Expectations of blockchain technology and how they affect food supply chains

An in-depth analysis of three cases

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Abstract

Blockchain is a popular novel technology, a distributed ledger which is praised for its versatility, reliability and immutable and decentralized character. More and more actors are using blockchain technology in order to solve organizational and societal issues. This research focuses on how blockchain technology is used for issues within food chains and ultimately, how it affects these food chains. This is done by analyzing expectations that were uttered for three different cases – a collaboration between IBM and Walmart, an activist organization named Fairfood and a social venture, Agunity. These cases focus on increased efficiency, fair trade and improved trust and cooperation respectively.

It appeared that the three case studies tended to overlook the technological aspects of blockchain and focused mainly on the social and organizational aspects. Also, they spoke of similar concepts – such as transparency – but all interpreted and expressed them differently within the design of their blockchain. Therefore, the underlying discourse of the cases appeared to be crucial to recognize. This can give a lot of insight in how a blockchain will be designed. Also, physical social interaction appeared to be more flexible and fluid than blockchain technology. Therefore we could note that there is incongruence between the social and digital world. Finally, it appeared that the initiators of the blockchains all had a large influence on how the blockchain was implemented and what effect it had. Therefore, the decentralized character of blockchain can be refuted, because there will always be a form of power-inequality within a blockchain initiative.

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Contents

1. Introduction

Blockchain is currently a widely popular IT technology, which became a hype when Bitcoin reached its all-time high value of almost $20.000 (Volpicelli, 2018; Notheisen, Hawlitschek & Weinhardt 2017). Put shortly, a blockchain is a distributed ledger technology (DLT) where information can be stored. It is distributed, since all members of the blockchain own a copy on their device. Within this ledger, members can exchange money (such as Bitcoin or any other kind of cryptocurrency) or any other kind of information. For any new entry in the ledger, the transaction needs to be approved of by at least 51% of the members of the blockchain, so there is no need for any intermediary to facilitate this transaction (Swan, 2015). This approval mechanism makes the blockchain hard to hack as well, which provides a sense of safety and trust for those who are involved (Drescher, 2017). The reason blockchain technology has had a breakthrough is because it is considered to be widely applicable for numerous uses and industries. It is considered to be a disruptive technology, and many believe that blockchain has the potential to cause fundamental change throughout society (Notheisen, et al., 2017; Swartz 2016). Increasingly, it is argued that blockchain technology can be used for recording non-financial information. Ethereum is one example of a blockchain. Vitalik Buterin, the founder of Ethereum – another famous cryptocurrency - states the following:

'Alternative applications of blockchain technology include using on-blockchain digital assets to represent custom currencies and financial instruments […] the ownership of an underlying physical device […], non-fungible assets such as domain names […], as well as more complex applications involving having digital assets being directly controlled by a piece of code implementing arbitrary rules ('smart contracts') or even blockchain-based 'decentralized autonomous organizations'(DAOs)' (Buterin and et al., 2014-2016). As Buterin explains, there are many possible applications for blockchain technology, such as even self-controlling autonomous organizations (DAOs) or smart contracts, which makes it possible to make trade happen automatically.

This decentralized (or disintermediated) character means that there is no intermediary powerful party present in the network, which does not have the single power to approve and facilitate transactions. This idea is very popular in current blockchain applications, because it would mean a complete shift in power – especially in the financial world. Steve Wozniak, one of the founders of Apple Inc., states that blockchain "…will serve as a cornerstone for business and industry in the future, calling it "decentralized and totally trustworthy" (Paden, 2018). The decentralized blockchain network is visualized in the left picture below; on the right one can see a traditional network in which one powerful intermediary would control all transactions in the network. In a world without intermediaries, there would be no need for lawyers, brokers or bankers for instance (Iansithi & Lakhani, 2017).

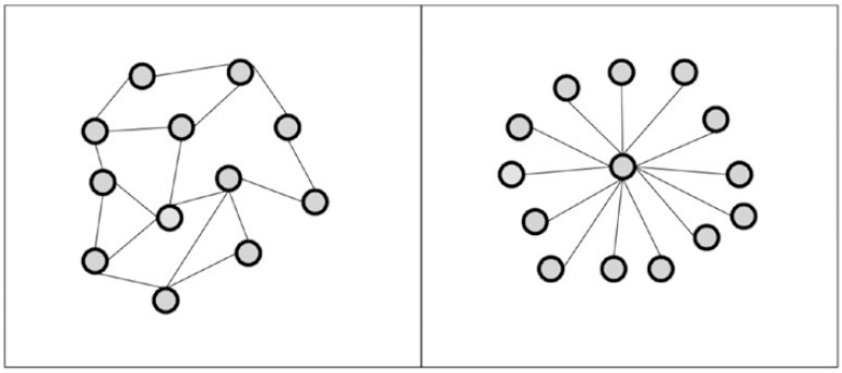

Figure 1. Distributed network (left) vs. centralized network (right) (Drescher, 2017: p. 11)

Another major promise by blockchain technology, next to disintermediation is immutability. The blockchain is a ledger, which consists out of a chain of connected 'blocks' of data – hence the name

blockchain. Each block is encrypted with a 'hash', which can be compared to a digital key and is based on the entries of the previous blocks in the chain. Once one of the blocks within the chain is changed, all the entries after that, will become invalid and the network will indicate that someone attempted to tamper with the data. In this sense, blockchain is unique - safer and more difficult to hack than regular ledgers, or even other DLTs (distributed ledger technologies) (Drescher, 2017).

There are also critiques surrounding the blockchain hype. Scalability is mentioned as one of the largest limitations of the technology, as each block can only contain a certain quantity of data and the verification of a transaction takes time. Others fear of a 51-percent attack, in which one entity (a hacker, for instance) could take over control of the blockchain and alter the data or steal cryptocurrencies from other accounts. Others wonder how blockchains can be controlled, since they are often wide-spread across territorial boundaries and they may be used for illegal trade (Swan, 2016). These are but a few of the many different fears that are voiced regarding blockchain technology, but they seem to be the most common (Swan, 2016).

Blockchain is a versatile technology – as said, it can be used for many other uses than cryptocurrencies. Applications have been set up in many sectors to solve different problems. One sector that is predominant in the development of blockchain applications, are (global) food chains. There are many hopes being voiced about the potential of blockchain technology to solve complex issues within the global food production system. Expectations are high, among a wide variety of different actors – from governments, NGOs to smallholder farmers. This widely acclaimed interest in blockchain technology causes the food chains to be an interesting case to consider within this research.

1.1. Food chains and blockchain

Global food chains are 'the entire set of production, manufacturing/transformations, distribution and marketing activities by which a consumer is supplied with a desired [food] product' (Opara, 2003: p. 101,102). They are complex, since they have a wide range of different actors involved (from smallholder farmers to multinational corporations), spread across territorial borders and have a widespread effect the environment. In the current global food chains, there are many issues involved and there are great expectations on the potential of blockchain to solve them. Below, I will elaborate two main challenges within food chains.

Traceability and transparency

People want to know where their food comes from and producers want to track back faulty products faster (Aung & Chang, 2013). Food scandals in the past years have increased awareness of food safety and security. There is a greater emphasis on the need to track foods to their origin, in the case of unsafe or fraudulent products. There is also an increasing desire for consumers to know if their products are organic or fair trade. But there are a multitude of certifications, that confuse consumers – which one is the best one? This unclarity creates opportunity for fraud and is difficult to monitor. There is a desire for an easier way to know more about how products were made and where they come from (Harris, 2007).

There is a difference between transparency and traceability. "[The] transparency of a supply chain is the extent to which all its stakeholders have a shared understanding of and access to the product related information that they request without loss, noise, delay and distortion" (Pant, Prakash & Farooquie, 2015: p. 386). Put simply, transparency therefore refers to how easy it is for everyone to know what is actually going on within the supply chain. Once this is the case, it is easier to trace back

where a certain product comes from, or where it is situated within the supply chain, at a certain point in time.

Inequality

It is estimated, that there are about 1.7 billion peasant and smallholder farmers worldwide, although some authors state that this number is probably twice as big, making up nearly half the global population (McKeon, 2015). Despite the fact that they provide for about 70% of the world's food, peasants and smallholder farmers are marginalized by powerful economic and political processes (Friedmann & McMichael, 1989). Farmers are unable to compete for low bulk prices on the world market, which increases an unequal distribution of food and exacerbated world hunger (McKeon, 2015).

Especially the unequal distribution of wealth due to this system is considered a problem that can be solved by using blockchain technologies. Several initiatives have set up cooperatives using blockchain, in order to increase local development and collaboration among farmers and locals. This way, smallholder farmers can be empowered. Examples of such initiatives are Fairfood and Agunity (fairfood.nl; agunity.com). They aim to guarantee a better position for the farmers and a fair payment for their produce.

1.2. Problem definition

Blockchain is considered to be a disruptive technology, but scientific literature on the contents and framing of these expectations is rare and nor do there seem to be established discourses regarding blockchain technology. This means that there does not seem to be a unique, specific solution that people expect to solve with blockchain. Expectations regarding this new technology, differ greatly – and even though expectations are high, not every stakeholder expects the same thing of blockchain (Notheisen et al., 2017). For instance, some focus on the ability of blockchain technology to eliminate the intermediary, others consider the concept of decentralized trust very promising (Swan, 2015).

There are critics and enthusiasts for blockchain, but more important it is to know, is who these actors are and what they think, because they might have an effect on how blockchain applications will evolve over time. Borup, Brown, Konrad and Van Lente (2006) explain how this happens: "Novel technologies and fundamental changes in scientific principle do not substantively pre-exist themselves, except and only in terms of the imaginings, expectations and visions that have shaped their potential. … Such expectations can be seen to be fundamentally 'generative', they guide activities, provide structure and legitimation, attract interest and foster investment" (p. 285-286). So, in a sense, how actors think and talk about certain innovations, is essentially a shaping process, which can have an actual effect on how these innovations evolve and are applied. One therefore might even state that this is a political process with potentially large socio-economic consequences. Expectations therefore have the ability to, for instance, influence (power-)relations and create societal change.

Also, in the case of food chains, there is a multitude of startups working on solving issues – such as the ones introduced in paragraph 1.1. It is interesting to investigate which problems they see in the food chains, and how they believe blockchain will help them solve these. As Borup et al. (2006) state, insights in these expectations by different actors, can help us learn to understand how the technology might evolve and how this in turn will influence social (power) relations within the food chain. It is interesting to look at this in depth in a number of different cases. This way, we can get a clear view of what different expectations different types of actors have, which problems they hope to solve by using blockchain technology and how this is translated into blockchain use per case.

1.3. Research Questions

The problem statement in the previous section results in the following general research question:

How do expectations of blockchain technology in different problem-solution cases influence the food chains they operate in?

(The problem-solution cases that are mentioned in the general research question refer to the case studies that have been executed. These cases are typical examples of blockchain applications, specifically applied to a certain food chain issue. For more information, see the Methodology, chapter 3.)

This general research question can be broken into several sub-questions that guide us to the answer to the general research question. The dynamics that are referred to in the sub-questions are explained in the conceptual and theoretical framework (see chapter 2).

1. What different expectations about blockchain for food chains, can we identify for each problem-solution case?
2. What are the different interpretations of challenges of blockchain for food chains for each problem-solution case?
3. How are the expectations of blockchain for food chains translated into concrete activities in each problem-solution case?

The questions relate to the dynamics of expectations that are described in the conceptual framework in Chapter 2. Question 1 focuses on the expectations from the perspective of the initiatives themselves. Question 2 focuses on the challenges and risks expected with regard to blockchain for food chains – from the perspective of the initiatives as well as from blockchain experts and critics. The final question (3) will focus on how these expectations are set into motion in the form of actor coalitions and strategies.

1.4. Thesis structure

In this report, I will first elaborate the theoretical framework, which will form the guidelines for the methodology. The methodology will follow in chapter 3; here I will explain how this research was executed and provide a reflection on the methodological limitations of my approach. Next, I will provide the three case studies respectively. I will then, in the discussion (chapter 7) provide a further analysis and compare and contrast the three different cases. I will then reflect on the research process. This all will then lead to answering the research questions in the final conclusion, chapter 8.

2. Conceptual framework

In this chapter, I will provide a critical literature review on the available literature surrounding expectations of technological innovations. This will lead to a conceptual framework which will provide a guideline for the analysis. The major component of this conceptual framework will be based on literature from the field of Science, Technology and Society (STS).

2.1. Relevance of expectations

In order to comprehend how a hype develops over time, I will elaborate on the Hype Cycle for Emerging Technologies (Linden & Fenn, 2003). The hype cycle represents the evolution of new, promising technologies. It shows how they can be of potential relevance for industries. It can be an aid in defining the current state of a hyped solution and provides insights of how the technology will evolve over time. Also, the expectations of a technology change over time, as the technology itself evolves and applications of this technology prove to be (un) successful.

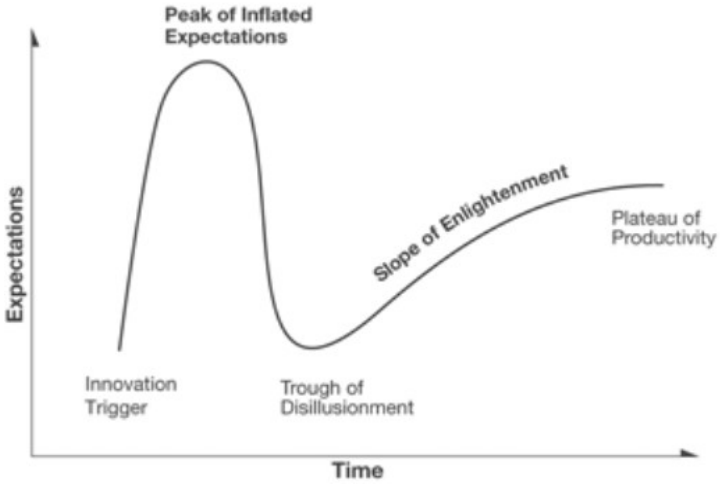

Figure 2. The Hype Cycle for Emerging Technologies (Linden & Fenn, 2003).

The hype cycle consists out of a number of stages (Linden & Fenn, 2003):

- **Innovation trigger:** The hype cycle starts off with the development of a new technology. Media interest and successful early adopters trigger the publicity. In this stage, there are few to no proven cases of viability.
- **Peak of inflated expectations:** As the technology is increasingly adopted, success stories further spark the hype. Also, there are some cases of failing applications, which stagnate the interest.
- **Trough of disillusionment:** publicity and interest fade away as the high expectations are not met. Further development and investment only continue if the remaining providers manage to improve.
- **Slope of enlightenment:** increasing understanding of how the technology can be most effectively adopted. It sparks the development of new products.
- **Plateau of productivity:** Start of mainstream adoption.

