

Governing Higher Education in The Netherlands: The Applications of Blockchain in Higher Education

Author: Morteza Kiani Anbouee
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands

ABSTRACT, Blockchain technology has gained a lot of attention mainly due to bitcoin but also for offering immutable public ledgers within decentralized networks. The higher education industry has been adapting to new digital methods over the years and with blockchain already proving to be successful in other industries, this research paper aims to consider the implications of blockchain in higher education. The following paper analyzes the higher education industry as a value chain in order to provide a better understanding of all the actors and their relationships. The research paper then makes three suggestions for blockchain applications and explains how they can be beneficial to the industry. The next step after making the suggestions is to analyze how the market will change if the industry applies the blockchain based methods. The research paper then argues what the challenges are with the implementation of these suggestions and takes into account past experiences from the Netherlands and also internationally. Once the suggestions and their limitations are fully discussed, the research paper makes a conclusion on blockchain benefits and challenges and makes suggestions for future research.

Graduation Committee members:

1. **Prof. Dr. Barend Van Der Meulen**
2. **Dr. Harry De Boer**

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1. INTRODUCTION

The rapid development of internet since the early 1990s, has made life without internet inconceivable. The internet introduced new means of communication and value creation thus affecting how companies do business in different industries. Over the past few years one of the most trendy digital topics has been Bitcoin. Bitcoin is a result of Satoshi Nakamoto's efforts to create a digital currency in 2008. The technology behind bitcoin is blockchain. A blockchain is a way to combine peer to peer networks, such as the internet with cryptography to create an immutable time-stamped public ledger (Swan 2015). The technology behind blockchain is not fundamentally new. Peer to peer networks such as the internet have existed for a long time. And so did cryptography technologies involving public and private key messaging and hash functions. However, the unique manner in which these technologies are integrated leads to a consensus about the true state of ledger across the whole blockchain at all time; Therefore, removing the need for a third party organization to validate any change to the ledger. To explain more precisely, one can consider blockchain as a database shared across the members of a network. This database is known as a ledger. The closest physical form to a ledger is a spreadsheet which contains all the data in the database. Since the ledger is fully digital, it is easily duplicated multiple times and recorded in multiple locations across the network. The network constantly checks the records containing the state of the ledger in order to make sure they all report the same data. Once a data is added, it enters the blockchain as a block. The network then communicates this information to all the duplicates of the ledger and updates them instantly. This causes for all the network members to view the state of the ledger in real time while no one can change everything since their power is limited to adding new blocks of data. Therefore, the members of the network are assured about the transparency and security of the ledger.

In addition to providing security and transparency to the data communicated within the network, blockchain improves the process of transfer of ownership. An example from the logistics industry can explain the process of ownership transfer more in detail. Before using blockchain for instance, for a shipment to arrive and be processed at the port of Rotterdam, multiple parties had to process a variety of administrative paperwork physically and digitally. The port of Rotterdam reports that the cost of administration was one fifth of the total transportation cost. In addition to cutting down on the total cost, blockchain removes the need for a centralized administrator for the whole process. Without blockchain, a third party administrator had to administer the whole process to make sure that all the parties live up to their duties. However, by using blockchain technology the members of the network are aware of the state of the shipment at all times as well as the payment and other factors. According to the World Economic Forum, reducing these barriers could boost worldwide trade by \$1Trillion in the next 10 years."

One can claim that in any case where a database is required to be shared across a network, blockchain is the technology to employ. This is why many academic articles consider blockchain as the next generation of internet or as "the internet of value"(Swan 2015).

The higher education industry has shown a lot of interest in digitalization over the past decades. More specially recently, due to the outbreak of novel Corona virus, many universities are looking forward to improve their digital infrastructure and move their administrative and academic activities online. Many administrative applications in the academic world however are still done physically. For example, for this research paper to be published, the researcher had to hand in a physical form to the

respective department initially. However, due to the corona virus, the university asked students to do it online. In the academic world, a database of academic records is constantly shared over a network of institutions, governments and businesses. This research paper aims to analyze the manners in which blockchain technology can improve this process. In order to do so, the research paper aims to look at the academic industry through a scientific theoretical framework and analyze the potentials of blockchain in higher education industry. In addition to providing theoretical understanding of blockchain implications in the academic world, the research paper considers the past experiences with blockchain in higher education so as to provide the readers of the paper with detailed explanation on how blockchain can improve the higher education and what the limitations are.

