Industry 4.0 Conference: Blockchain possible in Dutch hospitals?

Bilal el Khoulati
Researcher
B.elkhoulati@tilburguniversity.edu

Roy Hochstenbach
Researcher
R.j.m.hochstenbach@tilburguniversity.edu

Doha Bouaissaoui
Researcher
D.bouaissaoui@tilburguniversity.edu

ABSTRACT

This paper addresses the general question ” What is the relationship between the use of blockchain and the impact on data processing in Dutch hospitals’’. It occurs that a patient in the healthcare industry has different medical data which are not centralized in one specific database. Based on a quantitative survey that is conducted amongst young (20 till 40) and old (41 till 61) patients, the research investigates the possibilities and impact of blockchain in Dutch hospitals. In addition, the educational level of the participants were also taken into consideration. The paper contributes insights of the impact of blockchain on patients with regard to their wellbeing. Implementing blockchain within hospitals results in a positive impact on the wellbeing of a patient and could help hospitals with fragmented soloed data and delayed communication. However, the wellbeing are more positive for young people than for older people.

Keywords

Blockchain, wellbeing, processing, conference, hospitals.

1. Introduction

Different types of technological developments have emerged in the past decades within the healthcare sector. For instance, the use of internet, which eventually led in the use of different systems. For example, ERP-systems and other operational systems. Additionally, the developments resulted in organizations that use heterogeneous systems which influenced the interoperability of the sector. Moreover, the use of data within the systems changed from: ‘’need to know‘’ to ‘’need to share’’ (Codagnone and Wimmer, 2013). The development of data processing has become increasingly prominent (Beck, R. Stenum Czepluch, J. Lollike, N. & Malone, S, 2016).

One of these popular developments is the use of blockchain. Blockchain gained popularity with the emergence of cryptocurrency. Nowadays, we still are at the beginning of understanding blockchain’s full potential (Beck, R. Stenum Czepluch, J. Lollike, N. & Malone, S, 2016). After the hype about cryptocurrency tempered, researchers and companies started their research on blockchain, the technology behind cryptocurrency. Research concluded that blockchain could have multiple possibilities in order to save, share and store data in a valid and secure database (Williams, 2018).

An industry where blockchain could have a positive impact is the healthcare industry, specific for Dutch hospitals. Dutch hospitals have a data-sensitive domain that uses medical data of patients to perform medical treatments. Hospitals are in need of systems that ensure data delivery for individuals and communities, to collaborate within and beyond organizational boundaries. Currently, there are some issues regarding the effective delivery of data in the hospitals industry (Zhang, Schmidt, White, & Lenz, 2018).

Nowadays, the hospital industry is struggling with fragmented soloed data, delayed communication and disparate workflows (Zheng, Mukkamala, Vatrapu, & Ordieres-Mere, 2018). Also, it occurs that a patient in the hospitals has different medical data that are not centralized in one specific database. In addition, it appears that the data of the patients is only stored by a few healthcare institutions, which eventually results in files that are incomplete. For example, records of earlier visits with general medical practitioners and contacts with insurance companies are not included. As a result, different kinds of medical records of a single patient are not up to date. However, the findings of the literature have shown that it is not clear what the exact impact of technological developments of blockchain on hospitals is. Do the developments have an added value for hospitals? Within this research the subjective wellbeing of a patient is used as a measuring instrument to analyse the correlation

between blockchain and data processing in hospitals.

2. THEORY

Blockchain

A blockchain is a data ledger composed of blocks. Each block represents data which is linked to a previous block that stores more data, if one block changes this will affect all other linked blocks (Cichosz, Stausholm, Kronborg, Vestergaard, & Hejlesen, 2019). To ensure the quality of data each block is linked to a peer-to-peer network so the data will be authenticated before the data is stored in the blockchain. To protect the data blockchain uses encryption (encoding messages), it creates a private key which makes it practically impossible to hack the system (Boireau, O. 2018). The elements of the blockchain are useful for the Dutch hospitals to guarantee the validity and the safety of the stored data. Blockchain could solve issues by giving hospitals and other user's ownership and authorization of their own data (Zheng, Mukkamala, Vatrapu, & Ordieres- Mere, 2018). However, it has not yet been properly introduced in the hospitals industry. As stated earlier, the healthcare industry is a data sensitive market with heterogeneous systems. Even though it could be possible to use blockchain technology in the hospital industry, there has to be taken into consideration how it will impact the hospital industry. It is also important to take into account the impact of the application of blockchain on the patient. The blockchain will be used as the technological development on data processing.

