the first step, the general key feature of the data collection phase, as per Amy Webb, is to consider the unusual suspects that directly or adjacently related to the concerned field, (Webb, A. 2016 p. 58-66). Moreover, we should separate the assumptions and our own knowledge to recognize the vital facts, (Webb, A. 2016 p. 76-78). This meets the first criteria of our evaluation framework to consider the facts prioritization and filtering to includes more relevant inputs for our forecasting system. Another criterion is the importance of expert diversity and public participations to gather the data. Although the expert diversity is mentioned as an option in the first step Webb, A. (2016) Chapter 4. p 80, however the main data collection method relies on one expert only giving specific characteristics of this actor.

This category includes also the discussion about the data pre-processing which concerns whether the forecasting methodology explicitly includes tools or models to organize and translate the data
from its sources into a signal format (auditing tools). This could be achieved using some analytical and visualization tools before data can be normalized, transformed for further processing and draw the scenarios future of a technology to take a decision for action. The forecasting methodology of Amy Webb has explicitly involved these tools in many steps, for instance, the Value Network applied as model in the first step to visualize the fringe data and then organize these data in a periodic manner. The “Guiding Questions” is a qualitative method to gather the data required to build the value network, and we can consider it as novel collection techniques developed by Amy Webb. Next a filter has been applied to separate the vital facts from the assumptions as explained previously, (Webb, A. 2016 p. 74-75). From my point of view, the value network is the best tool to visualize the unstructured data from the fringe and perform the link analysis between the nodes which is required to discover the data patterns. However, this visualization tool cannot handle large data set derived from wide range of sources. It is basically a qualitative tool to visualize our data input.

5.2. Processing Tools

In this criterion, we assume that our methodology should has a set of processes to make sure that only relevant and useful facts are presented in our outcomes. The forecasting methodology should explicitly guide the forecaster to organize the data in a way that improve the human ability of cognitive processing. The processing tools should be used to track the trends, identify the enablers and inhibitors of trends arrival toward the disruptive or mainstream. Additionally, the methodology should include tools to uncover the demand factors on the disruptive technology, signal detection methods, and link analysis tools.

Looking through the forecasting methodology of Amy Webb, we can clearly notice that many models and visualization tools are used to process the data that acquired from the previous steps. These tools are applied to produce more relevant information for further analysis. For instance, tracking the trends is conducted using CIPHER model, Webb, A. (2016 chapter 5). CIPHER technique is harnessed to uncover the hidden patterns at fringe and track the real trends. It is argued that a good forecasting methodology should track many kinds of trends – e.g. technological based discoveries, trends in nature and societal trends. The tool used in the second step (CIPHER) has
ability to uncover all these three categories as we discussed in the case of blockchain trends, in section 4.2. Using six-pattern model we could critically find the early weak signals of a complex set of data particularly as new disruptive is expected.

A good forecasting methodology should involve also a systematic effort to identify the inhibitors and enablers of the technology mainstream. As I mentioned in section 4.4, in order to estimate the arrival time of a technology, we should identify two things: The internal developments of the technology (I) and the external events (E) that affect its movement toward the mainstream. We explained the main events in section 4.4/blockchain adoption blockstones. S-curve adoption is used also as tool to visualize the waypoints, enablers and inhibitors on the trend trajectory and to create information sensors as way to evaluation the technological progress toward the mainstream. Identify the demand factors for the technology is also important and should be presented in the methodology. We can consider the toothbrush test applied on blockchain in step 2 chapter 4.2, as best model to discuss the demand factors of blockchain. One last consideration of this criterion is to measure the ability of the forecasting methodology to present a link analysis discussion in its body. This is required to establish baseline facts for some areas of focus and forces explored earlier. In Chapter 4 of her book, Amy Webb discussed many “Guiding Questions” as framework to create what we call it Network Value of nodes and relationships of what we found in the fringe. By asking those questions, we can build a general sense of the relationships between the main players of blockchain ecosystem, step1 section 4.1. Next, we analyzed the relationships to uncover the main trends of blockchain at present and use the output for the next steps for further analysis.