1.1 Research Question

The following research paper aims to answer the following research questions:

To what extent implementing blockchain technology in the higher education value chain benefits all the parties involved and ultimately improve the value chain as a whole?

Sub questions:

- *How are the improvements caused by blockchain in other industries, applicable to higher education?*
- *How will the higher education value chain with blockchain look like in comparison to the current value chain?*
- *What are the market challenges against the implementation of blockchain technology?*
- *How does blockchain technology improve the governance of higher education industry while making it more flexible?*
- *How will the position of all the actors look like in the new value chain? More particularly, how much power will the actors have in comparison to the current system without the blockchain.*

2. THEORETICAL FRAMEWORK

2.1 Porter's Value Chain

The higher education system involves many actors, each with their own domain of power. A way to draw a clear image the higher education system is to look at it as a value chain. A value chain, as described by Porter (1985) is a collection of activities performed by a company to create value for its customers. In case of higher education, the companies are the higher education institutions and the customer groups are consisted of internal and external customers such as employees and students respectively. Figure 1 represents the porter value chain in case of higher education.

Figure 1. As adopted from Groves et al., 1997, p. 304

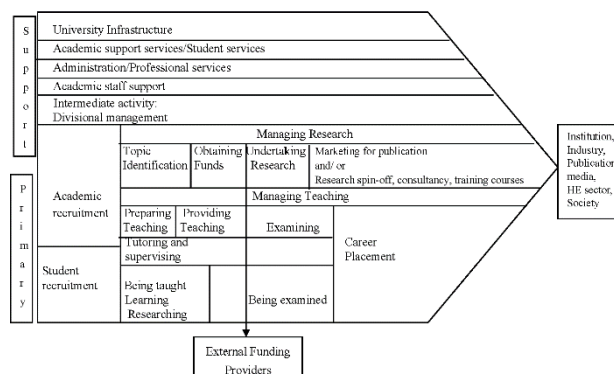


Figure 1

In case of higher education, another factor affecting the value chain is the government. The government in this case acts as a regulator defining how the domain of power for each actor and ensuring that every actor acts upon their duty. The government acts as a customer as well as it grants funding to the universities. In addition to the governments affecting the higher education value chain, the companies play a role as well. If university graduates do not choose to stay in the academic world, they will enter a job market. Therefore, companies affect the higher education value chain by defining their standards on what type of workforce they are willing to hire. Given the above explanations, the actors in the Dutch higher education value chain are thus defined as followed:

- Governments
- Higher education institutes including research, applied science and medical universities/ university staff
- Students
- Businesses/ communities

2.2 Porter's Five Forces

Porter's five forces model is used to analyze five competitive forces that shape every industry. Porter lists the five forces as

- *Competition within the industry*
- *Threat of new entrants in the industry*
- *Supplier bargaining power*
- *Customer bargaining power*
- *Threat of substitutes*

The research paper aims to use Porter's five forces and value chain in order to draw a clear map of higher education industry and analyze the actors involved in the market more precisely.

2.3 Disruptive Innovation

In 1995, Clayton M. Christensen introduce the concept of disruptive innovation. The official website of Christensen's institutes defines disruptive innovation as a process by which a product or service initially takes root in simple applications at the bottom of a market—typically by being less expensive and more accessible—and then relentlessly moves upmarket, eventually displacing established competitors.

It is important to keep in mind that disruptive innovation does not mean improving the current products or practices but rather introducing new products or practices for the same problem.

Given that blockchain is a novel way of sharing a database across a network, depending on the extent of its implementation can prove to be a disruptive innovation in the higher education sector.

One simple way to assess whether a new technology is indeed a disruptive innovation is to look at how the sector is doing and whether there have been any changes in practices by the actors in the market and if the way the actors interact has shifted. One can safely say that if the implementation of blockchain leads to currently dominant actors facilitating their internal processes while they still uphold their competitive advantage, is not considered a disruptive innovation.

Applying new technologies in established markets and industries in many cases requires a considerable amount of investment. The investments can be both monetary, in this case building the necessary infrastructure for blockchain or in other forms. Clayton M. Christensen, in his book "The innovator dilemma", discusses that enhancement applied to a product at times can exceed the expectations of even the most demanding customers. In case of higher education therefore, it is important to consider whether the external customers of the product, the

students and the internal customers, the university staff, do truly realize the value of blockchain in higher education.