According to Notheisen et al. (2017), blockchain technology is yet to reach the 'Peak of inflated expectations', as expectations are high, and the technology is considered to be disruptive and

transformational. Across a wide variety of industries, people are now experimenting with possible blockchain applications.

The hype cycle is often criticized though, as it is oversimplified and does not provide space for the different variation and volatility that is characteristic for (technological) innovations. Sometimes, a hype can just stop at the trough of disillusionment, for instance, when an innovation appears not to be feasible. In our case, it is perhaps more interesting to consider the *content* of the expectations, in order to see what dynamics are currently predominant and how these relate to (possible) socio-political outcomes.

In order to make sense of political and social outcomes as a result of expectations, Jasanoff and Kim (2009) introduce the concept of 'imaginaries'. Imaginaries are '…collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects' (Jasanoff & Kim, 2009: p. 120). Imaginaries are 'cultural resources' that shape social reactions to (technical) innovations (Jasanoff & Kim, 2009). Jasanoff & Kim (2009) argue that imaginaries influence choices that are made and thus directly influence concrete outcomes, such as social infrastructures and patterns.

However, analyzing the imaginaries around blockchain for food chains, has its drawbacks. Jasanoff and Kim (2009) consider imaginaries to be limited to national boundaries and assume a degree of homogeneity and rigidity within national imaginaries. They also tend to consider cases that are generally not 'newly emerging', which causes less fluctuation and interplay between different expectations. Technologies are changing, but the bottom-up character of blockchain causes not only powerful nation-states and large corporate players to have a say about blockchain. Instead, there are many different actors that voice their expectations. The mediating role of these imaginaries as discussed by Jasanoff and Kim (2009) is a powerful aspect to consider, but we need other concepts that help us understand the different types of expectations in the field of blockchain for food.

Borup et al. (2006) also acknowledge the shaping power of expectations but have a more dynamic understanding of the concept. They state that analyzing of the dynamics of expectations is key when one wants to understand technological change. According to the authors, expectations have a mediating character, across different boundaries. Expectations also connect the technical and social sphere. Finally, Borup et al. (2006) consider expectations to be a cause as well as a result of technological activity and innovation.

Borup et al. (2006) state that innovation in contemporary science and technology is inherently future-orientated. This means that expectations have a shaping power in how these innovative technologies are shaped and shape the world. "As such, very little in innovation can work in isolation from a highly dynamic and variegated body of future-oriented understandings about the future" (Borup et al, 2006, p: 286). Therefore, to understand scientific and technological change, it is important to analyze the dynamics of expectations (Borup et al., 2006). Borup et al.'s (2006) 'fluid' understanding of expectations can help understand expectations around blockchain for food. Blockchain, after all, is not a separate field, but emerges in a wide variety of industries, in many different forms and applications (I will explain this in the methodology, chapter 3).

2.2. Expectations and socio-political outcomes

Borup emphasizes important mainstream assumptions and approaches that are characteristic for their field of study – STS (social studies of science, technology and science). We need to keep these in the back of our mind while examining the expectations of novel technologies such as blockchain:

- Technology and knowledge production is a heterogeneous, non-linear process (this notion is also illustrated in the hype cycle in paragraph 2.1).
- The social and technology mutually shape each other. Social aspects influence the way technology is shaped and implemented. The technology in turn then influences social relations and structures.
- Research generally has an actor-oriented approach (Borup et al., 2006)

Furthermore, Borup et al. (2006) distinguish three central dynamics of expectations in science and technology. I will discuss them below.

Expectations and socio-spatial variability

Expectations about an innovation are rarely homogeneous. Different groups have different ideas about a novel technology and the uncertainties that accompany these technologies. The expectations that are uttered, may not only differ per actor, but also per situation. In the case a researcher needs funding to further investigate (the potential of) a new technology, he or she will most likely utter positive expectations about the technology. While working with colleagues, for instance, this same scientist may be more likely to talk about potential risks or uncertainty. They might even contradict themselves (Borup et al., 2006).

This 'social patterning' and 'interpretative flexibility' are a result of information asymmetry between different sectors (Brown & Michael, 2003). Higher expectations about innovations may provoke varying concerns in different sectors about risk and uncertainty, based on different values and knowledge. On the other hand, expectations may have a more powerful effect on those who believe to have little influence on the final outcome of a certain technology (Borup et al., 2006). This variability may explain why different types of actors 1) have different expectations about for instance a novel technology and 2) have different levels of confidence in a novel technology.

Expectations as a constitutive force

New technologies are shaped by the expectations, visions and imaginations that inherently create its potential. Expectations can therefore be seen as a generative force, driving innovation. In the current economic model, innovation is considered to be a strategic goal as well, for corporations and the public sector (i.e. local, national and transnational governments). When expectations are accepted as credible, they become part of an agenda which requires further, more detailed expectations to be articulated (Borup et al., 2006).

Expectations create coalitions and define roles for strategic reasons. After all, especially in the case of an insecure, novel technology, actors look for allies. When teaming up with other, like-minded actors, there is a stronger coalition which has more power to achieve its goals, to realize its expectations and create success for themselves. More importantly, a coalition can share risks, which otherwise, actors would have to bear on their own. Also, the utterances of expectations can be considered an indirect 'promise', which leads to agenda-setting. Expectations create so-called clusters of 'guiding visions', that aid coalitions in their way (Borup et al., 2006).

Van Lente (2000) describes the dynamics of these promises and additional 'requirements' that come with these promises. Uttering expectations in fact can be seen as commitments which become part of a shared agenda within a coalition – which require action. Voicing expectations does not inevitably lead to a responsibility to act, but it does trigger responses and expectations should be answered for. In the case of a common expectation, there is no to little need for legitimation. Common expectations can use as legitimation for other expectations, even. A deviant opinion or expectation is often considered less legitimate (Van Lente, 2000).

Expectations and temporal variability

As discussed above in Gartner's hype cycle, there is a clear trend of hype and disappointment. Borup et al. (2006) state that - although the hype cycle has its drawbacks – there is a pattern of hype and disappointment when it comes to expectations in science and technology. Earlier technologies are tending to be framed as backward and the novel technologies are often considered to be disruptive and able to make a fundamental change for the better (Borup et al., 2006). But although initial promises of an innovation are often high, they often tend to ignore more complex aspects such as cultural determinants or negative externalities (Borup et al., 2006). The dynamics of expectations appear to contain a built-in degree of disappointment.

Borup et al. (2006) state that the future thus rarely is what actors expect it to be and in hindsight, actors view their expectations and the technology differently as well. This means that in the case of a successful technology is often considered successful on itself, while complexities and contingencies which contributed to this success, are neglected. In the same sense, failures are often considered singular cases and being contrasted to novel, new interesting technologies. So, past failures are often also used to describe the promises of new technologies (Borup et al., 2006).

3. Methodology

In this chapter, I will present the three cases that I explore during this research. Also, I will elaborate on the exact methods that I use to answer the three sub questions and ultimately, the general research question. Finally, I will critically reflect on the limitations of the methodology.

3.1. The case studies

I have chosen to provide an in-depth analysis of three different initiatives within the field. Because blockchain is a relatively new technology and pilots are only just being set up, little academic literature – regarding the expectations - about it is present. Therefore, there is little to no knowledge at all on which to base a large-scale survey, for instance. The current focus is to create more insight in how the expectations shape the food chains and therefore, the most effective way to do this is to execute case studies.

It is a common misconception that context-independent knowledge (such as abstract theories) is more valuable than context-specific, practical knowledge (for instance case studies) and that the latter cannot contribute to scientific advancement (Flyvbjerg, 2006). Flyfbjerg (2006) states that, in order to become an expert in a certain field, one must not only have general knowledge, but also know how things work in specific contexts. General, context independent knowledge will be helpful for those who are new to the field of research, while context-specific knowledge is helpful for those that want to obtain a more nuanced view of reality. This knowledge can be obtained by executing many case studies, which each will contribute a little, but crucial part of knowledge to the researcher. Besides, in the study of the social, it is nearly impossible to find predictive theories and universal rules since social conventions, relationships and power may differ per situation (Flyvbjerg, 2006). Flyvbjerg (2006) therefore states that "concrete, context-dependent knowledge produced by case studies is therefore more valuable than the vain search for predictive theories and universals" (p. 122).

In order to learn more about blockchain (for food) and which possible cases I could study, I went to meetups regarding blockchain technology. The largest blockchain community surrounding blockchain for food, is called Food Integrity Blockchained and gets together in Amsterdam. Here is where I learnt about the different initiatives that are currently going on within the blockchain for food scene and which ones would be most interesting and useful to study.

Flyvbjerg (2006) proposes a few strategies for choosing adequate cases to study – for this research I have to the maximum variation strategy. This means that I have chosen three different cases, which have in this case the blockchain technology and high expectations in common, but apart from that, differ vastly in terms of size and orientation. This will help us analyze how the expectations surrounding blockchain affect the food chains in different situations and applications. In the end, the three different cases will hopefully provide us with interesting insights, which help not only answer the general research question, but also perhaps provide ideas and suggestions for future research of blockchain or another novel technology. I chose to provide an analysis on the collaboration between Walmart and IBM, Fairfood and Agunity. They have in common that they all recently started using blockchain for their ideals. They are however different in terms of ideology and their expectations and approach to blockchain for food. The cooperation between Walmart and IBM focus on traceability and efficiency within the supply chain. Fairfood focuses on traceability of fair trade coconuts in order to create awareness about unfair trade within the industry and consumers. Agunity focuses on increasing trust and cooperation in smallholder farmers in developing countries, which in turn will lead to higher yields. In the respective chapters 4, 5 and 6, I will provide a more elaborate background on these initiatives.

3.2. Data collection

As stated in paragraph 3.1., I started out at the meetups of Food Integrity Blockchained (FIB, hereafter) in order to learn more about blockchain technology for food and the different possible cases to study. It is here where I found out about the three interesting initiatives I studied; IBM/Walmart, Fairfood and Agunity. Because there was only a limited possibility (initially, none) to perform interviews, I decided to take the livestreams of these meetups, transcribe them and then use the expectations uttered by the different initiatives as a unit of analysis. Because these expectations, fears and plans were uttered by the representatives from these initiatives themselves, I found it a credible source of information to study.

In the case of Agunity and Fairfood, I had the opportunity to perform interviews to obtain more in-depth information. Based on the theoretical framework, I compiled a topic list for the interviews (which can be seen in Appendix I). The reason I chose a semi-structured interview, was that I did not want to decide too much what would be discussed in the interview. A semi-structured interview can be quite helpful in obtaining the relevant information, but also creates the opportunity to go into topics that appear to be relevant during the conversation.

I also used other sources of data for the research. In the case of IBM/Walmart, I could not perform any interviews, nor were they presenting at the FIB meetups. Instead, I depended for information on the official sites of IBM and Walmart. For all three cases, I depended on news articles on well-established (blockchain- and crypto-) news websites and Dutch national newspapers (Financieel Dagblad, Trouw). Additionally, I used the year reports of Fairfood and Walmart – Agunity does not have any year reports so far.

N.B. The transcriptions of FIB meetups and interviews are available upon request at the secretariat of the Environmental Policy Group at Wageningen University.

3.3. Analysis

I have performed a discourse analysis on the different data that I have obtained. Next, I attempted to find patterns within these discourses. Perhaps there are different actors who have similar concerns regarding blockchain technology for food chains. Or the expectations might be conflicting. This can tell us all about the dynamics of expectations for blockchain for food.

In order to analyze the data that I gathered, I used a bottom-up coding technique. I did not know which expectations and ideas the respondents would come up with, so it was quite difficult to set up a coding scheme beforehand. I read and reread the data and made notes on them for coding. Based on the arguments that were presented in the data, I divided the data into three different categories of arguments; social, organizational and technological:

- Social: all arguments that refer to the (changing) roles of the actors in the food chain: this entails social relations, cooperation and power relations et cetera.
- Organizational: all arguments that refer to the (changing) processes in the food chain: such as a change in efficiency, data sharing, traceability et cetera.
- Technological: all arguments that refer to the technological side of using blockchain (in the food chain) – such as speed, scalability et cetera.

One might think that these are rather broad themes, but I have chosen these for a reason. I dealt with three different case studies and I wanted to be able to maintain a clear oversight, so it would not be too complex to compare and contrast them. I have considered adding a fourth theme, regarding

expectations about blockchain technology in general, but did not do this in the end. The reason for this, is that it is difficult to conceptualize 'general' ideas, because they still might refer to technology, changing social roles or organizing data management, albeit not for food chains in particular. Also, I did not want to minimize the arguments per category to 'only one' which probably would have happened when having more categories.

3.4. Limitations

As discussed above, I chose the maximum variation strategy to pick my case studies. These cases are supposed to have everything in common and vary greatly on only one aspect. The challenge here is that I did not manage to find cases that would perfectly fit this description. After all, blockchain is a relatively novel technology and in the field of food specifically, there are not that many initiatives up and running yet. These three cases I chose all intend to use blockchain for food chains but differ in both size and discourse. So, there might be a challenge to compare the three. The reason I chose for these three cases nonetheless was mainly a practical one; I would have relatively easy access to information on the expectations of the initiatives.

Furthermore, this research was executed within a limited time span. For this reason, I had to make choices regarding the scope of the research. In the theoretical framework, I discuss the three main dynamics concerning expectations as introduced by Borup et al. (2006). One of them refers to how expectations evolve over time and how actors look back on previous innovations. It would have been very interesting to study this phenomenon, but I did not have the time to wait for expectations regarding blockchain technology to change. I did not have any indication how fast (or slow) this process would take place, so therefore, I had to leave this behind.

When it comes to data collection, I was fronted by a challenge – there is very little academic literature available about blockchain for food, let alone these specific cases I attempted to study. Therefore, I could not be very picky about which information I would use. After all, I needed a certain amount of data, before I could study it. I attempted to use information from reliable, well-established sources, such as well-known newspapers or magazines. There is however, always a risk that these sources are more biased in one way or another than a regular academic source. This is important to keep in mind as it might be of influence on my results.

4. A case for efficiency

In this chapter, I will elaborate the first case. This is the case of the collaboration between IBM and Walmart, which aims for transparency and traceability for a more efficient supply chain (and tracing back faulty products). First of all, I will elaborate on these two main actors in the initiative and the actor coalition that is involved. Then, I will discuss the initiative and the expectations around it. Finally, I will consider the challenges, risks and limitations that are related to this initiative and provide concluding remarks.

4.1. Actors and initiative

About IBM

IBM (International Business Machines corp.) is a technology and consultancy company, based in the United States. It is the largest employer in its field globally, with over 370,000 employees working across 170 countries. It is best known as a company that serves in computer services, software and hardware, but is increasingly focused on cognitive solutions such as artificial intelligence, machine learning and natural language processing. IBM emphasizes her importance across a wide variety of fields, such as healthcare and traffic management (IBM, 2018). Since IBM is one of the largest IT companies worldwide, it has a lot of power to transform the way data is used and shared. After all, because many industries are working with IBM products, the effects of IT transformation will be very influential on society.