5.3. Forecasting Methods

As stated previously, because there is no single tool is suitable to forecast the disruptive technology and address such complex system with variety of issues, challenges and decision maker needs. It is argued that using several forecasting tools as input to the process will help the forecaster to capture wider alternatives of possible futures and increase the accuracy of the output. As we discussed in the evaluation framework before, there are a range of forecasting methods include statistical models, models, scenarios, and “backcasting”. The main forecasting method used in our methodology based on Chaos theory logic which tell us that any complex system is dynamic and
a multitude of futures are possible. We should project a set of P’s futures (possible, plausible, probable and preferable scenarios) using trends as anchors, Amy Webb (2016, p.28). As stated in section 4.5, the P’s futures in future studies cover the following concerns as framework to discuss the alternative futures. In possible futures we ask: what may happen, with probable futures: what more likely to happen, and for preferable futures: what we prefer to happen, Robinson, J. B. (1990). Backcasting seems to cover the latter by identifying the preferable futures for action, Amy Webb (2016, chapter 9). Additionally, A formula is harnessed in our methodology to extract the trends signals in the fringe: IF [Facts, Perspective, Framing] … THEN [OUTCOMES], Amy Webb (2016, p.125). Using facts from trend analysis and perspectives of stakeholders we can write a detailed scenario and build the strategy for our preferred future. Framing the expert’s feeling in these stories should be considered also: optimistic or what we want to happen, pragmatic what we feel strongly won’t happen and catastrophic or wild-card events, Amy Webb (2016, p.127). Although it is mentioned the importance integrate a form of a quantitative methods by developing subjective but informed probabilities-based scenarios, there are no explicit use of these methods in the forecasting methodology. “If we have 40 % or less of the facts, we need to make a decision, we must pause the scenario building until we have at least 80% of the information” Amy Webb (2016, p.130). It was, however, not clear how we can measure the amount of information we have until the point we should either inform a strategy or pause until we have all required data.

5.4. Forecasting Bias

It is argued that many forecasting methodologies suffer from bias because of inadequacies in the forecasting process, data source or the expert’s ignorance, Faber et al. (1992a). Amy Webb believes that the mitigation of the individual or forecasting bias requires a deep investigation about what we think is a real trend. The reason is that when the trend comes wrapped in a catchy phrase, such as: “blockchain for everything” or "The disruptor of everything”. The entrepreneurs, leaders, and investors will leap to a decision which may not be accurate and assume that this technology will jump across industries, organizations, and scale in the same way of e.g. the Internet. Under this situation, researches and futurist thinkers would heavily weigh their judgements on more recent information or similar situations like comparing the beginning of Internet with blockchain
to conclude a result making our opinions biased toward that trend. Step 3 of Amy Webb’s methodology focuses on what she calls it “belief bias”, “It influences the way we parse the facts, and we sway by the milieu of popular sentiment, Webb, A. (2016, chapter 6. p.96)”. She added: “When a conclusion match with our existing system of belief and we do not adopt an opposite way of thinking to challenge the facts, that called: belief bias” Webb, A. (2016 chapter 6. p.102). She also introduced other terminologies such as: “The availability heuristic”, “deliberate disagreement”, and many support questions to guide the process of bias mitigation Webb, A. (2016 chapter 6. p.103). Amy recommended that the futurist thinkers must start with one main question and then break the concepts down into smaller parts. “What would have to be true in order for blockchain to prove out as a manifestation of sustained change within society, industry, or the way we behave toward each other?” This process needs a deliberate disagreement to move our past belief bias about a technology or having contrarian points of view even if we believe in what we are seeing. To answer this question, we should break the big concepts down into smaller parts and see if we could prove each one wrong, and poke holes in our hypothesis. From my point of view, this step meets largely the ideal attribute of bias mitigation as mentioned in the developed evaluation criteria, section 2.3.