Concluding on the explanations above, it can only be after the implementation of blockchain technology that one can consider it as a disruptive innovation depending on the extent of its implementation. It is only in the case of market dynamic change due to blockchain that blockchain can be considered a disruptive innovation. Also, for the technology to become wide spread, it requires the market to have demand for the applications of the technology.

The graph below shows how an organization operating at the lower end of the market can move their offering to the mainstream section of the market through disruptive innovation and thus challenge the companies dominating the majority of the market.

The Disruptive Innovation Model

This diagram contrasts *product performance trajectories* (the red lines showing how products or services improve over time) with *customer demand trajectories* (the blue lines showing customers' willingness to pay for performance). As incumbent companies introduce higher-quality products or services (upper red line) to satisfy the high end of the market (where profitability is highest), they overshoot the needs of low-end customers and many mainstream customers. This leaves an opening for entrants to find footholds in the less-profitable segments that incumbents are neglecting. Entrants on a disruptive trajectory (lower red line) improve the performance of their offerings and move upmarket (where profitability is highest for them, too) and challenge the dominance of the incumbents.



Figure 2

3. METHODOLOGY

The methodology used in this research involves finding research papers on blockchain in higher education and interviews with blockchain companies involved in higher education as well as interviews with university staff working on bringing blockchain in the higher education.

Since the research paper aims to discover ways in which blockchain can improve the higher education industry, most of the data discussed will be theoretical data from previous studies on blockchain in higher education.

Moreover, experiences from academic staff with blockchain in higher education will help the paper realize the current limitations imposed by blockchain technology and the higher education industry.

Lastly, the paper aims to use reports from previous applications of blockchain in higher education in order to provide plausible suggestions towards blockchain implications in higher education.

4. CURRENT HIGHER EDUCATION VALUE CHAIN AND TRENDS

In order to understand how the blockchain technology can improve this value chain, it is important to define the role of each actor in the value chain first. The following section looks into all the actors within the value chain and aims to explain what are the roles of each actor within the value chain. Doing so helps with

understanding how blockchain affects each actor later on in this paper.

4.1 The role of Dutch government

The role of Dutch government in the higher education system has changed throughout history. As explained by De Boer et al (2015), the state's role in the higher education system has shifted from control to supervision. The modern agenda called "Quality in Diversity" launched in 2011, uses performance agreements to determine the amount of funding each university receives. These agreements between the institutions and the government are based upon defined targets in set criteria. Institutions meeting their criteria will be rewarded and institutions which do not will be punished. In late 2018, the Dutch government defined five criteria which universities define their targets in. These criteria include:

- *More accessible higher education and student success*
- *Closer alignment to labour market and society*
- *More cooperation for better synergy and less competition*
- *More flexible higher education*
- *Regional bedrock and international cooperation*

This research paper aims to explain how blockchain technology can facilitate the institutions to meet these criteria in later chapters.

4.2 The role of universities

In the current higher education value chain, universities have a lot of control. As explained earlier, the role of government is supervision but it is up to the universities to define their targets in each criteria. Universities operate in a model that expects students to study at the institution for a full higher education degree and they are fully responsible for the educational program of students. This means that universities take the responsibility of taking care almost all elements in the value chain.. Considering this conventional education model, there are currently three important trends that universities are experiencing.

First and foremost, there is a growing demand for a remote higher education. The outbreak of Coronavirus lead universities to realize their potential in adapting to online educational model which eventually can lead to a whole online higher education sector.

Furthermore, there is an ongoing pressure for institutions to offer more value from the society. Messen et al 2013, explains that "a closer look at the new demands from the society reveals that universities are not only required to produce new knowledge, but are also expected to take the responsibility of transferring knowledge to the society and engaging with the society." The implementation of challenge based programs such as InGenious shows that universities are showing a lot of interest in collaborating with companies and communities and share their knowledge with them.

The third trend within the higher education industry is the rise in popularity of alternative degrees such as online certificates or certificates from the companies. This lead universities to recognize the need for a lifelong learning in higher education. The development of a lifelong learning at the higher education level requires a modularized higher education which allows students to work and study in parallel.