About Walmart

Walmart is currently the largest retailer in the world and profiles itself as a discount store, where people can get their daily groceries for a low price. Walmart has nearly 12,000 stores in 28 countries and serves customers through a webshop in 11 countries. It has approximately 2.3 million employees worldwide, serving over 260 million customers weekly (Walmart, 2018). In 2007, Walmart was the largest employer in the United States and the largest retailer in the world (Basker, 2007). Also, Walmart is currently expanding through vertical integration; it is taking over the players in the supply chain – such as processing plants (LeBaron, 2013). Considering Walmart's immense (and increasing) power, it has a large effect on the economy and aspects such as (local) labor markets, market prices and food suppliers – to name but a few.

Walmart is a controversial corporation. It presents itself not only as market leader in retail, but also as a "leader in sustainability, corporate philanthropy and employment opportunity. It's all part of our unwavering commitment to creating opportunities and bringing value to customers and communities around the world" (Walmart, 2017). Walmart is, however, often criticized for its policy. Walmart has been accused many times of underpaying employees, bankrupting smaller competitors and exploiting farmers and suppliers (Morillo et al., 2015).

Actor coalition

One of the most famous initiatives concerning blockchain and food is the collaboration between IBM and Walmart, as many prominent sources write about it (Paden, 2017; Aitken, 2017). The fact that two market-leaders of their industry are partnering up, means that there will be a hugely powerful coalition working on traceability in the food chain. This is likely to have effects across the food industry – as Walmart already has a large and increasing power over producers and suppliers worldwide (Basker, 2007; LeBaron, 2013). Also, there is a significant chance that this coalition will also affect supply chains in other industries, as IBM is active in many other industries besides the food industry.

Initially, the initiative started out between IBM and Walmart. In the summer of 2017 however, it was announced that the partnership will be extended with other major food retailers; Dole, Unilever, Walmart, Golden State Foods, Kroger and Nestle, as well as Tyson Foods, McLane Company and McCormick and Company - amongst others. The ultimate goal is to shorten the time needed to find the source of food contamination and be able to eradicate it (Del Castillo, 2017). Unfortunately, the new partners are not willing to share any information on this cooperation (Bos, 2017). Most likely, this is because sharing information might mean that these partners can lose their competitive advantage over other players in the industry.

This expansion of the already powerful coalition has large potential effects on the global food system. The aim of this coalition is to increase this blockchain for food 'empire', so it covers all food chains worldwide. In a professional publication of 'Progressive Grocer', the Vice President of IBM Food Trust department stated that '[Our] goal is to have all members of the food ecosystem participating, so that the transparency we create is across the entire ecosystem. This means all retailers, all manufacturers, all growers, etc. We will continue to add partners who are interested in improving trust and transparency in the food sector (in Progressive Grocer, 2018)'.

The initiative

Walmart has been working on improving traceability and transparency in the food supply chain for many years, like many other food retailers. So far, it has been troublesome, since farmers, shippers and other actors in the supply chain often cannot provide all the data required. Different types of technology (such as radio-frequency identification chips) are difficult to implement, since they are costly and impractical (Nash, 2016). Now, Walmart and IBM have teamed up to increase transparency within the food supply chain. IBM will provide the digital infrastructure – a blockchain platform - and Walmart focuses on involving the actors in the supply chain (Walmart, 2017; Nash, 2016). The ultimate goal is to create a 'standards-based method' of gathering data about the security, authenticity and source of food, using blockchain technology for traceability through the food supply chain (IBM.com, 2017).

There will be two cases in the pilot study – in China and the United States, both regarding pork meat. Walmart will focus on traceability and transparency for two pork meat supply chains from both countries. Pork is the most popular meat in China and is often unsafe or tampered with (Wong, 2018). For the Chinese case, Walmart and IBM are teaming up with JD.com, the largest Chinese online retailer and Tsinghua University who will mainly provide information and advice. Tsinghua University will mainly work with IBM to give consultation regarding the technology and the Chinese food safety ecosystem. Walmart and JD.com will then further develop and roll out the technology to the actors in the food supply chain that are part of the collaboration (IBM.com, 2017).

The data related to the pork (such as inspection reports at the farm and livestock quarantine certificates) are put on the blockchain by what is called an 'industrial personal digital assistant' (PDA). This is a small electronic device, comparable to a smartphone. The drivers that transport the pork from one location to the next, are also important links within the food supply chain. Using the PDA, they photograph the certificates as they transport the pork. The certificates get stamped at each location to verify that the products were moving to the correct places. Before this was implemented, it would take a lot of time to trace back a certain document. However, when these documents are linked to particular batches and physical locations and put on the blockchain, this can be done easily. So far, this pilot has not tracked individual packages – only batches. The available data is sufficiently detailed that it should be possible at one point to do this (Wong, 2018).

4.2. Expectations

In this paragraph, I will elaborate the social, organizational and technological expectations that are being voiced in regard to this initiative.

Social

Not only the blockchain technology itself, but also the new social structures that develop around it, will have an effect on the food chain, for instance in preventing fraud. Louis de Bruin, a representative from the Dutch IBM department foresees that blockchain in food chains will have a preventive effect. 'Companies will be more careful, once they know that other players in the food chain will easily trace faulty products back to them. It will be more difficult to get away with bad management' (Bos, 2017). So here, we see that IBM does not only have a lot of knowledge on 'simply' developing blockchains, it has an eye for social structures as well.

IBM is looking forward for new opportunities to expand, which they expect to have a large effect on other industry players and lead to more cooperation in the chain (Bos, 2017). De Bruin states that the parties within the food industry will be forced to work together. 'It starts with the big players, who make agreements with one another. They have the power to set requirements for the smaller players, to make them put data on the blockchain. Also, it will be difficult to refrain from putting data on the blockchain when everyone else does it. It will look suspicious' (Bos, 2017). This seems to be like a deliberate intention of 'the big players' (IBM and possibly also Walmart) to force all other players to start acting on the blockchain, of which they can determine the rules. This appears to be a strong strategic move by IBM/Walmart, which makes them have more power within the food chain, as a result of using blockchain.

Organizational

In several media, representatives from IBM and Walmart have outed their expectations of the technology and the pilots. Frank Yiannas, spokesperson and vice-president 'Food Safety' at Walmart considers blockchain to be a promising technology. He states that the exponentially growing presence of smartphones creates new opportunities for increased transparency in the food chain through real-time digital data sharing. Previously, this has been a problem, because data sharing systems used to be mainly paper-based and prone to errors (Nash, 2016).

Although blockchain is a technological solution for data sharing problems, Walmart and IBM is aware of the social side of IT. Yiannas: '[Blockchain] solves not only digitizing food information but it addresses the social issue of how that information is shared.' (Wong, 2018). This 'social issue' of information sharing refers to the organization of actors – who provides which information. It is interesting to see that IBM, being a technological company, acknowledges the social and organizational aspects of information sharing. This shows us that the company looks further than simply producing the actual technology.

Walmart's year report for 2017 also discusses the pilot partnership with IBM. The goal is to accelerate and optimize traceability. 'Enhanced traceability may allow industry and regulators to more quickly and accurately identify affected product during recalls and remove that product from store shelves and distribution centers' (Walmart, 2017). The word 'may', implies an expectation here. Another expectation that is being voiced in Walmart's year report, is the possibility that increased visibility in the supply chain through blockchain technology can help decrease food waste, by reducing and eliminating delays within the chain (Walmart, 2017). It is striking to see that in the year report, Walmart notes other food-related issues than traceability, such as food waste. In the other sources that are

available on the blockchain initiative, sustainability related topics are never mentioned. Apparently, although sustainability is not one of the initiative's main goals, it is a positive externality.

Bridget van Kralingen, senior vice president at IBM Industry Platforms declares that 'blockchain holds incredible promise in delivering the transparency that is needed to help promote food safety across the whole supply chain. This is a fundamental reason why IBM believes strongly in the impact this technology will have on business models' (IBM.com, 2017). IBM believes that blockchain is a widely applicable and disruptive innovation that can 'generate breakthroughs in three different areas: visibility, optimization and demand (IBM, 2016). This shows that IBM has a firm belief not only in the initial, financial application of blockchain, but also in the application of blockchain in (food) supply chains.

De Bruin does not think that sharing information on the blockchain will put the competitive advantages of the partners in jeopardy. 'All data is encrypted and as party within the food chain, you will be able to see only the data that would be relevant for you'. For instance, Walmart will be able to see from which seller they got their oranges. Another supermarket will, on the other hand, not be able to see where Walmart bought her oranges. Whenever something is wrong with the oranges in a certain Walmart retail store, Walmart can ask the wholesale about the history of the oranges. These information requests can be fully automatized, so one can get insights and act upon it really quickly (Bos, 2017).

Technological

It is notable that in none of the sources, IBM nor Walmart discussed the technological expectations they have regarding their initiative or blockchain in general. Although there may be many reasons why, it does tell us about their stance on the technology. All expectations that are being voiced, are extremely positive, although regarding social and organizational aspects of the blockchain. From this, we may conclude that the technological aspect seems to be less important to the initiative, than the organizational and social consequences it is expected to have.

4.3. Challenges, Risks and Limitations

In this paragraph, I will elaborate the social, organizational and technological challenges, risks and limitations that are being voiced in regard to this initiative.

Social

As discussed in chapter 1, data is often fragmented and dispersed, and some believe that blockchain will be effective in putting data in one place. Valdes, analyst at Gartner, a prominent research firm in IT, states that blockchains do have a high potential, since they can overcome current issues with fragmented data and data silos in supply chains. However, he believes that the industry needs to reorganize, to make this happen. "There is a need for fundamental changes in the industry, before the adoption can successfully take place. In the most ideal situation, the industry would rearrange itself within a decade" (Wong, 2018). All players need to adhere to one particular IT solution, which requires agreements on how to share information, and on which information needs to be shared.

Some worry that the blockchain will disadvantage the less powerful players in the chain, such as smallholder farmers. In a discussion platform of Harvard Business School (HBS, 2017), several critics voice their doubts regarding blockchain use for food chains by Walmart. One of the responders notes that he sees a challenge in the adoption aspect of blockchain, especially concerning the farmers. They

are financially squeezed, and this will only become a bigger problem, he thinks, as 'it seems like they might have the least to gain in this scenario'. He states that, once a problem arises early on in the food supply chain, farmers will be an easy target to blame. This can be refuted, however, because a well-working blockchain traceability system will be able to pinpoint the exact cause of a certain problem in a food chain. Also, others worry about the position of poorer and less powerful actors in the food chain. Another responder (HBS, 2017) notes that the transition towards blockchain-based food chains can be difficult for Walmart, because it requires quite some investment from both Walmart and its suppliers. In the case of suppliers with low margins, this can be a problem, squeezing them in a financially difficult position.

Furthermore, since all the information of the food chain will be accessible to all players, there will be a need for contracts to maintain a certain level of confidentiality. It can be challenging to maintain a balance between discretion and transparency. Players in the food supply chain, is that too much of their information will be shared (Craik, 2017). Also, blockchain can be beneficial for some, and problematic for other players. Many players now are able to maintain their position due to the fact that they have information that others have not. Information asymmetry apparently leads to power relations within the food chain. Implementing a blockchain can change these relations (Charlebois, 2017). Charlebois (2017) thinks that this can work out positively for Walmart, who will be able to exert more influence on other companies in the food chain. 'In food distribution, not all companies are equal, and some can exercise their power more than others' (Charlebois, 2017).

Charlebois (2017) also states that blockchain still is in its infancy and there is still a lot of uncertainty about its potential. He states that the major challenge is a social one – participation. All parties within the food chain need to be willing and able to adopt the blockchain technology and the procedures that come with it. The engagement of all participating actors is therefore crucial for blockchain technology to be really successful.

Organizational

An organizational challenge relates to putting data on the blockchain; all actors need to put the right information on the blockchain in the right way. Incorrect or incomplete information will not lead to a well-functioning and trustworthy blockchain. Walmart will therefore have to confront this so-called 'garbage in, garbage out'-problem. One of the respondents on the discussion platform of Harvard Business School notes that the information on a blockchain will only be useful if the physical transaction is recorded correctly in the first place. This means that Walmart will need to set clear and strict standards and procedures for all of the partners in the food supply chains, in order for the blockchain to be able to live up to its potential.

Technological

In the case of IBM/Walmart, the majority of the voices is very enthusiastic, but there are also people who place some critical notes to the traceability initiative of these two industrial giants. Ray Valdes notes that many supply chain blockchain initiatives can just as well be placed on a regular ledger, instead of on a blockchain. 'Ninety percent of enterprise blockchain projects today do not need a blockchain, and would be better off without one, because they are not aligned with what a blockchain can actually do' (Wong, 2018). One example of this, is scalability. When using blockchain on a larger scale, an increased amount of computing power is needed to continue operating the system. This can be a problem once more and increasingly complex supply chains are put on the blockchain (Charlebois, 2017).

4.4. Concluding remarks

In this final paragraph, I will elaborate on the findings of this chapter, regarding the three sub-questions of this research. So, I will discuss findings concerning the expectations, the interpretations of risks and finally, how these are all translated into action within the initiative.

In this case study, we see that IBM and Walmart focus on traceability and transparency and clearly emphasize that these should help achieve food safety and efficiency within the food supply chain. In itself, traceability and transparency are not goals; they are expected side effects of blockchain technology which helps IBM and Walmart obtain well-functioning, efficient food supply chains in which faulty or fraudulent products can easily be traced back. This can be seen especially in the statements of Frank Yiannas, and the fact that next to spokesperson of this project, he is vice-president of the Food Safety department at Walmart.

The fact that it was difficult to get in touch with IBM and Walmart for more information, also tells that they are rather secretive – this might be because they want to maintain their competitive advantage over other industry players. The information that is available online is rather shallow – the utterances on behalf of IBM and Walmart, were statements on how 'amazing' and 'promising' this initiative is. Other actors in the coalition were also rather reserved – there was little to no information available on this initiative on their websites. Also, they were not willing to share information in an interview (Bos, 2017). This relates to the fact that information asymmetry leads to power relations – knowing more than other parties in the industry, means having competitive advantages over the others. This tells us that the blockchain in this case, is a closed, commercial project.

Also, there seems to be a focus in expectations on social aspects of the initiative, as IBM and Walmart believe that roles and power relations change when the blockchain will be implemented. Most importantly, they seem to expect that blockchain will be an aid in increasing their power over other players in the food chain, as they will be able to dictate what information need to be shared. Considering the size and impact that both IBM and Walmart have in the world today, they expect to be able to put the global food industry on the blockchain – while being able to decide how it should be done.