Data processing in hospitals

Medical data is both quantitative and qualitative. The type of medical data determines whether the data are quantitative or qualitative. Qualitative data on the patient's satisfaction with current health care is collected by hospitals on the basis of annual surveys. The most common problem with medical qualitative data is the incompleteness of data and therefore insufficiently representative of a population (Strong et a., 1997). The incompleteness of data is the result of the limited access to medical data, which means that statements can still be generalised. In this research qualitative medical data will be used. The reason for this is that this research focuses on the impact of technological developments, especially blockchain, on hospitals. In order to investigate this, we need to collect data through interviews and a survey with hospitals.

Due to the rise of Big Data, it has become increasingly difficult to process medical data through efficient information systems. This is also the case in Dutch hospitals. The most common challenges that hospitals face when collecting, processing and analysing data is security and privacy (Olaronke & Oluwaseun, 2016). This is because medical data is highly sensitive to unauthorized persons, fraud, dissemination and attacks on integrity. It also has to do with the fact that medical data has a complex nature and standards in order to be able to process or implement it successfully. The current information systems are not intended for the processing of Big Data. This is evident from the high error rates and the high costs, which have resulted in a high mortality rate. In addition to privacy and security, the resistance to switching from the traditional way in which data are processed to a new information system is a considerable obstacle to the implementation of an information system. This idea arises mainly when it comes to having to trust something that is unknown, in this case a non-information system (Olaronke & Oluwaseun, 2016).

Wellbeing

Wellbeing can be categorized in three different dimensions according to White (2018). The first dimension is the material concerns like income, wealth, employment, education and skills. The second dimension is relational concerns such as personal and social relations. For example, the relations of love and care, networks of support and obligation, relations with the state (law, politics and welfare), political and cultural identities. The third dimension of wellbeing is the subjective concerns like values, perceptions and experiences. For example, understanding of moral order, self-concept and personality, hopes, fears and aspirations, sense of meaning/meaninglessness, level of (dis) satisfaction, trust and confidence. This research will be primarily located in the third dimension (White, 2008). This because the level of (dis) satisfaction, trust and moral order in technological developments are key elements for customers to rate their own wellbeing in relation to technology developments in hospitals.

According to White (2008) is wellbeing a process that can differ by time. The research concluded that '' Which factor is driver and which driven, which is prominent and which less significant, will differ between different actors and situations. This understanding of wellbeing as a process (or set of processes) then relates to the dimension – time. Understandings of what wellbeing is, change with historical time''. In the course of time, people acquire different needs and different perceptions of wellbeing. The definition of time can be converted into age because time and age are connected with each other.

There is no theory that indicates the influence of education on a person his/her wellbeing. Several studies indicate that the influence of education on wellbeing is too complex as a subject to get an unambiguous theory. There are many factors that affect each other and therefore it is not a measurable element. In addition, there is also no theory that shows that age influences the relationship between the wellbeing of a customer and technological developments. On the basis of the survey, an attempt will be made to gain more insight into the influence that education has on the wellbeing of patients at Dutch hospitals and whether age has a positive or negative influence on wellbeing of patients in Dutch hospitals.

Possibilities of blockchain in hospitals

The technological applications in hospitals have brought both advantages and disadvantages for patients and healthcare providers. An example of a technological development are buzzers for nurses and patients to be able to communicate with each other remotely. Other examples of technological developments in the healthcare industry are the cloud technology and mobile applications development like e-health apps (Rakic, 2018).

One of the most popular technological development at the moment is blockchain. Blockchain is a distributed system that is memorized in blocks where data is collected, processed and stored. One of the biggest advantages of this technological development for hospitals is that medical data can be processed and stored centrally, so that Dutch hospitals always have the right information to be able to offer optimal healthcare. Another advantage is that care providers can more easily switch over to the patient because the right information is always within reach. A blockchain technology is also a secure application to guarantee the privacy of medical data (Rakic, 2018).