4.3 The role of students

The current role of students in the academic industry can best be described as customers. Students enter universities and pay tuition fees in exchange for educational services from their institutions. Upon finishing a certain path dictated by their universities, students receive a degree as a proof of knowledge and work. In the learning process, students do not have a lot of freedom to choose their path of education. In some cases for instance students can do an exchange year or choose between different electives or minors, however most of their courses are still pre-determined. Considering a UT bachelor student as an example, they can choose between two different electives in two modules of their studies and they can choose to do an exchange program for another two modules. These count as 60 EC out of mandatory 180 to obtain in order to graduate. The rest of the 120 is dictated by the institution. Not to mention the electives are usually a choice between only two different courses so the student does not get a lot of freedom in choosing their path.

A study by Middlesex university of London found out that from 4300 employees, more than 70% felt that they were not achieving their full potential due to the lack of development opportunities. Based on this study, it is safe to say that in a lot of cases, employees development during their academic studies is limited and does not help them to realize their full potential and thus businesses need to offer training programs for new employees. It is important to point out however, that universities are engaging in programs which allow students to work with businesses while doing their academic studies. At the university of Twente for instance, the university is engaging in programs such as strategic business development and ingenious challenges which allow students to work with local and international companies as their student projects in order to get a grasp of how businesses work outside of the academic world.

4.4 The role of businesses

As mentioned earlier, the societies have raised their voice demanding the higher education institutions to bridge the gap between the academic world and communities. Such request is fairly reasonable as universities are a public service in most parts of the world including the Netherlands which means that their funding comes from the public. For instance, in the Netherlands, a European student pays a quarter of an international student for tuition fees and a Dutch student half of that of other European students. The difference in the such cost is subsidized by the Dutch government from public funding. Moreover, Dutch and European students can apply for student loans with fairly relaxed conditions around it. Over the years, the Dutch government managed to introduce policies in order to stop students from abusing the study loan. For instance a student can only take up to ten years to graduate in order to keep their study financing. Over the past years however, there has been a growing cooperation between higher education institutions and the society.

For instance as mentioned earlier, the University of Twente is part of the program called InGenious challenges which allows companies to work closely with student teams. This is beneficial for both companies as they utilize an outsider view and for the students to gain experience working in a real life condition. Such programs are not only limited to UT and the Netherlands. The InGenious challenges for example take place in university of Stavanger and Linkoping university located in Norway and Denmark respectively. In addition to helping ongoing businesses, the universities are helping the society by accelerating student start-ups. Over the past couple of decades many entrepreneurs started their business while being enrolled in the university and have grown their companies to a huge scale. One of the most famous cases is Facebook which started as a university social

network and now is one of the biggest social networks worldwide. Such projects are not scarce in the Netherlands either. Thuisbezorgd was founded by a business student at the university of Twente in the early 2000s. The company became so successful that it raised 328 million euros when it went IPO in 2016. Such companies born out of university students made a huge impact on the society drawing a better image of academic institutes in the public eyes.

5. WHAT BLOCKCHAIN CAN OFFER IN HIGHER EDUCATION

In the following section, the research paper will discuss how blockchain can improve the higher education value chain. The blockchain technology has already shown positive effects in other industries such as logistics. In order to explain how the actors in the value chain will be affected if blockchain technology gets implemented.

In the following parts of this chapter, the research paper discussed three applications of blockchain in the higher education. The first point considers the application of blockchain in the higher education and analysis its potential to become a disruptive innovation as a way of sharing databases. The second part looks into how blockchain can facilitate student mobility in the higher education. The third and last part argues how blockchain can help growing the higher education as a competitive market.

Since blockchain is still a new and developing technology, a simple way of implementing blockchain technology is to consider every student's academic and professional record a blockchain of its own. This database containing the student records is then shared across a network of institutions, businesses and government entities.

5.1 Micro credentials

Using blockchain for human credentials has been on the rise over the past years. IBM technologies, one of the biggest digital companies has been working towards transforming digital identity to decentralized identity based on blockchain technology. The case of IBM, is just one example of many ongoing projects of converting different forms identification documents into a decentralized digital manner. Given the fact that blockchain is a way of sharing a database across a network, in case of higher education, the database contains student records. The database is then shared across a network of higher education institutions, businesses and related government entities. Not only can higher education institutions keep the student records digitally based on blockchain, but also they can provide a more precise explanation of each students strength and weaknesses through blockchain.

One of the potential uses of blockchain in higher education is to transform the manners of accreditation to a decentralized digital manner of providing students with badges. The idea of blockchain based badges is not entirely new. The surf association in the Netherlands has been running pilot programs with the use of edu badges alongside seventeen Dutch higher academic institutions, namely The University of Twente.