There are several challenges, risks and limitations that are connected to this initiative and most importantly, many of them are related to the expected social consequences. The downside, according to external critics of the program, seems to be the (financial) squeezing of less powerful actors in the food supply chain. This risk directly stems from the utterances of IBM/Walmart that they attempt to 'have all members of the food ecosystem participating' – so also the poorer farmers that have little agency compared to the large multinational corporations. This is interesting, because it shows how a positive expectation for one party, may directly form a risk for someone else within the food chain, participating within the same blockchain.

It is remarkable, that apart from the challenges that are being stated by external critics, there is not one single risk, challenge or limitation of blockchain uttered by anyone from IBM or Walmart. Therefore, what they deliberately seem to show us, is a fantastic, perfect, ideal initiative which will make the world a better place. They do not respond to the fears that are being outed on other platforms, nor are they available for questions. This provides the impression that there is more to this initiative than meets the eye, also in terms of expectations; we simply do not know everything Walmart and IBM expect to happen as a result of their initiative – both in terms of positive prospects and risks.

For IBM and Walmart blockchain appears to be more than just a tool to increase traceability and transparency – it is a strategic move. In the expectations that these companies voice, there is a great

focus on the social and power relations in the food chain. It is clear that the collaboration between Walmart and IBM is a very powerful one and one of their main expectations is that blockchain will be a useful means to extend this power across the industry. This especially becomes clear by the utterance of an IBM employee that the 'big players' have the power to set requirements for the smaller players in the food chain. Apparently, the blockchain project is not only a tool for enhanced traceability and transparency, it seems to be to be a strategy for empire building as well. Therefore, this initiative can have great consequences for the power relations within the food chains, worldwide.

5. A case for activism

In this chapter, I will elaborate the second case. This is the case of Fairfood, which aims for a fair payment to smallholder farmers and increased awareness among consumers. First of all, I will elaborate on Fairfood and its history. I will then discuss the actors in the initiative and the actor coalition that is involved. Then, I will discuss the initiative itself and the expectations around it. Finally, I will consider the challenges, risks and limitations that are related to this initiative and provide with concluding remarks. In this chapter, the spokesperson of Fairfood (Marten van Gils) may also be referred to as 'Fairfood', since he speaks on behalf of the organization.

5.1. Actors and initiative

About Fairfood

Inequality is a pressing issue within food chains, especially for smallholder farmers, which motivates Fairfood to start their campaigns. Fairfood is currently focusing on increasing transparency in the food supply chain, with a final goal to guarantee fair prices for farmers and consumer awareness (Fairfood, 2018). Marten van Gils, product manager and spokesperson at Fairfood states that they want "…the people who make our food to be able to feed their families, have a roof over their head and have some saving if a tsunami hits the house. Not a fair price per se, but more than that; Fairfood aims for people to be able to make a living' (2017).

Many farmers in developing countries are struggling just to get by and often live under the poverty line. By documenting fair payment on a blockchain, people can be guaranteed that the product they buy in the supermarket, is a product for which the farmer was fairly paid (Van Gils, 2017). Van Gils notes "…. that Fairfood aims to make the food system 'future-proof', since the amount of food that we need to produce in the next years is very big while still so many people go to bed hungry and so much food is being thrown away" (Van Gils, 2017; 2018). This tells us that Fairfood has taken on an ambitious role in the food chain, which implies that they have high expectations of their ability to trigger change.

Fairfood aims to change the bad position of farmers in developing countries, by putting food products on the blockchain, but it is very costly to have a custom blockchain built. Fairfood has won a fund, called 'Blockchain for Good', issued by SIDN, the Dutch national company that manages '.nl'-domain names. With this fund, Fairfood was able to set up the coconut case (Van Gils, 2018). In February 2018, Fairfood was awarded with €500.000 at the 'Goed Geld Gala' of the *Nationale Postcodeloterij*. (Fairfood, 2018). This way, Fairfood could start their first campaign with the blockchain.

Actor coalition

Within this initiative, Fairfood has not used an existing food supply chain, but created a new one – for coconuts. This entailed including all the actors that are involved in a regular coconut supply chain; the shipping companies, the cooperatives, and the farmers. In order for the coconut to flow through the supply chain and be documented on the blockchain simultaneously, all actors needed to have a digital identity. This meant that all the stakeholders in this project needed to be awarded a phone and a training on how to use it. Also, there was someone on the ground to manage the project (Van Gils, 2018).

Fairfood refers to its initiatives as 'campaigns' and the activist approach is prominent in Van Gils' utterances as well (Fairfood website). Van Gils: "We have done this to get the industry's attention and

to get them to act. As a result of the coconut pilot, we have attracted a range of small and large industry players. We are looking for ways to collaborate with them and set up new projects" (2018). This statement shows that the initiative is more of a campaign to create awareness within the food chain, than a structural solution in itself. Even more, this implies that Fairfood expects the industry to act when there is more attention for the poor position of smallholder farmers in developing countries. Van Gils thinks that the biggest impact can be made while working with large industry players (Van Gils, 2018). However, large industry players are quite slow in adopting new technologies and strategies. Small industry players are more versatile and quicker. So, Van Gils expects that in the beginning, there will be more partnering with small players, and later on with large players (Van Gils, 2018).

The aim is to scale up and start new projects with new products in the coming years. There are both plans to scale up the coconut case, next to starting new projects and partnerships to improve the farmers' position. Van Gils states that Fairfood aims to launch a new product campaign every year. The case for 2017 was coconuts, the case for 2018 will be coffee. The case for next year is still unknown (Van Gils, 2018). The coconut case, however, has ended. It was a one-time only pilot and right now, there are no plans to elaborate the case or help farmers structurally (Van Gils, 2018). So, this tells us that Fairfood is aiming to create awareness among consumers and industry, regarding different food products, rather than to elaborate their impact on one particular food chain.

Fairfood is active in discussions about blockchain, at Food Integrity Blockchained (see also: methodology, chapter 3), but this is not their primary because they are looking for potential partners for new campaign, in the first place. According to Van Gils, most of the meetings are still at the basic level – discussing what blockchain is and what it can do. Fairfood's interest goes out to the next step; working together with food companies on using blockchain. So, Fairfood is working on living wage and has gathered a network of companies (both small and large) in which the applications are thought out – this will be called the 'blockchain lab' (Van Gils, 2018). Another part of Fairfood is the living wage lab, which aims at developing living income benchmarks, indicators and tools. The living wage lab is a collaboration with HIVOS, a Dutch development organization with a humanistic background (Fairfood, 2018). Next to that, Fairfood has a campaigning team. Currently, Fairfood is working on a living wage tool with several well-known certification companies (Van Gils, 2018).

Fairfood is maintaining relationships with four blockchain-building companies. The most important one is Provenance, that built the blockchain infrastructure. They generally work with other startups who aim to make the food chain fairer by using blockchain technology. According to Van Gils, Fairfood considers Provenance as a partner because they share ideals, even though they are simply a supplier of the technical infrastructure (Van Gils, 2018). Provenance is a company that specifically creates blockchains for food initiatives, for the sake of transparency and traceability. They are a for-profit company, helping out initiatives that focus on sustainability and fair trade (Provenance, 2018).

The initiative

The ultimate goal of Fairfood is to pay farmers a living income. That is not the same as a fair pay, or a fair-trade premium – it is a wage that enables farmers to maintain their family and a roof over their head. Usually certification initiatives provide farmers with a small premium, but do not suffice. Van Gils states that "certification such as UTZ or Rainforest alliance are doing a great job in improving payment, but that these certification schemes still do not lead to a living wage" (2017). Therefore, Fairfood looked beyond certification, at possibilities that can help the food industry to make the system fair (Van Gils, 2018).

The first pilot concerned coconuts, produced in Indonesia. About 16 million coconut farmers produce all of the coconuts in the world, and nearly all of them do not make a minimum wage (Van Gils, 2017). Coconut is a bulk product and it is used in a large number of products, which we often do not know

about – it is a hidden product. The goal of this pilot was to bring a container full of fair coconuts to The Netherlands, while documenting each step on the blockchain. First, Fairfood started looking for farmers and technology partners to work with and project designs. During this pilot, Fairfood wanted to test two hypotheses they had regarding blockchain technology; 1) that blockchain can be used to verify a fair price without a certificate; and 2) that it can be used to show the provenance of a product (Van Gils, 2017). Fairfood set up a digital system together with the British company Provenance, to put coconuts on the blockchain (Provenance, 2018).

In order to calculate the fair price, Fairfood researched the communities where these farmers come from and what they should receive for a coconut to make a living. There was a rather significant difference between the current coconut price and what they should earn to be able to make a living. The commodity price of coconuts varies between 12 and 14 cents apiece. The local price is about 36 cents. However, the calculations by Fairfood pointed out that farmers needed to earn 60 cents on top of the local price, in order to make a living income (Van Gils, 2017).

The project was aired on June 12, 2017 and the farmers were now able to confirm their harvest and payments through text messages. The farmers harvested the coconuts. Next, they sent back a text message with the number of coconuts they harvested. This was the first entry on the blockchain – an asset that was connected to the farmer's identity. The system then automatically transferred that asset to the next one in the chain; the supplier. The farmers had to indicate by SMS message, whether they received the living wage price. If not, Fairfood would not buy the coconuts of the intermediaries. This was an incentive for the intermediaries to pay the farmers the right price. Once the farmers are rightfully paid, the supplier accepted the asset and transferred it to Fairfood, who were the retailer in this sense. Fairfood then accepted the coconuts but only once they knew they were fairly paid for (Van Gils, 2017). Farmers therefore, suddenly, were awarded with a crucial role in the food chain, whereas previously they did not have a deciding voice.

These farmers did not have a database before the blockchain pilot, although some write down their harvest numbers in a small notebook. Suppliers had excel-sheets with their data, transporters used ERP (Enterprise Resource Planning) systems. So, data was stored in a lot of different places. These data silos did not previously connect with one another. This is what the blockchain did. It created a small layer in which those assets and prices can be registered. "Basically, this blockchain is a vertical chain integration, as Fairfood is managing the whole supply chain" (Van Gils, 2017). Vertical chain integration leads to a lesser dispersion of data, since all stakeholders are managed by one and the same party.

In the pilot, there were 55 farmers, but not all of them did receive the correct price at once. Eventually, 50 of them could register their coconuts via a text message. The five farmers who could not, did not have reception. Initially, out of all 55 farmers, eight did not receive the fair price. Fairfood stopped the payments, until these farmers received a fair price. This proves that the system worked quite well. Without using certification methods, fair payment was proven, as well as the provenance of the product (Van Gils, 2017). "These eight farmers, who did not receive the fair price at first, now had a voice and could influence the food chain", according to Van Gils (2017).

The eight farmers did not get the right price at once, and they could now register this on the blockchain. There was a simple reason for this; the man who comes to pick up the coconuts, simply did not have enough cash on him to pay the farmers right away. He came back later to pay them. In food supply chains, what often happens is that people get paid in advance, or later on. The system however, required a straightforward, immediate pay when the coconuts were transferred. This flexibility that exists in the physical world, does not really work on the blockchain, yet (Van Gils, 2017). This means that the blockchain is not as flexible as physical human interactions. This can form a fundamental hurdle in cases where blockchain is used in social and informal settings – such as small-scale, local trade.

The farmers who are previously undocumented, now have an identity and are able to influence the food chain. Previously, they were unseen and now that they are on the blockchain, they are an active participant in the food chain. “When a farmer has a say in what happens with a product, he is empowered” (Van Gils, 2017). By this, Van Gils means to say that farmers were awarded with the ability to influence the food chain and could demand the living wage that they were supposed to be paid.

After the shipment of coconuts arrived at The Netherlands, Fairfood sold them at theatre festival ‘De Parade’. Each bag with coconuts was labeled according to the farmer it came from. By scanning the QR code on the product, the customers could see who produced the coconut, when and where. Also, they could see how much money the farmer received for the coconut (Van Gils, 2017; 2018). So far, 1000 coconuts have been accounted for on the blockchain by Fairfood (Provenance, 2018).

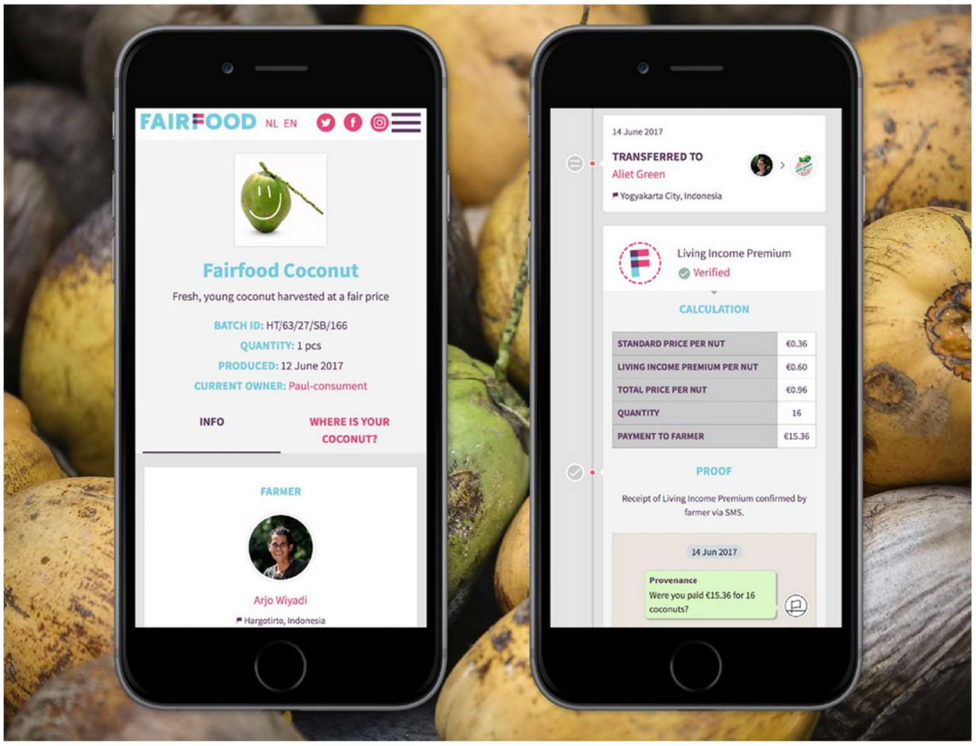

Figure 3. A screenshot, after scanning the QR code on the coconut (Provenance, 2018).

5.2. Expectations

In this paragraph, I will elaborate the social, organizational and technological expectations that are being voiced in regard to this initiative.

Social

Fairfood came across blockchain technology and was intrigued by the claim that it might improve transparency within food chains. Van Gils: “If you create transparency, efficiency within the food chain is a logical consequence. Once the steps in the food chain are clear, one might be able to take out middlemen, or improve speed and quality between the steps. We therefore think that efficiency is a big plus. But inclusiveness is the big goal” (2017). This way, Fairfood expresses her expectation that they might have an influence on other aspects of the food chain, than just inclusiveness – which was the initial goal.