A possible solution for the problems in Dutch hospitals could be the use of blockchain in the healthcare industry. Blockchain could be used in order to create a decentralized and secure database for healthcare, which benefits the patients, practitioners and insurance companies. The data will always be available and up to date for each user because of the fact that blockchain can serve as a public records repository (Perez, 2019); (Swan, 2015). However, it is unknown what the effect of the blockchain will be on data processing in hospitals. This is also the aim of the study. In order to conduct this research, the following research question has been formulated: ” What is the relationship between the use of blockchain and the impact on data processing in Dutch hospitals’’. In order to answer the research question, further research is required.

Theoretical framework

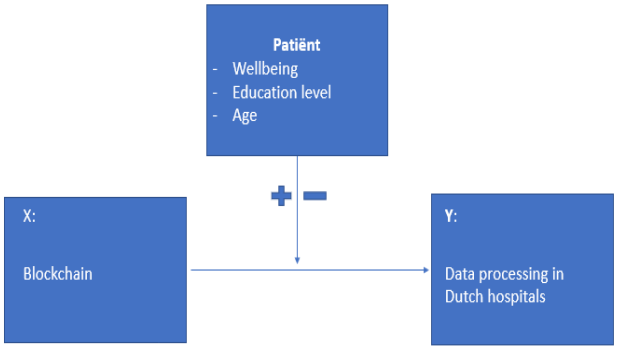

Figure 1: Theoretical framework

In order to answer the research question, the theoretical framework is developed as shown in Figure 1 which contains the dependent variable *‘Data processing in Dutch hospitals’.* This can be seen as the way a hospital processes its data nowadays. That is influenced by the independent variable *‘Blockchain’*. Blockchain can be seen in this study as the development of data processing. Additionally, the wellbeing of a patient can be divided into three categories, namely: the moral feeling of a patient, the trust of a patient and (dis)satisfaction. The patient is the full moderator because it moderates the relationship between the dependent and independent variable, but has no direct relationship with the dependent variable. The variable ‘Patiënt’ is used as a measuring tool where the wellbeing is differed bij education level and age.

Furthermore, the wellbeing with regard to technological developments and data processing in hospitals is measured, which will result in the wellbeing about day-to-day technological developments. Also, data processing in Dutch hospitals is questioned by the same questions. Moreover, at the end, the two variables are questioned into relationship with each other where the use of blockchain in the hospital is questioned. This will result in base level opinions about their wellbeing toward (normal) data processing in a hospital, technological developments in general, but also wellbeing in relationship with blockchain usage on data processing of hospitals. The idea behind this mechanism is to study whether a positive/negative relationship exists between the two variables and what their opinion is if we combine the two variables. Additionally, we expect that age, education level and the wellbeing of patients will pure moderate the relationship. For instance, if patients are older, their wellbeing will be influenced in a negative way by blockchain in

hospitals. On the other hand, if people are younger, their wellbeing will be positively influenced by blockchain in Dutch hospitals. Data processing is constructed in the context of processing medical data. The following hypothesis have been derived from the theory:

H1: The effect of being satisfied with sharing medical information among medical organizations is stronger for highly educated people than lower educated people.

H2: The effect of being satisfied with sharing medical information among medical organizations is stronger for older people than younger people.

3. METHOD

The research method that has been chosen for this study is a quantitative research method. Quantitative research is a descriptive research that is supported by numbers, experiences and interpretations. We have chosen for this type of research, since we want to study the subjective thoughts of people with regard to blockchain in Dutch hospitals. The variables in the research question have a correlational relationship. Moreover, a survey has been chosen as the research strategy. From the variables, an analytical framework is made to cover all the critical factors of the variables as can be seen in figure 2. The analytical framework provides a clear and solid base to develop the questions of the survey.