Given the fact that the use of badges is not being done fully at a national level and even university wise, the utilization of badges is up to the institutions to decide, it is important to point out the potentials of blockchain based badges in higher education in order to provide the institutions and staff with a deeper understanding on how these badges can be useful.

One of the benefits of badges for all the parties within the value chain is to provide a more accurate representation of the persons capabilities. For example, currently the students at the University

of Twente are graded on the scale of one to ten on their project grades. In majority of cases, all the students receive the same grade for the teams overall performance. One can clearly see the problem of free riders arising in this case. A study by Nauta et al 2003 from the university of Groningen shows that having a free rider within a project group lowers the final result for the group and causes demotivation and a lack of trust between all the members. Through using blockchain based badges, the universities can provide each members with a badges certifying the fact that the student contributed to the completion of the project. Additionally, given the fact that the badge is fully digital, it can contain explicit data about each students level of contribution and their take points throughout the project.

These badges help students pursue a more specialized study path as they get the opportunity to express their capabilities more precisely. Within the current system of higher education in the Netherlands, the students graduated from a certain major degree, all receive the same certificate. The certificate merely verifies that the student has successfully obtained the required number of ECs required to obtain the degree. In case of using badges however, each student's badge provides an accurate data on the students' performance on each subject. This is beneficial for businesses looking to hire university graduates since for instance a company looking for an accountant, can see more precisely how each of their candidates did on their accounting course and related assignments. On the other hand, students are encouraged to take on more extracurricular courses related to their domain of interest as the badge they receive upon finishing the course verifies their knowledge and proficiency in the said domain.

These badges help academic institutions realize one of the governments visions towards a more accessible education and student success. As the Corona virus outbreak accelerated the process of translating means of education online, universities are now able to reach out more students if they intend to do so. As students are encouraged to collect the badges that fit their desired study path best, students become more motivated to go through the challenges with their studies.

5.2 Increased student mobility

In addition to providing more transparency in student records and capabilities, blockchain also has the potential to provide flexibility for students in their academic path. In the current education system students cannot move between universities unless they do an exchange for 30EC of their studies through Erasmus or similar programs.

As reported by the European commission, the Erasmus program is growing in popularity over the years and therefore attracting more investment. The expected budget for 2020 is 3billion which is a 12% increase comparing to last year 2019. In addition to growing in popularity among students, more schools are signing up to be part of the Erasmus program. However, in case of Erasmus, students can do the program only up to 30ECs and the program is not only about academics as it focuses on cultural diversity and not providing flexibility for students studying path. Another issue with exchange programs is that students cannot do an exchange in a university in the same country. By using blockchain however, students are provided more flexibility in choosing their study path. Considering the idea of badges discussed above, since all of the students' academic experience is recorded in their blockchain, students aim to build a portfolio of compatibility badges. This opens up the opportunity for students to take different courses in different institutions. For instance, considering the case of two different IBA students at the university of Twente. Student A is more interested in the domain of finance while student B is more interested in purchasing. By allowing students to complete their portfolio

while obtaining badges, both students can do their preferred course at different universities and obtain a badge for it. The process however, is easier said than done. The process of university accreditation is complicated and requires great adjustment to make such flexibility possible. First and foremost, every Dutch university with a right of accreditation provides a level of guarantee about the level of knowledge acquired by their graduates. Therefore, if a student from one university wants to do some of their courses in another university, the student's initial university must approve of the material taught by the second university as the student will graduate with a degree from the university they are initially enrolled in. This requires a great attention and adjustments to university policies and such complex issue requires a lengthy process.

5.3 Building Higher Education as a Market

The position of universities in the higher education market is highly safe as they are the only institutions with the right of accrediting Bachelor's, Master's, PhD or similar degrees. Although some companies have the right to accreditation as acknowledged by the government, they are not the equivalent of the degrees mentioned above. This implies that students enrolled in those degrees are either not using their knowledge in the practical field or they do mainly research work. In the earlier chapters of this research paper, the role of blockchain in bringing higher education institutions to the society was discussed. However, in case of accreditation, the universities still work separately from companies. As many companies such as law firms are providing their own courses and degrees, blockchain opens up the opportunity for companies to collaborate with institutions. Given that blockchain has the potential to provide students with a flexible study path such that they can take up courses in multiple academic institutions, it makes a lot of sense to have students taking courses at companies as well. This allows both companies to have a better recognition for their courses as it is in collaboration with universities. On the other hand, higher academic graduates can enter the job market with a better idea about the practical side of their fields and are more likely to perform better.