Fairfood is a relatively small NGO and although they considered their pilot successful, they have not made a structural change in food chains, because they believe that they need the industry to act. The majority of food chains is strongly influenced by large food corporations. Van Gils: "We do not expect big food to build blockchains to include the farmers. Maybe they will, and we would love to work with them on that. But we do not expect them to start doing it". He states that Fairfood is very much open to collaborating with bigger players in the field to develop inclusive food chains (Van Gils, 2017).

Fairfood considers itself as a catalyst of change in the food system (Fairfood, 2016; Van Gils, 2018). The year report of 2016 states that, as a result of the campaigns, food consumers are more aware of issues within the food system. Consumers will demand healthy and sustainably produced food and have the power to drive CSOs (civil society organizations), trade unions, food companies and governments to a better cooperation. With the emergence of new technologies, there come new initiatives and better forms of food supply which are transparent (Fairfood, 2016).

Van Gils has clear expectations about how blockchains will change the role of certification parties (Van Gils, 2018). Blockchains are sometimes considered to be a potential threat to certification initiatives, since some afraid it will take over their job (Amsterdam traceability meetup). Van Gils thinks "that blockchain has the potential to take over a part of the tasks of certification parties – namely the labelling part. But there still needs a party that makes sure good data is available and certification initiatives are the best party to do so "(Van Gils, 2018). So here we find an expectation, which entails a changing role for certification parties.

Organizational

The application of the blockchain has proven successful in increasing financial transparency and proof of fair trade for Fairfood and Provenance. Provenance is positive about the future of blockchain for transparency and traceability and fair production: 'Working with Fairfood coconuts takes another step closer to a future where every great product comes with accessible, verifiable information about its origin and journey' (Provenance.org, 2018). On the website, Provenance keeps their statements rather vague as well. Since Provenance is a commercial company, sharing information on their business, might harm their competitive advantage over other players in the blockchain-building industry.

Technological

According to Van Gils, scalability is currently an issue, but he has high expectations for technological advancements. "If you look at the current state of blockchain, scalability is abominable. However, websites were slow 20 years ago and that changed. I am structurally not worried about this. There are many actors in the blockchain world, looking for ways to increase scalability" (Van Gils, 2018). Apparently, there are high expectations in the technological development of blockchain technology. Also, Van Gils sees new opportunities in smart contracts. "That is where blockchain overperforms other DLT [distributed ledger technologies] and I think that we will see a lot of that in the future" (Van Gils, 2018).

There are clear expectations that blockchain will change the role of certification parties and sustainability labels. There are currently a lot of labels with claims of sustainability or fair trade. The large number of labels is confusing consumers – it is difficult to know by heart what each label represents. Van Gils does not expect this will be the same in the future. "In the future, we will be able to scan a QR-code with our smartphones, on a product and see whether the product meets certain standards" (Van Gils, 2018). Fairfood states that, since it is possible to directly check how much a farmer was paid for his product, certification labelling becomes redundant. This would be a positive development for consumers, since they are often overwhelmed by the myriad number of certification labels they find on supermarket products (Berends, 2017). So, this development would mean a more direct form of traceability, where the role of certification labels appears to become redundant.

However, the role of certification parties (i.e. the institutions that currently provide the labels), will monitor the quality of the data that enters the system (Van Gils, 2018).

5.3. Risks & limitations

In this paragraph, I will elaborate the social, organizational and technological challenges, risks and limitations that are being voiced in regard to this initiative.

Social

An issue that is related to scalability, is pricing. According to Fairfood research, the market price for coconuts is between 12 to 14 (Euro)cents per piece. There is a big demand for coconuts, and many farmers are dropping out of the market. This means that the local price for coconuts is a lot higher. But in order to make it a fair price, Fairfood had to add a premium of about 200%. To sell this on the consumer market, will be a challenge, as people will have the choice between very cheap coconut, or coconuts that are fair, but a lot more expensive (Van Gils, 2017). So, this is a complex issue that Fairfood is facing right now – how does awareness really lead to the willingness to pay 200% more for the same product?

As discussed in paragraph 5.1, the (in)flexibility of the blockchain system can be a challenge. Social relations and interaction are generally more fluent than a digital system, that works according to fixed rules. In this case, the farmers were paid later, but the blockchain infrastructure demanded that they filled in what they received, right away. This tells us that there is still a discrepancy between what happens in the physical world and what is registered on the blockchain. Van Gils, however, does not see this as a problem and considers this purely positive; after all, these farmers now could finally say that they did not receive the money. They could not do this before the pilot (Van Gils, 2018).

Van Gils believes there are more risks involved with blockchain for the farmers. Information that is stored on the blockchain, will not ever be changed. There are identification registration systems that make use of blockchain, according to Van Gils. This can be a threat to the privacy of people. Also, poorly constructed smart contracts, can have large consequences for farmers (Van Gils, 2018). This can cause farmers structurally getting paid too little, for instance. It is interesting that he should mention this issue with identification and privacy, while he also stresses that farmers need a digital identity on the blockchain, before they can be empowered.

Organizational

The initiative put coconuts, an unprocessed product, on the blockchain, which is less complex than a processed product. When improving transparency in food supply chains, it will become necessary to further develop the technology in order to be able to track processed goods. This is expected to be solved in the future. Provenance, the company, makes systems that allows for some mass balancing and splitting. In that field, the first pilots are already being set up (Van Gils, 2017). According to Van Gils, mass balance products, such as cocoa, coconut milk, et cetera are an interesting case for the future. Since they are not single products that can be labelled, but are stored in silos that combine different batches, traceability can be a challenge (Van Gils, 2018). Fairfood is now also looking into coffee, as a case, where the same challenge is present. It is not possible to tag single coffee beans. But Fairfood is tracing 'mini batches', which are merged until there is a large pile of coffee. This coffee is put in bags and the result is a proportional traceability. This means, that you get a statement on the bag, that there is a certain % chance, that it contains coffee produced by a particular farmer. Or that the coffee is 70% fair (for instance)' (Van Gils, 2018).

Although blockchain is generally received positively by the players in the blockchain, several actors feel threatened by the amount of information that it reveals about them (Van Gils, 2018). As was mentioned in paragraph 5.1., initially eight out of the 55 farmers in the pilot study, did not get the fair price that was agreed upon. Van Gils noticed that blockchain for traceability is generally considered a good idea. However, when the data on the blockchain stated that not everybody paid the farmers the right price, actors were less enthusiastic. They do not want this information to be public (Van Gils, 2018). Apparently, there is a downside to transparency in the food chain for several players. The challenge here is to find a balance between transparency and privacy, in order to maintain a well-functioning transparent blockchain, while safeguarding the actors' competitive positions on the market.

According to Van Gils, there is a lot of discussion about the larger players in the food chain making the blockchain – some are afraid that small farmers will not be empowered when this is the case (Van Gils, 2017). "Are we going to rely on big corporations to make these chains, or should we work on an accessible low-threshold system to include the farmers?" (Van Gils, 2017). In 2018, Van Gils however states that Fairfood is open to work with big and small actors in the food industry, since the primary goal is to accelerate change (Van Gils, 2018). One may question whether the direction of this change can be influenced by the bigger actors.

Technological

Van Gils is less optimistic about blockchain than one year ago. "I think that traceability is a relatively weak blockchain case. The reason for this, is that blockchain is mostly an idea that encourages parties to think about traceability claims and verification in their supply chain. Now, a lot of things are being traced, that were not traced before. But a blockchain is not necessary to do this, other existing systems, might be better suitable for traceability. Only, if you do not trust those, blockchain can be a better option" (Van Gils, 2018). This statement, interestingly, gives the impression that blockchain is not used for the sake of it being useful technology, but awareness – a social goal - instead. Also, one might argue that blockchain as a hype, can be used as a marketing strategy for gaining even more attention.

Not only in the case of Walmart and IBM, scaling is considered a problem. Van Gils believes that it is one of the largest cons in the system that Fairfood uses. Especially because of the fact that every coconut was traced individually, it took a lot of time to transfer to the blockchain. Products could have been merged per farmer, but the goal was to be able to trace single coconuts, instead of batches. Scalability is difficult, also in the sense that transaction verifications need to be sped up (Van Gils, 2017). However, Van Gils considers scalability a solvable problem, as technology continues to develop quickly (2018).

5.4. Concluding remarks

In this final paragraph, I will elaborate on the findings of this chapter, regarding the three sub-questions of this research. So, I will discuss findings concerning the expectations, the interpretations of risks and finally, how these are all translated into action within the initiative.

Fairfood states that it wants to create change in the food industry, by increasing awareness, but their pilots are one-time only initiatives. Every year, there is a new initiative - a campaign, as Fairfood calls it. The campaign strives to improve farmer payments and finally to achieve a living wage. But once the pilot is done, the farmers are back to business (and income) as usual and Fairfood moves onto a new project. So, while Van Gils may state differently, Fairfood seems to be aiming for awareness, more than actual inclusiveness (Van Gils, 2018). Apparently, there is an underlying expectation, that awareness within the industry and consumers, will eventually lead to inclusiveness of poor farmers.

There are also expectations surrounding the changing roles of certification parties, due to blockchain innovations. Van Gils argues that in the future, certification organizations will have a monitoring position in which they make sure that the right data is put on the blockchain. In this sense, blockchain will not only affect the farmers, but also how the information about fair trade will be brought to the consumers. Therefore, one might argue that such an initiative might have an effect on industry players that do not directly engage within the blockchain infrastructure – such as certification parties.

What is also noteworthy, is the fact that Fairfood has a high level of trust in technological development. While they acknowledge there might be risks, challenges and limitations involved with the use of blockchain, they believe that technological issues will be solved over time. Van Gils states this as he recalls the steep development of computer technology over the last decades. Past experiences inform new expectations and ultimately actions, such as implementing a novel technology like blockchain.

Van Gils states that one of the issues that Fairfood currently faces in making the food chain more equal, is pricing. Because there are many cheap coconuts available on the market, people might be inclined to just buy the cheap ones. The question is if people really able and willing to pay a 200% premium for a coconut as a result of awareness. Related to this issue, is the question if increased awareness among consumers will lead to structural improvement by companies – especially if consumers themselves are reluctant to pay the premium as a result of fair pricing.

An interesting outcome of the coconut pilot was that eight farmers initially did not get paid the right price, which they could now indicate on the blockchain. They were not unfairly paid, though – as they specified that they would get the money later. This tells us that there is a discrepancy between the fixed rules of the blockchain, and the fluid character of everyday social life and trading. This could become an issue in case these pilots were to be scaled up. However, Fairfood considers this simply as a positive outcome – they now have their say – and does not worry about the organizational or social effects this discrepancy might have.

Since Fairfood does not expect the industry to change itself, they take on the responsibility to be a driver of change, a catalyst, a frontrunner (Van Gils, 2018). Therefore, they are also open to work with all kinds of different actors – ranging from small startups to large multinational food corporations. Basically, this tells us that Fairfood is not that picky when it comes to working together with controversial large players in the industry. This is interesting, because it tells us something about the underlying philosophy of Fairfood – the final goal is to create a positive change throughout the industry and with whom, is not as important. After all, the aim is for all players in the food chain to be working in a fair manner – also the big players who currently have a large negative impact on local farmers.

This tells us that this case is not specifically about blockchain as a technology. Nor is it using blockchain because it seems to be the best option, as Marten van Gils has stated. Blockchain is however a controversial and well-discussed topic and it seems that this is the reason why this technology has been chosen as a means to create awareness among consumers. Blockchain for the sake of publicity, instead of it being the ideal technology in terms of usefulness or practicality. Furthermore, the notion of ‘campaign’ implies a political initiative. More than actually creating a change for the farmers, the campaign signifies a move towards awareness and publicity.

6. A case for inclusive business

In this chapter, I will discuss and analyze the third and final case. This is the case of Agunity, which aims for more trust among smallholder farmers in developing countries. First of all, I will elaborate on Agunity and the actor coalition that is involved. Then, I will discuss the initiative and the expectations around it. Finally, I will consider the challenges, risks and limitations that are related to this initiative and provide with concluding remarks. In this chapter, the representatives of Agunity (David Davies and Angus Keck) may also be referred to as 'Agunity', since they speak on behalf of the organization.

6.1. Actors and initiative

About Agunity

The concept of Agunity was born at a hackathon in London, in 2016. The goal was to come up with a way to help people lift themselves out of poverty. The team of Agunity focused on the billion small-scale farmers in the world; farmers with only a couple of acres of land, that survive on only a few dollars a day. 'These people are so poor that nobody really seems to care to develop a solution for them, because they are not really a part of the economy in a big way. They are often forgotten, even to a large extent by the NGOs' (Davies, 2017). This statement by David Davies, the CEO of Agunity, shows the core purpose of the initiative and legitimizes their projects.

The major problem that Agunity addresses, is a lack of trust and cooperation (Davies, 2017). Agunity discovered that when farmers trust each other and cooperate and share equipment, they can easily increase their income. People are however reluctant to do so, because they are afraid they won't get their equipment or money back. 'Many institutions focus on giving them wheat or better fertilizers, but the fundamental issues are social. In a Western society, people can go to the police when they aren't paid for their products. In countries like New Guinea or Kenya, that is not really possible, therefore people are very careful to trade and cooperate with others' (Davies, 2017). This statement demonstrates the view of Agunity; they want to improve relations and cooperation among famers, but do keep in mind the political and social environment they are operating in.

Actor coalition

Agunity considers contacts with local people on the ground to be very important. The locations – in Papua New Guinea, Bali, Solomon Islands and Ethiopia - have been chosen so far, based on the availability and willingness of these local partners. These partners can either be local elders, community leaders, or NGOs for example. Agunity finds it important that these actors match well with Agunity's goals and values (Keck, 2018). One of the co-founders, John, went for 18 months to Kenya to learn about the local communities and how Agunity could play a role in empowering them. It took about 3 to 4 months before the local community farmers trusted John enough to agree on participating in the pilot project. One of the reasons for this, is that there are a lot of NGOs who worked in the area. Keck explains: 'What usually happens, is that an NGO comes in and signs people in for a project, provides them to seeds and fertilizers, et cetera. But these projects have a limited time span and might not get their funding renewed. So, a lot of farmers are often quite hesitant when they see a white guy coming to their community, saying that he wants to help them out.' It will not be very feasible to spend 3 to 4 months in every community to build up trust with the local farmers – the investment would be very high. The main takeaway is therefore that you need to have a partner who has already done the ground work. 'Someone who is respected by the farmers and also who matches with Agunity. An NGO or just a community elder, as is the case in Papua New Guinea, are the kind of partners Agunity is looking for' (Keck, 2018).