The survey will exist of three parts which are classified as follows: the first questions will cover demographic aspects like age and education level. We have chosen for these questions, since we expect that age and education will play a role in the wellbeing of a client with regard to blockchain in a Dutch hospital. Moreover, this will be an open-ended question, which results in the outcome of this question to be transformed to a ratio scale. Further on, questions will be asked about the satisfaction, trust and moral feeling towards the way hospitals process their medical data. These questions will also be asked with regard to technological developments. Also, questions about satisfaction, trust and moral feeling regarding blockchain in Dutch hospitals will be asked to analyse if blockchain indeed is related to wellbeing. The last three subjects of questions will be asked by the use of a liker scale. This provides in answers that can be compared easily. Also, there is added a 'namely' option to cover all the possible answers of the respondents. Conclusions are made out of the data by using a regression analyses.

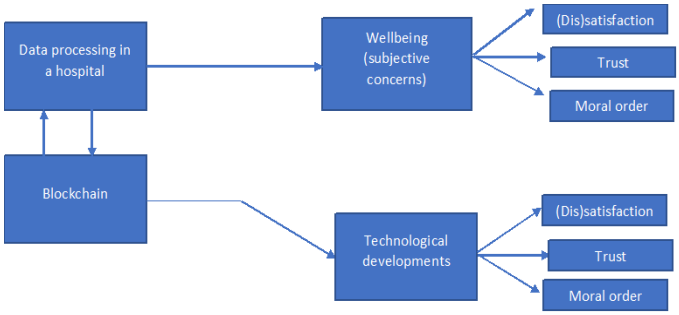

Figure 2: Analytical Framework

4. DATA & CASE STUDY: JEROEN BOSCH ZIEKENHUIS

The population of the survey are all the clients of Dutch hospitals. The sampling frame will be the client database of the Jeroen Bosch Ziekenhuis (JBZ) hospital in 's-Hertogenbosch. We will restrict ourselves to this hospital, since it is easy to contact the hospital and send the survey to a group of their clients. A probability sampling method will be chosen which will consist of a simple random sampling method eventually leading in a higher external validity. The sample size will be chosen from people of 20 to 60 years old. Further on, the education level of the respondents are categorized in three groups, namely: intermediate education, higher education, scientific education (MBO, HBO and WO). The sample size is derived from the fact that we have a multivariate research (Young 20-40) vs Old (41-60) and Low Education vs High education MBO/HBO-WO and Wellbeing) resulting in the following calculation, 7 (parameters)*10=70. A sample size of 75 people would be enough to cover the external validity Sekaran and Bougie (2016). Within this research a sample size of 44 people is used, which is a limitation in the generalizability. The questions of the survey are based on research questions derived from the analytical framework made by ourselves and will be tested by other people before sending it to the actual respondents. This results in a higher reliability.

Four variables are made out of the questions of the survey. The variables are named swellbeing1, blockchain, education and age. Education and age represent the same information as mentioned earlier and are used as pure moderators between the two variables that are explained next. Furthermore, blockchain consists of the questions Q8, Q9, Q10, Q11 and Q12. These questions simulate the influence of blockchain on data processing in the Jeroen Bosch Ziekenhuis, where the patients are used as a measuring instrument. Next, swellbeing1 consists of the questions Q1, Q2, Q3, Q4 and Q5. This variable constructs the wellbeing of patients toward technological developments in general. The

descriptive statistics are presented in figure 3. It can be seen that 44 respondents filled in the survey between the age of 21 until 55. The mean age of the sample is 31.5 and the standard deviation is 10.491.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	44	21	55	31.50	10.491
Education	44	1	3	2.34	.645
Q1 Are you aware that hospitals store your personal (medical) data	44	1	2	1.05	.211
Q2 I like the fact that hospitals store my medical records	44	1	5	3.98	.927
Q3 How would you describe the satisfaction with the way they handle your data	44	1	5	3.50	1.131
Q4 How much do you trust them	44	1	5	3.57	1.108
Q5 I think it is morally okay, that if ¡want to be helped, my data has to be handed over	44	1	5	3.84	1.119
Q6 To what extent do you get satisfaction from technological developments	44	1	5	3.30	1.133
Q7 I trust technological developments	44	1	5	3.30	1.173
Q8 Do you know what a blockchain is	44	1	2	1.20	.408
Q9 To what extent would you be satisfied with blockchain in hospitals	44	2	5	3.66	1.055
Q10 To what extent would you trust the blockchain in combination with your medical records	44	1	5	3.84	1.055
Q11 I think it is okay that my medical data is stored forever and will never be deleted again	44	1	5	3.07	1.453
Q12 I like the fact that my medical information is up-to-date and everywhere available	44	1	5	3.80	1.091
Q13 I think it's morally acceptable that technological developments are taking place.	44	1	5	3.07	1.453
Valid N (listwise)	44				