One of the most ambitious projects in this case is taking place in the United States. A non-profit company Learning Economy is offering a AI based algorithms to help students choose the study path that suits their past records and overall capabilities best. On the other hand, all the student records are kept in a blockchain which allows the approved members of the network to have access to those records. Jackson Smith, the CTO of the company believes that this allows students to get paid to learn new skills in exchange for their data. Although there are privacy concerns over the decentralized way of keeping student records, however, such programs allow education to become a currency of its own where students get rewarded for taking up new skills while contributing in improving educational models in the long run.

Another way which blockchain contributes to growing the higher education as a market is through providing government with better monitoring tools. The Dutch government is not only funding universities but also providing study grants to Dutch and EU students. These study grants however, require students to pass a certain number of ECs a year and for some nationalities to work certain hours per month. Currently if a student wants to apply for the grant, they need to send all the documents by themselves. Moreover, for European students who need to work a certain hours in order to get study funding, they need to make sure that they successfully submit their contract and approved hours from their employers. A lot of time this process costs time and there is a chance for fraud. By using blockchain, all the parties save time and the process is immutable.

6. CHANGES IN VALUE CHAIN WITH BLOCKCHAIN IMPLEMENTATION

Like many other industries, the use of blockchain technology in higher education is a novel concept. Based on the blockchain applications discussed earlier, blockchain is expected to shift how the value chain as a whole interacts and thus altering the role of every actor.

In his interview with Cointelegraph, Christopher Allen explains that blockchain "makes it possible for there to be a peer to peer competency record for fellow students, teachers, employees and employers – not just educational institutions". In addition to providing students the opportunity to have their competency record without having to ask their institutions or previous employer, blockchain provides flexibility for students in their education path. This leads to a different operational model than the current one which requires students to stay within the same institution for their whole degree. Subsequently as students gain more flexibility in their education path, their bargaining power as customers increases. On the other hand, businesses as the other group of customers in the value chain, enjoy a more specialized range of potential employees and thus their bargaining power as customers increases.

It is safe to say that the blockchain applications discussed in this research paper are all aligned with the Dutch government's strategic agenda. Since the institutions are highly government funded, successfully compiling the blockchain applications within the higher education, allows for institutions to gather more bargaining power as blockchain implementation is aligned with the government demands.

The position of universities within the value chain however, is a difficult topic to evaluate.

Considering the fact that blockchain has already been implemented in other industries such as logistics, it is safe to say that the technology readiness is not the bottleneck in transitioning to a blockchain based education model but rather the universities preparedness level. As explained by Alex Grench, "the (European) commission may fund or develop the most sophisticated blockchain infrastructure available to EC member states and provide it for free. but it will not maximize its potential until a raft of policymakers and education institutions decided to buy into the solution since they are most likely to be locked into existing technologies and procedures".

Although blockchain has a high potential in contributing positively to the future of higher education institutions, with the current level of digitalized database management many universities have developed a safe market position and therefore many do not feel the need to implement new technologies such as blockchain. Chhay Lin Lim is a BMS faculty member and blockchain expert at the Saxion university. In his interview with the researcher, he mentioned that "teachers do not feel the need to switch to blockchain based student record due to multiple reasons. Firstly, the positive impacts of blockchain are not clearly significant to everyone and therefore teachers do not feel the need for it. Also, if teachers are required to do things differently, they require a learning period which is not desirable for everyone."

Therefore, to analyze the position of universities in the value chain upon blockchain implementation, it is important to consider, if universities are early adopters to the new technology. Considering the scenario where universities preclude the use of blockchain based database management. Meanwhile, businesses and online educational facilities acquire blockchain based models. This leads to a niche part of market using blockchain which over time can develop in to the new norm as the theory of

disruptive innovation suggest. In this case, blockchain is considered a disruptive innovation and the higher education institutions lose bargaining power and in order to sustain their position as market dominators, they need to adapt to blockchain practices as well. In a different scenario however, if universities are one of the first actors to implement blockchain, they can uphold a strong bargaining power and sustain their dominating position as the suppliers in the value chain. In this case, blockchain implementation is not necessary a disruptive innovation as it does not affect the market positions by a great degree.