In terms of funding, Agunity counts on three main sources; angel investors, impact investors and strategic partners. Angel investors are people who have money and are keen to invest in early state startups. They know there is a greater risk, but they also know they can make a lot of impact by facilitating the growth of a small startup that does something sustainable and gets larger. Impact investors are the second source of funding and are often angel investors as well (but do not have to be). An example of an impact investor is a venture capital fund that wants to invest in a startup with a social and sustainable impact on the world. The third and final main source of funding, are strategic partners. Agunity set up a marketplace for the farmers, where they can purchase goods and services (Keck, 2018).

So Agunity notes that they are looking for partners who are not only able and willing to fund the project, but also connect with the farmers and the objectives and values of Agunity. This is a significant statement, since this shows that Agunity cares not only about 'generating funding', but also requires a certain mindset from their partners. Apparently, they find their views and ideas very important and are looking for people and institutions that share them. So, we see a lot of private investors, such as the angel and impact investors (Keck, 2018).

Remarkably, Agunity is not only interested in small-scale investors necessarily and is also funded by several NGO's. The most important ones are UNICEF and the Bill & Melinda Gates Foundation, that funded the distribution of the phones with the application on it. Especially the Bill & Melinda Gates Foundation is a controversial organization, often criticized for its lack of attention for the needs of the local citizens they attempt to help. The Foundations' focus seems to be more on developing new technological 'solutions' without first questioning if that is the ideal way to tackle specific development problems. This is in contrast to the approach of Agunity, who first closely investigate the area and the social environment of the places where the different pilots took place. Critics of the Bill & Melinda Gates Foundation expressed their worries about the power that the Foundation can exert on the projects they fund (Belluz, 2015). One may question whether to what extent and in what ways the Bill & Melinda Gates Foundation could influence Agunity and their work.

Agunity is not only working in developing countries, but also has partnerships in Australia as well. These partnerships are mainly test pilots. One example is a test pilot for the traceability of Merino wool, called MyOrigins. 'A lot of people approach us and say they want to be able to record the supply chain on the blockchain and they know we have the technology' (Keck, 2018). These projects are done for a couple of reasons. 'One, is to see whether this is a viable revenue stream, if it can help supplement the main source of income and help the roll-out with the developing world farmers. Two, it is a validation of the technology, because provenance and traceability are something that we are doing in the Solomon Islands. Doing these other projects helps us figure out what is required and educate us' (Keck, 2018). The main reason Agunity can do these projects, is that these partners – Australian or any developed world famers and companies – have the money to fund it up front. In developing world, one needs their own capital or an NGO grant. It can be another form of generating revenue (Keck, 2018).

Initially for Agunity, the focus was on increasing cooperation and trust among farmers. Now the aim is to take it one step further and record the food supply chain to the blockchain. Agunity has partnered up with a chocolate manufacturer – Makira Gold - who is based in Brisbane, Australia. Brian Atkin, the founder of Makira Gold is originally from the Solomon Islands and wanted to help cocoa farmers increase their income by helping them and the cooperatives get fermenters and driers. One issue Atkin encountered, was that it was hard for the farmers and cooperatives to find end buyers for the cocoa. He therefore established his own chocolate manufacturing company and buys cocoa directly from the farmers, so they get the best price for what they are producing (Keck, 2018). So here we do see a partnership emerging that is specifically linked to a grassroots Agunity case.

The initiative

The Agunity team went out and spent months living and working in some of the worlds' remote rural communities, initially in Kenya. They ran tests in these places and worked with the local farmers. The application that Agunity developed in order to increase trust and cooperation, is called Agriledger. It is based on a blockchain and in this instance, it works like a transaction log. It is a record keeping application for the farmer, which helps them plan the trade and share resources securely. One of the unique aspects of Agriledger is that it deals with people who never owned a smart device or computer in their life before. Together with these farmers, Agunity designed the application and in order to come up with something that made sense to them, the design went through many iterations (Davies, 2017). Because of the intensive background research, the application works in such a way that these farmers understand and cooperate and the way that they deal with cooperatives. Agunity therefore seems to have a more bottom-up approach in their work. The application is a record keeping aid, which helps farmers keep track in a reliable way of what they owe each other. This way, farmers overcome the hurdle of lending each other equipment or seeds and help each other to increase their yields and income.

This can also be seen in the application of the app in different settings. The functionalities of the application are designed to be very simple and the benefit of this is that it can be used in different countries, in similar contexts, such as Papua New Guinea and Indonesia. But what Agunity has noticed, for example in Bali, is that there is an extra step that needs to occur in the process in order to increase the sense of security – an extra kind of 'digital handshake'. This has not occurred in previous projects, so they have to add in this kind of functionality to the phone. 'Also, there might be the need to update the app to be culturally appropriate in the different settings. For example, in Bali, orange and yellow are not well-liked colors, so we have to be kind of conscious of that and choose a color set that matches with local culture' (Keck, 2018). Another example of using the application differently in a specific cultural context, is the pilot study in Papua New Guinea, where farmers grow cocoa and there is a need for an extra confirmation for increased trust. When a farmer hands over his or her beans to the cooperative, they both take a photo with a QR-code and they both send it, getting the same transaction. As soon as either of the phones gets connected to the internet, they send up a signal to the cloud, saying the number of bags of cocoa was transferred and between whom. This is also written on the blockchain automatically, as a log. In the Kenya pilot, for instance, people do not work with these QR codes, simply because there appears to no need for it in this social environment (Davies, 2017; Keck 2018). This approach also tells us that Agunity has an inductive way of developing their business – based on the needs and cultural background of the farmers. They seem to believe that blockchain applications should be usable for people in distinct social settings.

The application was tested in two pilot projects; in Kenya and Papua New Guinea. In these two examples, Agunity managed to increase the average farmer income by about three times, from one season to the next. The results surprised even Agunity, who expected a maximum increase of about 20 to 30%. 'What we utterly underestimate, is when you start dealing with the very poorest farmers in the world, their problems are so systemic that simply by getting them to cooperate, you can have a massive increase in their income' (Davies, 2017). Clearly, Agunity considers themselves as a facilitator of cooperation, instead of an interfering party.

One of the pilot studies was in Kenya. Here, people were seeding wheat by hand. The farmers started out by ploughing up a large field with a cow. They then threw wheat on it and plough it up again, which was quite inefficient and did not lead to high yields. The reason the smallholder farmers grow wheat is because the larger farmers in the area do manage to make incredibly high yields. But these smallholder farmers only have a couple of acres of land, the problem is that they do not have any money at the time they start seeding. Therefore, they cannot afford to hire someone with a tractor and a seeder to come and seed their field, which is far more efficient. The man with a tractor is willing

to seed for them, but he does not trust them to pay him back come harvest time, because there is no secure record keeping. 'So here, the Agriledger app comes in handy' (Davies, 2017). The farmer orders the seeder through the app to come and seed their land. That costs them about 50 Shillings, which is about €12. These farmers cannot pay upfront, but the seeder will be paid back when harvest time arrives through the app (Davies, 2017).

Once the pilots are running well and the farmers have some money to spare, Agunity wants to incorporate a market place within the Agriledger application. This way, farmers can also buy or lend products, such as solar panels. Agunity will make some money of it, which will be transferred through the application, too (Keck, 2018). Also, currently, most of the people that work for Agunity, do this voluntarily. When Agunity has a viable revenue stream, people can be hired to do this work fulltime (Keck, 2018). This way, Agunity will be part of the local economy and be able to maintain their projects, without being constantly financially depending on external funders.

According to Davies, the first Agunity pilots have harvested great results and the initiative is looking to set up new pilots in other communities and countries (Davies, 2017). Depending on the amount of funding that will come in, Agunity will invest in expanding their Papua New Guinea pilot and launch new pilots in Ethiopia, Turkey and the Solomon Islands.

6.2. Expectations

In this paragraph, I will elaborate the social, organizational and technological expectations that are being voiced in regard to this initiative.

Social

As Davies (2017) mentioned, the initiative attempts to fight a lack of trust among smallholder farmers in developing countries in order to help them cooperate and create higher crop yields. Even though these are not explicitly mentioned being an 'expectation', one may assume that they are, since trust is the main goal of the initiative for which blockchain was being used. Keck (2018) states that he did not even consider using any other type of technology to do this, even though blockchain is an expensive technology and there are many faster and cheaper DLT's available.

"People want to know where their food is coming from and they are willing to pay a premium for that product. So, that is what we are doing in the Solomon Islands" (Keck, 2018). So, in this case we see that Agunity is not focusing on simply creating trust for the farmers, but also extending this trust to the consumer; they will know what they are purchasing. So here again, the main goal is to achieve increased trust and revenues for farmers, as well as Agunity.

Through the Agriledger application, at first, farmers are stimulated to cooperate and increase their income. Next, these farmers have the opportunity to invest in – among other options – solar panels, microloans and water pumps (Davies, 2017). 'There is an incredible potential to create business in places where it previously did not exist'. This way, they can help 'farmers lift themselves out of poverty' (Davies, 2017). This approach says three things about Agunity. First, a point that is already mentioned in the previous section; the goal for Agunity to create business and a constant revenue through the marketplace in the application in order for Agunity to be independent from external funding. Secondly, it shows that Agunity expects to be a facilitating party which enables people to empower themselves. Finally, and most crucially in relation to the technology itself; they expect blockchain to be able to achieve financial inclusion of smallholder farmers.

Figure 4. A package of Makira Gold cocoa with a QR Code (private photo)

The partnership with Makira Gold goes further than to increase trust among farmers and aims to record every step from the production to the consumer. Fairfood and Makira Gold already created test packets of chocolate from individual farmer families from the Solomon Islands. Each packet had a label with a QR code that can be scanned with a phone. The code would send the consumer to a website that had details of the farmer, a little bit of background information on the product and a photo of the farmer and the land. This way, people can connect to the person who grew the food they are about to eat. "That is a really big and exciting part of what we do. We can actually provide that traceability and I guess from here we will try to make it more sophisticated. That was a demo project, now we are trying to build it out" (Keck, 2018). Here we see that Agunity expects the technology to not only improve the position of farmers, but also create awareness among consumers.

Organizational

The suppliers of these goods and services can be potential investors. They want to help grow the business, because it creates a new market for them. On the other hand, it is beneficial to Agunity, because they can earn some extra revenue by selling through their marketplace. Most of the sources of funding are angel and impact investors (Keck, 2018). The fact that Agunity chose for these partners, tells us that they do not operate like a traditional NGO, but are also looking for strategic partnerships that can help them increase revenue and scale up their business.

Agunity works together with Australian companies – such as MyOrigins – to create revenues and in this respect, we can see that Agunity has more of a business approach than a typical NGO. This approach can partially be explained by the background of Agunity's founders; they have been working in the financial technology sector for many years. Also, there might be a simple practical reason for Agunity to be aspiring to be a fully independently operating business. This would also solve the question of the risk of being influenced by funding partners who have the power to determine Agunity's agenda.

Technological

What is striking, is that in the interviews and lectures by and with Agunity's team, nobody really mentions their expectations about technical aspects of the blockchain. The technical side of the initiative, such as developing the application and testing it – it is rarely a topic of discussion. This might tell us something about the audience in the lectures and their possible lack of interest in the technology, but also about the expectations of Agunity. They might not want to share this information because of their competitive advantage. Another option is that Agunity does not see blockchain as very important in a technical sense but focuses more on the social side effects they expect it to have: improved trust and cooperation.

We can also see this in the following statements. 'It is true that blockchain has become such a buzzword. However, we do use blockchain because we believe that it has the benefits that we are trying to deliver. It has transparency and security. The fact that the blockchain cannot be changed, the transactions cannot be altered, that is important to us.' Blockchain therefore provides a sense of security. 'We could use a regular database to record the transactions and using blockchain is not fully necessary. But in terms of what we are doing, we believe that it matches very simply. It is not a complex use of blockchain, but a very authentic use of blockchain.' According to Agunity, that it will continue to be the case. 'I don't think we have ever thought or discussed not using a blockchain. But very much so, now and into the future, it is one of the bedrocks of the application and also just the principle of what we are trying to achieve' (Keck, 2018).

6.3. Risks and limitations

In this paragraph, I will elaborate the social, organizational and technological challenges, risks and limitations that are being voiced in regard to this initiative.

Social

One of Agunity's big challenges, for the coming year, is the validation of the business model and the changing role of the farmers as economic actors, actively participating in the food chain. In Papua New Guinea, farmers were complaining that they wanted to be able to get access to goods and services. Their incomes increased by three times, but they have no way of purchasing anything meaningful with that money. So, in Papua New Guinea, Agunity organized the sale of solar lighting systems; about $25000 worth of solar lights. That however was directly with the cooperative and the farmers, but yet not through the marketplace functionality in the application. 'So, for 2018, a big part will be trying out the market place – will we get enough throughput there to generate enough revenue? And perhaps we will be looking at alternative revenue models, such as charging a percentage of the farmers' sale. If we are going to scale, at any kind of pace, we need to be generating enough revenue' (Keck, 2018). This is not really a blockchain-related challenge. It is more a challenge that is related to Agunity as a business, specifically, and their desire to be self-sufficient.

Another challenge that is voiced by Agunity, is the trust-building aspect of the projects. Previously, in order to set up pilots in new places, volunteers for Agunity stayed there for a couple of months in order to build trust with the local community so the people were open to work with them and the application. Usually, people are rather reluctant, because NGOs are not able to offer structural solutions to development issues. Eventually NGOs either run out of funding, or it does not get renewed and the local community is left empty handed. However, it is quite expensive for Agunity to spend months starting up the pilot in new places, so it is a challenge to find ways to speed up this process (Keck, 2018).

Organizational

One of the new pilots that Agunity will engage in the coming months, is in Papua New Guinea. Here, the focus will be on cocoa farmers and the traceability of fairly produced cocoa through the food supply chain. One of first challenges Agunity ran into during this project, is tracing the mass balance products. So, the cocoa is not a single product that can be individually traced, but it is produced, processed and transported in batches. Eventually, the produce from one farmer might get mixed with other cocoa, which makes it difficult to trace it back. This is a challenge for Agunity, especially if they want to scale up the production and trade of cocoa. On the one hand, it is better to be drying and shipping as much as possible at once. On the other hand, working with tiny batches will help increase traceability (Keck, 2018). So, this is still an issue to work out in the future. Also, this is not quite a blockchain-related issue, but more of a bookkeeping challenge.