5.5. Data Output

Some argue that the output data during the process should be presented in a way that is informative and intuitive using visualization tools. The forecasting methodology of Amy Webb is mainly focused on representing qualitative output in each step with some quantitative in last step. A numeric-based scale assessment is integrated with the scenario method as mentioned in Amy Webb (2016, p.130). The output data created by the formula: IF [Facts, Perspective, Framing] ... THEN [OUTCOMES], will identify the required narrative of P’s future of a technology - probable, plausible, possible and preferable. We can place the results in a matrix with level values assigned to each future scenario as illustrated in Amy Webb (2016, Chapter 8. p.131). We place the future scenarios in a matrix and assign the level of importance/certainty to each scenario. The high level assigned for the scenarios we think are more important and fall within the cone of certainty. Other scenarios with less significant influence on the business, communities, or the ecosystem, will be assigned with the low level of importance and certainty. Next, the visualization tool illustrated in
figure 8 is harnessed to help a decision maker to either inform the strategy for an immediate action or keep vigilant watch and revisit the fringe until he/she has more confidence to inform the strategy. In general, the output was clear and helpful to drive the decision making by evaluating the signals and inform the strategy we desire for the future of a technology.
6. Validity & Generalizability

Giving the validity criteria discussed in section 2.4, we can use six steps as an instrument to the external validity of the results. To validate our forecasting scenarios (FS1) we can imagine that someone else has applied the same methodology to forecast the future of blockchain and come with other results (FS2). We can consider that FS1 is more valid than FS2 from the pragmatic point of view discussed in section 2.4, if the following are valid (see table. 5):

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>FS1 suggests (more relevant) possible futures than FS2, or wide range of possibly relevant and acceptable futures.</td>
</tr>
<tr>
<td>C2</td>
<td>FS1 suggests the (most relevant) futures explicitly and FS2 not (what are the most important future scenarios that an actor can consider for his/her strategy).</td>
</tr>
<tr>
<td>C3</td>
<td>FS1 suggests and interprets (more relevant) data inputs, facts and weak signals than FS2.</td>
</tr>
<tr>
<td>C4</td>
<td>FS2 suggests the (most relevant) with as few scenarios as possible better than FS2.</td>
</tr>
<tr>
<td>C5</td>
<td>FS1 is understood and can be used by more customer, actors, or decision makers than FS2.</td>
</tr>
<tr>
<td>C6</td>
<td>FS1 is understood in better way than FS2 by the key actors those can benefit from the future scenarios.</td>
</tr>
</tbody>
</table>

*Table 5. External validity criteria.*

It is argued in section 4.5 that the futurists must identify a wide range of futures scenarios that will help them to take intelligent decisions by considering *more relevant* possible futures. Comparing with traditional forecasting methods which focus only on just one-line *probable* future, we have covered not only the possible futures (including possible, plausible and probable) but also the preferable future which inform the strategical foresight of blockchain future (criterion 1). The identification of the scenario paths is to present relevant gaps in our knowledge, therefore the validity of our results increases whenever it is able to evoke the *most relevant* futures paths. This is the case with the preferable future discussed in section 4.6, (criterion 2).

According to Amy Webb, ‘what-if?’ questions evoke the creativity and imagination to discover the unknown using the facts, perspectives, and our feeling. ‘What-if?’ is actually the formula used to produce our scenarios, that consider the facts from blockchain fringe at present, megatrends, weak signals, enablers and inhibitor of the technology progress, section 4.5. While the most relevant futures are identified by assigning each scenario with its level of importance and our level of certainty (*see table .4, section 4.5*). In our methodology, a matrix and visualizing tool are used
for this purpose (*see figure. 8, section 4.5*). This meets largely criterion 3 to indicate all casually relevant facts and criterion 4 to construct just few scenarios that help to inform the strategy. The facts that construct the preferable scenarios to inform the strategical foresight of blockchain are the most relevant facts in our methodology (criterion 4), giving a specific Blockchain use case to draw its most preferable future paths. On other words, we construct a few scenario paths that takes account of relevant set of facts and observations from our trend analysis and gives an interpretation of their future effects. Another example of criterion 4 in our case is the probable future, where we have a much narrower scope of possible path assuming that the trend will continue in liner progression.

Future scenarios are customer oriented. If we take into account that the relevant customers (e.g. the blockchain players in our case) can understand the future paths, then the validity will increase (criterion 5). Sometimes only the key customer of the forecasts will understand the future scenarios while the others not (criterion 6). The general purpose of forecasting the future of blockchain in this research is to address the general concern whether the blockchain is a real trend or just a hype. I did not discuss the future of this technology within a specific context (Supply chin, banking, healthcare …e.g.), however I built a decision framework for business leaders to help them prioritize their action. Should they wait for further maturation of blockchain or reap an advantage of being an early adoption? Therefore, the outcomes validity is relatively high giving the justifications in criterion 5 and low with criterion 6.
7. Discussion & Conclusion