7. THE WAY FORWARD

Given that there exist resistance to blockchain applications in the higher education market, it is important for the transition process to enable all the parties involved realize their full potential. Considering a hypothetical case of a well established institutions, institute X assessing whether they should invest into blockchain based solutions. Institute X currently has a dominant position in the market and does not fully feel the need for adapting to blockchain. However, institute X is aware that other institutes such as institute Y might implement blockchain to gain competitive advantage. The issue then becomes how institute X can adapt to blockchain while sustaining their market position.

A reflection on a pilot program ran by Surf association and nine Dutch universities in 2017-2018 can bring up some initial suggestion for this transition process.

As the institutions were provided with the opportunity to decide in what cases they want to use the badges, most universities ended up using the badges for extracurricular courses. Since implementing a university wide badges system requires all the staff to support the idea of badges implementation, universities were unable to offer badge certificates for main courses. The data provided by Surf highlights the importance of unified institutional decision in implementing blockchain. On the other hand, Surf reports that the participating institutions were excited about the sustainable and scalable new technology. However, in the same way as many students, the university staff did not view the badges as highly valuable. Rightfully so, a representative from one of the institutions argues that the badges only become valuable when there is demand. The demand for university certificates exist in the job market or when students want to continue further with their education. However, merely any company or academic institution gives a full recognition to digital badges. Thereby, in addition to providing an institutional wide method of badge certification, universities must provide students with guidelines on how they can use the badges on websites such as LinkedIn or their résumé. Providing students with such opportunities requires collaboration between the institutions and platforms such as LinkedIn. Therefore, for institute X to ensure the success of their blockchain programs, they need to make sure that there is a demand in the market for badges and they have the required infrastructure for blockchain implementation.

Another issue as addressed by Surf was that students had their badges associated with their student accounts at the moment which means that once they finish their studies and their student account gets terminated, they need to find new ways in order to get their skill badges. One of the institutions brought up the suggestion to associate the student badges with their BSN numbers, however, BSN numbers are sensitive and there are a lot of privacy concerns around associating student profiles with their BSN numbers. A simplistic idea of a solution to this problem can be to provide students with life long learning passport. If higher education institutions come to their consensus and provide students with a platform such that every student can receive their

own unique identification credentials where all of their skills data is recorded on the platform and they can choose who they share their data with. Such a platform allows students to cut down on cost and time spent on document sharing process. Alternatively, such platform should have an easy to use user interface for both students and the academic staff. As explained by Steven Verkuil, co-founder of Coinversable, a blockchain company which runs pilot programs with badges for higher and lower education institutions, many university staff are slow with adapting to the new ways of doing things and they require a lot of support specially during the first year. Hence, university X has to consider the external procedure of blockchain implementation as well as internal. Like other institutions, they benefit from a unified platform for blockchain based database. This requires institute X to collaborate with other actors in the market for this platform development. Moreover, a unified platform facilitates student mobility as students applying for multiple institutes do not have to switch between platforms.

8. CONCLUSION

Blockchain has already shown a great potential for market growth in many different industries. At this moment, the higher education market is highly dominated by universities. Blockchain offers solutions which not only help with other actors growing their position, but also growing the market as a whole. However, implementing blockchain solutions in the higher education market is not easy. As blockchain aims to improve the administration process in higher education, one institution cannot adapt to the new system by its own alone. Implementing blockchain requires a close collaboration between universities and businesses to ensure that the new ways of doing things will eventually become the new normal. For universities to allow for higher student mobility, they must go through a long procedure of reviewing their educational model to ensure that they share a level of compatibility. One can safely expect that the transition towards a blockchain based model to be slow based on previous experiences. However, the slow process for universities to adapt to blockchain based practices can be beneficial for them as it gives other actors in the market mainly businesses and governments to consider implementing the new technology as well.

As blockchain based solutions allow the educational model to become more student oriented, students are more encouraged to follow their passion for specialization and remain lifelong learners within the education system. Meanwhile, businesses enjoy a higher level of collaboration with the academic industry and they benefit from more specialized entry level candidates. As these actors gain more power in the value chain, universities can still maintain their strong position in the market if they adapt to the new practices early enough and do so with precision.

At this moment, there exist a lot of opportunity for future research and development in order to develop the necessary digital infrastructure for blockchain. Certainly, doing so is only viable through more collaboration between the institutions and other actors in the market.

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