Technological

Agunity states that there are certain limitations to blockchain technology in general but does not foresee large problems. 'You have to put more investment into the construction and design, it is probably easier to set up a regular database. Also, in terms of risks, blockchain is a new technology; it has only been around for ten years.' So, blockchain is still a very new technology in terms of its application and in terms of being tested out. However, it seems to be quite safe and Agunity sees no reason to worry. 'Also, a lot of people have tried to break it and hack it as best as they can. But it just turns out that the platforms that host most of the content, that is what gets hacked, not the blockchain itself; which is a fantastic validation of the technology' (Keck, 2018). They acknowledge that the discussion about limitations and risks is prominent, 'But I do not think from our perspective there is anything we feel particularly worried about.' It could be that there are risks in the future that come out with blockchain technology. I mean, that is kind of with every technology, there might be vulnerabilities that we do not yet know about' (Keck, 2018). This tells us that Agunity seems to have a large trust in the technical development of blockchain technology and is not very worried about future technical issues, although they keep the possibility in mind.

6.4. Concluding remarks

In this final paragraph, I will elaborate on the findings of this chapter, regarding the three sub-questions of this research. So, I will discuss findings concerning the expectations, the interpretations of risks and finally, how these are all translated into action within the initiative.

Another interesting finding is that Agunity is now looking further at the food chain and is also working on a traceability pilot for cocoa in Papua New Guinea. In this pilot, cocoa will be traced, and people will be able to scan the product in the supermarket and know who produced their product. So here we see a new project arise as a direct result of the cocoa pilot in Papua New Guinea and that Agunity's attention is also shifting towards creating awareness among consumers.

The fact that trust-building between the smallholder farmers and Agunity volunteers is mentioned as challenge, tells us that Agunity finds her relationship with the local community very important. They expect to be able to find a way to find a structural solution in which farmers 'can lift themselves out of poverty' (Davies, 2017). In order to do this, Agunity appears to believe that there must be trust between the local community and them, so they can work together. In this sense, there is an equal relationship, in which Agunity learns from the local community and vice versa – instead of an inequal situation where an external (development) party comes and tells the local community what they should do.

Although Agunity aims for inclusive business and higher yields for farmers in the first place, they tend to have a business-like approach. This is visible in the way they look for opportunities to create higher revenue streams and their strategic approach to growth. What seems to be characteristic for this case, is that Agunity strategically uses its partnerships for certain goals. They initially start off with external funding, but attempt to become an independently operating initiative, which is not dependent on funding. Also, Agunity strives to be able to pay their volunteers a living wage, so they can make a living themselves – most of them spend many hours for Agunity, next to a fulltime job (Keck, 2018).

The expectation that blockchain will increase a level of trust due to its immutable character, is the main reason why the founders of the initiative chose this particular technology. They state that there was no other ledger technology they even considered using. This is important to note, because it tells us that Agunity believes that the other available DLTs, do not measure up to blockchain technology

when it comes to safety and trust-building. Moreover, the fact that Agunity focuses on solving social issues, shows that using blockchain technology is a means, not a goal on itself. The choice for blockchain technology particularly, signifies that Agunity has the belief that there are positive social side effects to using this specific technology – such as trust and ultimately cooperation. So here is a direct link between the expectations of the technology and the translation into activities (i.e. the creation of the Agriledger application).

7. Discussion

In this chapter, I will elaborate on the three cases that I have discussed in the previous chapters. In this chapter, I will discuss how they compare and contrast in terms of their approach, expectations and critiques. Also, this analysis will aid me in answering the final research question in the conclusion chapter.

7.1. Different initiatives

Each different initiative can be viewed as a distinct problem-solution case. This means that each actor (i.e. Walmart/IBM, Fairfood and Agunity) each see different problems with regard to food supply chains, that they attempt to solve. In the case of Walmart, it is the fact that faulty and fraudulent products are difficult to be traced back. In order to discover where bad products come from, Walmart needs to invest a lot of time and money. Since, essentially, they are a for-profit multinational, this is a rather big issue for them. Therefore, they are looking for solutions that make traceability faster and more reliant. Fairfood, an activist initiative, wants the food system to be fair and smallholder farmers in developing countries to be paid well. However, these farmers are undocumented and have too little power to be able to stand up to the traders that buy their products. Basically, they are invisible players in the food chain. Also, Fairfood believes that consumers are not aware of these issues in the food system. In order to change this, Fairfood wants to give farmers an identity and a voice, as part of their (activist) campaign. The third and final case, Agunity, is like Fairfood in the sense that it wants to empower small-scale farmers who do account for a large portion of the worlds' food production, but often live under the poverty line. They see however, that income can be increased by higher yields (rather than a higher price), and that these yields are generally low due to a lack of fertilizer, use of equipment et cetera. These lacks can be solved by sharing and lending among farmers, and in order to do that, they need to have more trust in each other – that they will get paid for their goods and services.

So, interestingly, these different cases have different problems and they can be categorized along two axes. What I see, is that the three different initiatives have a different orientation when it comes to the food chain, as well when it comes to their focus. IBM/Walmart tend to focus more on improving profits and efficiency within their own chain– although it has to be mentioned that they seem to acknowledge the social aspects that are related to blockchain (I will discuss this notion below). This can be considered a more 'inward' focus than the two other initiatives – an activist initiative and a social venture. These latter two attempt to solve social issues within food chains and can therefore be considered to be more 'outward' focused. Furthermore, the three different initiatives operate on a different scale within the food chain. IBM/Walmart and Fairfood seem to focus on vertical chain integration and traceability within this chain. Agunity, on the other hand, appears to be more focused on individual actors – smallholder farmers - instead of the entire food supply chain. It has to be mentioned though, that with the chocolate initiative in Papua New Guinea, Agunity is starting to incorporate a food supply chain in their initiative. These findings can be visualized in the following scheme:

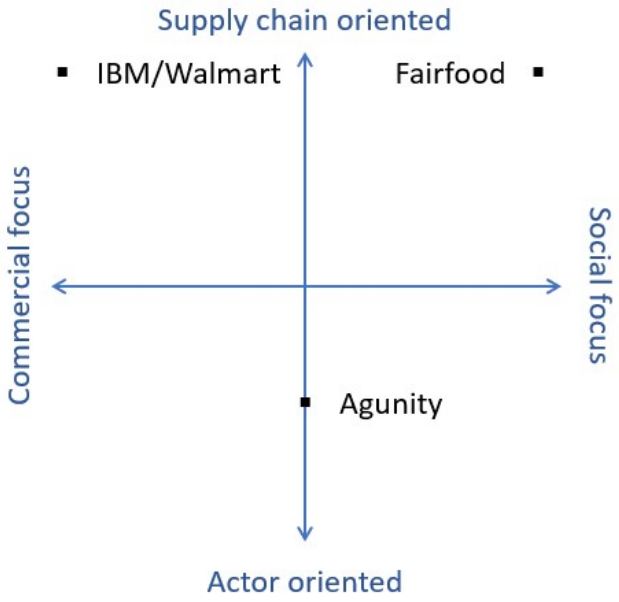

Figure 5. Visualizing the initiatives

I have deliberately chosen for these particular concepts. The notions of commercial versus social focus are selected because they are quite transparent. Initially, I wanted to put respectively inward, versus outward focus, but this appeared to be less clear for the reader. Now, just by looking at the scheme, one can see whether initiatives are focused on efficiency and profits, or positive effects on society (or something right in between). The reason I chose actor oriented versus supply chain oriented, is also simple. It shows to what degree the initiatives are focused on one particular type of actor in the food chain or on the supply chain in its whole. One might argue why I did not put farmer oriented, instead of actor oriented. I did not do this, because this way, other initiatives – that may focus on traders, or cooperatives, can also be scaled into this scheme. It can be an aid for further research, helping other researchers to create clarity in what kind of initiatives they are looking into.

This visualization tells us a couple of things about the stances of the different initiatives. Most interesting, is that Fairfood and IBM/Walmart – two seemingly opposing initiatives, do have something major in common. They both have a supply chain-oriented approach, which means that they focus on incorporating the entire food supply chain on the blockchain ledger. Agunity instead, although starting with a traceability pilot, focuses on using the blockchain for only one type of actor in the supply chain (i.e. the farmers). While Fairfood and IBM/Walmart are opposing in terms of focus, Agunity seems to be in the middle. They did start out as a not for profit initiative, but they are working with partners in order to set up a digital market place and make profit, so they can maintain and expand their practices and pay the people who are working for them. This is interesting, because it might be the case that Agunity moves more to the left in the diagram, once it starts making more profit. This might mean that the company will be increasingly internally focused, because Agunity's goal of making profit is to be able to set up more pilots. This will require more personnel, that need to be managed and finances will be more complex in the case of a bigger initiative.

7.2. The expectations

The expectations for each case have been divided into three categories; technological, social and organizational - which leads to some interesting observations. First of all, there seems to be little emphasis on the technological aspects of the blockchain application for each initiative. That is striking,

because they are all famous because of their use of blockchain technology. One might think that the initiatives share little information on their blockchain application because of their fear of losing competitive advantages, but it is not plausible that this is the case for each initiative. After all, (for instance) Fairfood does not seem to care about making profits, since it is an NGO. A competitive advantage therefore might not seem the actual reason for Fairfood. The other two initiatives are for-profit, so for them it might be reasonable not to share any technical information.

What is even more interesting, is the fact that all three initiatives appear to have a major interest in the social sides of the blockchain application. For instance, in the case of IBM/Walmart, it is expected that blockchain will help these two industrial giants obtain more power in the food chain. They expect to be able to dictate what information need to be shared – considering the current size and impact of both IBM and Walmart, this shift in power might be substantial. In the case of Fairfood, the farmers get an identity on the blockchain, which, is expected, to lead to empowerment and more equality. Also, they expect the role of certification parties to change – from providing certification themselves, to monitoring what will be put on the blockchain. In the case of Agunity, it is expected that the blockchain leads to higher levels of trust and social cohesion within a farmers' community.

When it comes to the organizational aspects of the three initiatives, there are some similarities and contrasts as well. For instance, in the case of IBM and Walmart, it gets mentioned that the blockchain might lead to a certain preventive effect, that traceability will keep people from trading in fraudulent or unsafe products. In a sense, this means that blockchain itself has a preventive effect when it comes to fraud and has the power to re-shape processes within the food chain. As for the second case, the expectation is that Fairfood's initiatives are steps towards a future in which all products are traceable to their origin. Blockchain in this sense is expected to have an impact on how certification of fair trade is organized. In the case of Agunity, the expectation is that their primary income – funding – will become less and their revenues, through the marketplace in their application, will increase. This way, Agunity will move from function like an NGO, towards a for-profit social venture. This would mean a shift to a more

Another interesting observation within these expectations, is that all three initiatives use some of the same concepts, but these do not always mean the same thing in different contexts. They are multi interpretable. The most prominent example of this is transparency. For IBM/Walmart, transparency is connected to the efficient traceability of faulty products to their origin. For Agunity, transparency is related to trust among farmers, which will eventually translate into more trade and higher yields. For Fairfood, transparency is associated with efficiently verifying fair trade and empowering smallholder farmers – who would otherwise be invisible and undocumented.

7.3. Challenges, risks and limitations

Also, for the challenges, risks and limitations there are some interesting observations to be made, for instance regarding the technological aspects of implementing blockchain. Agunity does not really seem to share a lot of ideas about what they think is a challenge about the blockchain. They see it might have some issues, but strongly believe in technological progress and issues will be solved as the technology further develops. They never even considered not using a blockchain. Fairfood has similar ideas – although there are issues with blockchain, technological innovation will solve these over time. They look back at the extremely rapid development of IT over the past few decades and believe that this development will continue to go on, cracking any current issues. Currently, blockchains are relatively slow and expensive, but this will improve over time, according to Van Gils. IBM and Walmart, on the other hand, do not utter any risks, challenges or limitations they think could be related to the

technological aspect of blockchain. However, there are external critics that voice their concerns regarding scalability and usefulness.

Another interesting observation related to the social aspect of blockchain, is the contradiction between IBM/Walmart and Fairfood and Agunity. While both Fairfood and Agunity are working on giving smallholder farmers respectively a higher income and the opportunity to actively take part in an economy, IBM/Walmart is receiving critiques on marginalizing other actors in the supply chain and even using blockchain technology to increase their power over others. All at the same time, they are all using blockchain technology specifically to achieve these goals. This means that blockchain can be used for opposing ends – accumulating power, as well as empowering the marginalized players in the food chain.

7.4. Translating expectations into action

This multi-interpretability of transparency within these blockchain initiatives is very interesting because it shows us what the different initiatives expect of blockchain technology and how they act upon these expectations. Each of the initiatives seems to connect different social or organizational effects to blockchain technology specifically and uses it for that particular goal. (For instance, Agunity expects blockchain to create transparency and reveal inequality in the food chain to the industry and consumers.) These goals and expectations have been elaborately discussed in the chapters about the case studies (chapter 4 – 6) so there is no need to go over all of them here again. However, it is important to note, that although there are faster and much cheaper DLTs available, specific expectations about social or organizational effects seem to be heavy-weighing factors, deciding in favor of blockchain usage.

All three initiatives are looking for ways to expand their practices and look for partners, but with a different ideal in mind. For IBM/Walmart, we can clearly state that they are looking for ways to integrate vertically and take over other players in the food chain because they explain this quite literally. In the case of Agunity, we do not see such strong desire for increased power in the food chain over other actors, but a need for more revenue and profits, so they can pay their own employees a living wage and start new pilots in other places. Also, they are currently very dependent on funding and when they make more profits, they do not have to rely on that as much anymore. Fairfood is an activist movement and they are not necessarily looking to make profits. Instead, they want to start up different campaigns for different products where farmers in developing countries are financially squeezed. In order to do this, they look for both small- and large-scale companies to work together. For them it is not so much about gaining capital or power, but mostly about creating awareness among both consumers and the (trading) industry. So, in each case we see a different realization of the same concept.

Furthermore, as discussed, the aim for transparency is considered in each case, albeit in different ways. What can be observed, is that they organize themselves in different ways, in order to obtain this transparency within their respective food chains. We can see that IBM/Walmart expresses this in the way they desire to have every single food chain registered on the blockchain eventually. So here, the desire for transparency is manifested in a play of power – forcing other players in the industry to publish their data. In the case of Fairfood, transparency is a means to reveal power imbalances to the larger public of consumers, as well as to the industrial players in food chains. After all, they are an activist organization, striving for more equality in the food chain. Finally, Agunity aims for transparency for increased trust to achieve a higher level of local trade – they do this by using the immutable character of the blockchain for more confidence among farmers.

7.5. Reflection

It is also important to look back on the process of performing the research and analyzing the data, because thesis research is not only a learning process in terms of the thesis topic. It is also a training in performing good, reliable and valid research, which can form a credible starting ground for further investigation. I will consider some of the hurdles I have encountered during this research, how they might have affected this thesis and what I have learned from them.