Disruptive technologies create unexpected surprises in the market causing losses to businesses and governments. The increasing potential impact of strategic decision-making in many areas and the necessity to select a forecasting tool with high validity results and well-designed to meet the ideal features of disruptive forecasting systems suggests a good reason to conduct this research. It is argued that the best way to minimize the unexpected losses is that the decision makers being always ready and use the forecasting techniques. This thesis described a forecasting methodology was as part of a book called “The Signal Are Talking” by Webb, A. (2016) and reported on strengths and weaknesses of this methodology use to forecast the future of a disruptive innovation. Based on the evaluation discussion in sections 5 & 6 we can conclude the evaluation summary presented in the below Table:

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
<th>Evaluation results (Ideal forecasting attributes Vs Amy Webb’s Methodology attributes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information collection and data sources</td>
<td>Diversity of experts (-).</td>
<td>Partially Meets:</td>
</tr>
<tr>
<td></td>
<td>Diversity of data sources (+).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data creditability (+).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diversity of qualitative &amp; quantitative sources (-).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public participation (-)</td>
<td></td>
</tr>
<tr>
<td>Forecasting tools &amp; methods</td>
<td>A combinations of forecasting methods (+).</td>
<td>Partially Meets:</td>
</tr>
<tr>
<td></td>
<td>Backcasting (+).</td>
<td></td>
</tr>
</tbody>
</table>

Data is collected from one expert/futurist, giving predefined characteristics of this actor. Novel methods as a source of data are used (guiding questions, 10 sources of change). Auditing tools for creditability, relevancy, and accuracy also used in the first step (Value Network). Mainly depends on qualitative methods to collect the data. Quantitative methods are not apparent. It was clearly stated in step 1 of Amy’s methodology that the public participation in gathering data is a good option to capture a broad range of views, signals, and perspectives. However, Amy Webb focused only on one actor as the source of data and incentive technique for experts/public participation is not apparent in the methodology, either for attracting experts from many fields or the public.

Trend analysis (S-curve technique), Scenarios and Backcasting are the main combinations used in the forecasting methodology. Principally, forecasts supplied by expert opinion using Kahn (1960).
Novel methods (−). No present evidence of using public opinion or any Novel methods. Trend analysis covered in step (1-4) while step (5-6) are mainly for scenarios buildings and backcasting the preferred future. In general, the forecasting methods and signals detections tools are largely qualitative. Quantitative tools are not apparent.

| Processing Tools | Identify Enablers/Block-stones of technology adoption (+). | Partially Meets: Signals, inhibitors, enablers of the technology maturity are identified, but it is not clear how we can measure exactly the progress or time of arrival. The forecasting methodology includes tools to capture the weak signals and analyze the relationships between the nodes in the fringe to uncover the trend pattern (using CIPHER technique). S-curve adoption is used also as tool to visualize the waypoints, enablers and inhibitors on the trend trajectory and to create information sensors as way to evaluation the technological progress toward the mainstream. A Matrix employed to escalate potentially high importance signals or developments. |
| Reducing bias tools. | Avoid individual bias (+) | Meets Largely: Amy Webb introduced many concepts and terminologies of individual bias and discussed implicitly on how to avoid the data source bias. She developed an inclusive method in form of guiding question to mitigate these sources of bias. She believes that answering these questions (as stated in her book chapter 6), will definitely help the futurist to avoid what she calls it “belief bias” and as a result will increase the validity of the forecast. |
| Data outputs | Avoid data source bias (+) | Meets Largely: Qualitative data output (future scenarios) with some quantitative representation and two scales of assessments (certainty, importance) impact and confidence level. Good Visualization tools for future scenarios, enablers, inhibitors, and links analysis. |
| | Visualization Tools for outputs (+). Escalation tools for signals (+) | |