First of all, the cases were different, in terms of data availability, which required a different approach. For Agunity and Fairfood, I could both rely on direct communication with these initiatives and directly ask them the questions that I wanted to know. I deliberately tried to not steer the respondents into talking a certain way, and simply kept to the interview topic list (which can be found in Appendix I). This helped me to obtain data which was genuine and as little influenced by myself as possible. I have to mention that probably, there is always a certain degree of influence by the interviewer, as I have used a topic list in order to be able to discuss all the issues that I needed for my research. This way I did steer the interviews in certain ways, although I attempted to let the respondent speak as much as possible, while listening carefully myself. I did not make notes, so I could fully focus on the conversation. In the end, I transcribed the interviews. Unfortunately, I was not able to perform a second interview with my respondents, as they are very busy. I believe that I would have gotten interesting results, to delve deeper into the different categories of expectations and how these are translated into action. Also, I transcribed the Food Integrity Blockchained meetings in Amsterdam, where both Agunity and Fairfood came to explain their initiative. This way, I had extensive information about how these two actors speak of their initiatives, expectations and worries.

In the case of IBM/Walmart, I had to tackle data-collection in a different way. This case, I did hear of first while being at the FIB meetings, but they did not present their case. Nor were they open for interviews. This meant that I was reliant on information from the internet; their own websites, year reports and news articles. This means that the type of data used for this case, is very different compared to Agunity and Fairfood. Since it was not possible to ask any questions, about for instance the risks and limitations, I might have obtained a more one-sided view than in the other two cases. After all, it is not plausible to announce on your website that you are excited about a new project and then name all of the concerns you have. Since company websites are very much a presentation towards customers and (future) partners, it must look appealing. I approached this problem by also looking at concerns that external people have towards the specific IBM/Walmart case, in order to see what concerns there might be. But it is true; this is not an ideal solution.

Blockchain is a relatively new technology and this has its implications for this research as well. Although I have managed to find interesting theory to analyze the data with, I have been dependent on many other sources than academic literature, which to be fair, I found slightly frustrating. There simple is too little academic literature about the specific application of blockchain technology in food chains. For this reason, I have been dependent on many news articles. The issue with these articles, is that they are not academic and therefore might be biased and influencing my own outcomes. This is something that could not have been avoided, but nonetheless important to keep in the back of our minds while reading the conclusions.

Expectations surrounding blockchain technology have developed faster than I expected them to, when starting this thesis. When I was writing the theoretical framework, I elaborated on three central dynamics of expectations, as explained by Borup et al. (2006). One of these, ‘expectations and temporal variability’, I did not fully investigate in this thesis. After all, I did not believe that the

developments in blockchain technology would be so fast, that I could analyze them. It seemed interesting to me, to discuss and evaluate how people's expectations would change over time and also, how they would talk of blockchain technology differently as their expectations would evolve. However, by the time that I finished off writing the thesis, I found out that expectations did change. The first doubts and negative connotations are being connected to blockchain technology and we may state that the hype has passed the 'peak' as discussed in Gartner's hype cycle (Detrixhe, 2018; Linden & Fenn, 2003). Due to a lack of time, unfortunately, I cannot further go into this, but it would be an interesting topic to study in future research.

8. Conclusion

In this chapter, I will aim to provide answers to the research questions. I will first shortly elaborate on the three sub-questions. Because the cases have been compared and contrasted in the discussion (chapter 7), I will not completely go over the results again, but take the most interesting findings and attempt to explain them using the theory from chapter 2. Then, I will use this to provide a complete but concise answer to the general research question. Subsequently, I will discuss suggestions for future research.

What different expectations about blockchain for food chains, can we identify for each problem-solution case?

After data collection, I grouped the expectations within three categories; social, organizational and technological. It appeared that the different cases use the same concepts but mean something completely different by them. For instance transparency in the eyes of IBM/Walmart would mean 'efficiency' or 'food safety', but from the perspective of Fairfood or Agunity 'fair trade' or 'building trust', respectively. This means that simply identifying what expectations are voiced, is not enough to understand what the different actors mean. The underlying values that they attach to certain blockchain promises stem from their core ideals and discourse. This means that they are seemingly attracted to blockchain technology for similar reasons, but that these reasons may be deceiving. Background information about the history, ideals, values and hopes of an initiative are crucial in order to find out what these expectations really mean.

The expectations that are being voiced are mainly social and organizational; this means that blockchain is often not used, just for the sake of having a blockchain. Instead, it is a means to achieve a certain effect within society, the organization or the food chain. The underlying values illustrate this; IBM and Walmart aim to build a 'food empire', Agunity wants to help farmers 'lift themselves out of poverty' and Fairfood purpose is to reveal inequality and power imbalances within the food chain. This is important to note, because it tells us that a technology is not neutral; it is what the user makes of it – interpretation is crucial in this sense. This is in line with what Borup et al. (2006) write "[…] Very little in innovation can work in isolation from a highly dynamic and variegated body of future-oriented understandings about the future" (p. 286; see also paragraph 2.1. in this thesis: p. 11).

What are the different interpretations of challenges of blockchain for food chains for each problem-solution case?

What was most striking in the case of the challenges, was the lack of focus on especially the technological aspect of blockchain. This was unexpected – after all, blockchain is a technology, new and relatively uncertain. It would only seem logical that one would question the feasibility of a relatively new technology. Borup et al. (2006) however have an explanation for this phenomenon. They emphasize that expectations regarding a novel technology are a constitutive force and utterances are often very positive for a strategic reason – it attracts potential investors and allies. Bundling forces help initiatives to be more resilient against uncertainties. Furthermore, Borup et al. (2006) acknowledge expectations as a temporal variability. This means that they tend to be overly positive in the beginning, but tend to ignore complexities, negative externalities and certain possible risks. This means that being overly confident, can lead to a higher degree of disappointment later on. It would have been interesting to investigate this, but unfortunately, the time span of this research was too limited.

As for the social and organizational categories of challenges, they differed per case. For IBM/Walmart, nearly all challenges that were mentioned, were mentioned by outsiders. This can be explained by the fact that I was not able to interview anyone from IBM/Walmart. Perhaps, the outcome would have been different if I had. For Fairfood, an important outcome was the apparent inflexibility of the digital system. It did not resonate with the social conventions on the ground – which appeared to be more flexible. People could pay each other later on, while the system did not allow for this. This is an interesting side effect of giving actors a digital identity. Another side effect of registration of information on the blockchain, is the challenge to find a balance between privacy and information sharing. This was mentioned for as well the farmers of Fairfood, as the actors in the Walmart/IBM initiative.

How are the expectations of blockchain for food chains translated into concrete activities in each problem-solution case?

Borup et al (2006) consider the constitutive force of expectations to be in actor coalitions and the setting of action agendas, which in turn drive further action. IBM/Walmart expect blockchain to help them build a food empire in which all data will be put on the blockchain. In order to do this, they partnered up with several other, similar large industry players (such as Nestlé and Dole). The reason for this might be that many powerful companies together will create an ever more powerful combination than Walmart/IBM already is. Creating this coalition, will provide IBM/Walmart to set requirements for even more players within the food industry, which will accelerate the building of the 'blockchain food empire'. This is in large contrast to Fairfood, who basically are indifferent to who they attract, as long as it helps them get more attention towards the poorly paid farmers, for who they campaign. In the case of Agunity, the focus is on finding partners who can participate in the marketplace functionality in the Agriledger application, which can help them create more revenue. It is most likely that Agunity does not intend to be dependent on external funding (which can simply end from one day to the next). Instead they look for ways to be profitable themselves, in order to maintain and expand their pilots.

Next to all of this, blockchain might be a strategic move for these initiatives, especially because it is a hype and attracts a lot of publicity. This can mainly be seen in the case of Fairfood, where blockchain is not used on a large scale, nor is it maintained after the campaigning ends – it is purely for attention and publicity for the smallholder farmers in developing countries. As Van Gils states, using blockchain is not the ideal solution to use, because it is not very fast and relatively expensive. Nevertheless Fairfood has chosen to work with blockchain technology. In the case of IBM/Walmart, there is quite some news on the website, mainly explaining how fantastic the pilot is and that it will change the future of food. This might be an indication that it is also part of a marketing strategy, providing readers with the idea that it is a great idea to use blockchain – while not mentioning that there might be a whole rearrangement of power within the food chain as a result. In the case of Agunity, they state that there was never even a mention of using any other technology because it would be ideal for trust-building due to its immutable character. This tells us that Agunity might have not as much focus on the marketing aspect of using blockchain for the sake of using blockchain but is more interested in the actual promises that are expected.

How do expectations of blockchain technology in different problem-solution cases influence the food chains they operate in?

The three sub-questions above already partially answered the main question and based upon these results, we can make some general conclusions. I will elaborate them below.

First of all, it is important to emphasize the effects of multi-interpretability of concepts that are used by the initiatives that implement blockchain. During this research, technology has proven not to be neutral; its effects are highly influenced by the values, ideas and underlying discourse of the party that designs and implements the application. Underestimating this, might lead to an underestimation of the possible effects of a certain novel technology. On the other hand, it must be mentioned that there is always a degree of uncertainty present, especially in circumstances where a relatively unknown technology is implemented.

The fact that the initiating party has the power to steer the direction and the possible effects of a certain technology – in our case, blockchain – is also crucial to recognize. This means that there is still a certain power play going on within the food chain as a result of the blockchain. After all, there is one party that apparently can dictate who puts what information on the ledger and in what way. In the case of Fairfood, farmers need to put whether they have received the right price for their coconuts and how much they have harvested. This is decided by Fairfood in collaboration with Provenance, who designed and developed the blockchain structure. Moreover, in the case of Fairfood and IBM/Walmart, all actors within the food chain need to participate, otherwise there will be no use of setting up a traceability program. Also Agunity has developed the structure for the smallholder farmers and guides them in how to use it. All three initiatives in this research have a certain power over those that use the blockchain, which essentially means that the initial promise of disintermediation (as discussed in the introduction of this research) seems to be refuted. The fact that the network is still in a distributed shape, as Drescher (2017) describes, seems misleading. The network itself does not have a central party through which each transaction must be monitored. Instead there is a monitoring, powerful party outside of the network, imposing its wishes upon those that take part within the network – the actors within the food chain. One might even argue that the idea of disintermediation (or decentralization) is an illusion and that there will always be some sort of power play, also in the case of a decentralized network. After all, its application needs to be designed and this is dependent on the underlying ideas and discourse of the initiating party (which, are in this research IBM/Walmart, Fairfood and Agunity). I have clarified this idea in the figure below:

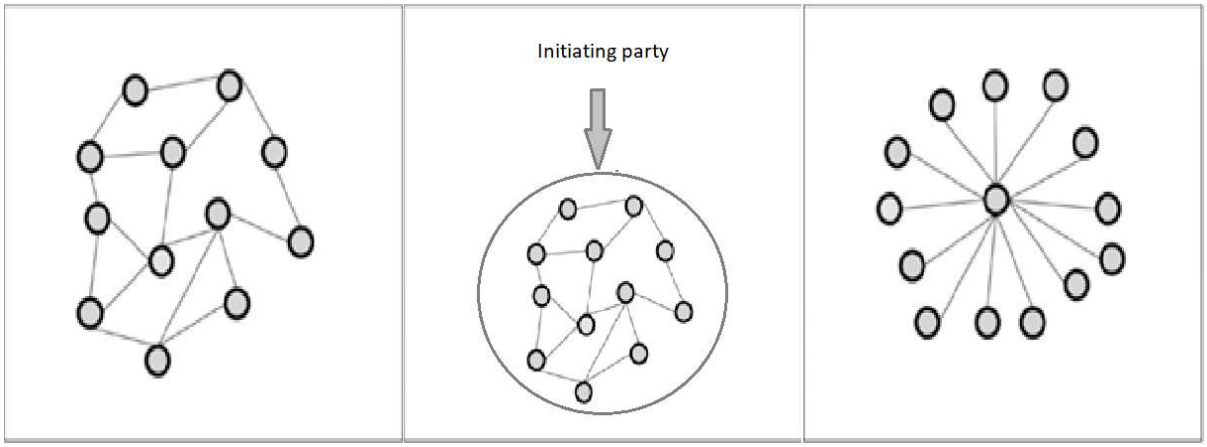

Figure 6. Complete left and right; decentralized and centralized network (Drescher, 2017: p.11). Center: altered visualization of blockchain network.

I have illustrated this idea in the figure (6) above. On the complete left, one can see a distributed (blockchain) network and on the complete right one can see a so-called centralized network, as proposed by Drescher (2017, p.11). In the middle, I have entered my suggestion; a decentralized network, but with also, the external initiating party depicted. I think it is crucial to acknowledge that in any blockchain that is developed, there will be an initiating party. Even though one can hardly generalize from case studies, it is reasonable to acknowledge that in every blockchain that needs to be designed, there is an initial wish that is desired to be attained by using blockchain. Therefore, there is reasonable ground to assume that there will be a third party, not influencing the network from within, but from without.

Finally, I would like to emphasize that blockchain is a rigid technology and there is a possibility of an incongruence between what happens in the physical world and the digital world (i.e. the blockchain ledger). I would like to refer to the example in which the farmers were obliged to write down whether they were paid at a certain moment in time – this was for them an opportunity to let their voices be heard and rightfully claim their incomes. But it also demonstrates the inflexibility of the blockchain system – the farmers were promised to be paid later, but the design of the blockchain did not leave room for this possibility. Although the rules of a blockchain can be changed after implementation, it does show there is a difference between physical social conventions which are more fluid and digital rules for registering transactions.

Suggestions for future research

Blockchain is a relatively new technology, which has not extensively been studied by social scientists (yet) and I would like to offer some suggestions and ideas for future research. First, I have noticed that the theory of Borup et al (2006) has proved quite useful in understanding the expectations that were voiced by the different initiatives. It has helped me in understanding in which ways expectations could be seen; actor coalitions, actions, risks and strategies/agenda setting.

In the case of future research, it would be very interesting to monitor these three initiatives and see how they develop over time, and how the expectations regarding these initiatives change. What might be even more interesting, as time passes, is how do the different parties look back upon their initiatives. This would be an interesting addition to the little amount of blockchain literature in the field of social studies of science, technology and society (STS). I would like to note, too, that it would be helpful to be able to talk to respondents from the initiatives more often. This way, it is easier to hold a grasp on how they speak of their initiative and how this evolves over time. Who knows, perhaps, in the future, blockchain technology will have changed the food system completely.

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Appendix I Interview topic list

About the company
History of the company/application
Why did you choose blockchain
Expectations for the application in five years
Expectations for blockchain for food chain you operate in, in five years

Risks and challenges
Challenges faced so far
Challenges facing right now
Expected challenges for the future
Risks and limitations involved with blockchain
Risks and limitations relevant for your application

Collaboration and activities
Collaboration with other parties/initiatives
Plans for collaboration in the future
The current status of the initiative (planning, implementing, monitoring, evaluating)
Which events do you attend as a company (conferences, meetups et cetera)
How / where did you obtain funding for the initiative?