Table. 6, evaluation summaries of the forecasting methodology, (+) means that the criteria are apparent in the methodology.
It can be concluded that the forecasting methodology meets partially the ideal attributes with particular strengths in qualitative data inputs, multiple forecasting tools, bias mitigation, and robustness of data output. Moreover, the visual presentation of quantitative data in many steps of the methodology provides futurist with a powerful tool to identify hidden trends and monitor the convergence of adjacent technologies. However, throughout the process, we noticed that Amy Webb has mainly concentrated on methods based on futurist opinion, which presumes the qualitative way of thinking. The quantitative methods are not suitable for long-term forecasting especially for the plausible and possible scenarios, Webb, A. (2016, Chapter 3, p46). On the other hand, a significant part of the scientific community holds a consensus that integrating both dimensions are important in the forecasting process especially for the disruptive events with high uncertainty, Sayer, 1992 (orig. 1984); Lawson 1996; Jick, 1979a; Olsen 2004; Howe, 1988, 1992. We can use the two paradigms in parallel for cross-checking of the inputs, analysis, and findings, Haegeman, K., Marinelli, E., Scapolo, F., Ricci, A., & Sokolov, A. (2013). This meets also the main attribute of an ideal system of integrating quantitative and qualitative tools in each step of the forecasting process. From my point of view, the forecasting methodology of Amy Webb could be strengthened through the explicit use of quantitative models for probable futures and focus mainly on qualitative approaches for long-term planning where the scenarios present higher credibility.

Another potential weakness includes its lack of participation of experts, stakeholders, and public to increase the transparency and validity of the forecasts. When expert/futurist judgments are only the source of knowledge concerning scenarios (like the case in our methodology) it is important to verify that the forecaster really believes his/her arguments, Kuusi (1999). Although the bias mitigation tools are integrated into the process to increase the level of confidence, I still believe that the assumptions and statements that represents the future elements should be evaluated, approved or open for refusal by others. One interesting example of such methodology based on the expert’s consultation and decision makers analysis, is Gartner forecasting system based in CIO survey (see section 4.4). We showed a clear evidence that we can improve our foresight by involving Gartner system as a quantitative source of data to uncover more inhibitors of blockchain trend. Social scanning or prediction markets can be used as tools and methods to improve the

We have also discussed six criteria to validate the quality of our methodology outcomes or what we call them the external validity criteria (see *section 6*). Using the validity criteria, we built a systematic frame to conduct a scientific evaluation for the results of any future projects using the forecasting methodology. There is a close connection between the evaluation criteria of the forecasting process in section 5 and the external validity criteria in section 6. The internal validity of the forecasting system and external validity of the outcomes will support each other in many ways, *Kuusi (1999)*. For instance, integrating more quantitative methods in the process will increase the validity of criterion 4 (see Table. 5) by giving a way to quantify the scenarios, facts and participation opinions, this also more in line with criterion 2 and 5.

With regards to the research question whether the methodology can serve as effective instruments to forecast the whole picture of a disruptive technology. I argue that the forecasting methodology of Amy Webb can be seen as a great success for the future studies and can provide the decision maker with scientific information on the link between the technology ecosystem and human perspectives. However, exploring the ‘whole picture’ of the future of a disruptive technology requires integrating of quantitative modelling in the forecasting process. The scenarios that based completely on quantitative methods, were able to explore several aspects of ecosystem, society and expert’s perspective. Those methods where possible to be quantify using numerical information by assigning the high or low level of importance and certainty to each scenario. The forecasting methodology also has involved novel methods to explore the linkages between the ecosystem developments in the fringe and individual’s behavior. However, without explicit integration of quantitative and qualitative methods especially in the collecting data phase, we will not able to explore a large number of ecological services and drivers of ecosystem developments.

Finally, A further research to identify a common ground to develop mixed forecasting methodologies is needed as future work for the scientific community in the context of future studies. We argue that a good methodological design should integrate quantitative and qualitative forecasting tools to explore more possible future and aim at reducing the uncertainty in complex systems.
8. References:

8.1. Academic peer reviewed references


EFFLA 2013: EFFLA POLICY BRIEF no. 14. Towards standards in Forward Looking Activities for the EC (main author: Cuhls, Kerstin); EUROPEAN FORUM ON FORWARD LOOKING ACTIVITIES.


Tashakkori A. and Teddlie C. (1998) Mixed methodology, Combining Qualitative and Quantitative Approaches,
8.2. Other references:


Hanson RT, Reeson A, Staples M (2017) Distributed Ledgers, Scenarios for the Australian economy over the coming decades, Canberra.


Credit Suisse. Blockchain 2.0 (January 11, 2018), https://www.blockchaindailynews.com/attachment/967068/