Source: Data SPSS 2019

Figure 3: Descriptive Statistics

As stated earlier, this study will conduct a case study to provide results that can be generalized back to different organizations. In addition, the characteristics that have been used within this study, namely organizations that suffer from internal heterogeneous systems, interoperability in the sector and technological developments among systems whom process personal data, are being used to perform the research and strengthen the reliability. The results that have been obtained would be the same for every organization that meets the characteristics mentioned earlier.

5. RESULTS

By analysing the first hypothesis: ‘’The effect of the wellbeing being positively influenced by sharing medical information among medical organizations is stronger for highly educated people than lower educated people’’, a linear regression is used. This analysis has been used because of the effect that blockchain on data processing in hospitals. Also education and age are used to analyse if a difference exists among these variables. This study shows that education has a positively strong relationship (.753) on people their wellbeing with regard to blockchain in hospitals for data processing as can be seen in figure 4. However, this relationship is not significant. This outcome suggests that there is no relationship between education and the wellbeing of patients as mentioned earlier, resulting in rejecting the hypothesis.

The study has shown that age has a negative influence (-.111) on blockchain in hospitals and is also significant (p<0.001). It seems that the older people are, the more they are negatively influenced by the blockchain in their hospital on data processing. With this outcome, the second hypothesis: ‘’The effect of the wellbeing being influenced with sharing medical information among medical organizations is negatively stronger for older people than younger people’’,can not be rejected, since it is proven that a negative relationship by age exists in wellbeing toward

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	13.236	2.588		5.113	.000
	Education	.753	.721	.156	1.045	.302
	Age	-.111	.044	-.373	-2.495	.017

a. Dependent Variable: blockchain

Source: Data SPSS 2019

Figure 4: Regression analysis 1

blockchain in hospitals.

Another linear regression is used to see what type of relationship exists between the wellbeing with regard to data processing in the hospital in general and blockchain usage in the hospital on data processing. A positive relationship exists (.340) between the two variables as presented in figure 6. This relationship is also significant (p>.001). This means that people their wellbeing towards hospitals in general will increase with the usage of blockchain in hospitals on data processing. Also, there is a strong correlation between these two variables (.378). This also supports the statement that people their wellbeing has a positive relationship regarding the use of blockchain in their hospital.

Correlations

		blockchain	swellbeing1
blockchain	Pearson Correlation	1	.378
	Sig. (2-tailed)		.011
	N	44	44
swellbeing1	Pearson Correlation	.378	1
	Sig. (2-tailed)	.011	
	N	44	44

Source: Data SPSS 2019

Figure 5: Correlation table

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	6.100	2.091		2.917	.006
	swellbeing1	.340	.128	.378	2.650	.011

a. Dependent Variable: blockchain

Source: Data SPSS 2019

Figure 6: Regression analysis 2

If a focus is placed on the wellbeing of people with regard to (normal) data processing in hospitals two interesting points occur, see figure 7**.** Also, education and age are used to see how this relates

to the wellbeing. First, a positive relationship exists between the wellbeing of the respondents and education level (1.922), which is also significant (p>.001). It seems that people with a higher education think that the way of data processing of today is enough. Second, a positive relationship exists between the wellbeing and the age of the respondents (.041). However, this relationship is not significant, which means that in this study there is no significant difference in age regarding the wellbeing of the patients.

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	10.148	3.049		3.329	.002
	Education	1.922	.849	.358	2.264	.029**
	Age	.041	.052	.124	.782	.439

1. Dependent Variable: swellbeing1
2. Source
3. **P(<0.05)

Source: Data SPSS 2019

Figure 7: Regression analysis 3

6. DISCUSSION & CONCLUSION

Several studies have been carried out into the functionalities of blockchain, its possibilities, but also into the possibilities within different disciplines. Within this study, a scope was set for Dutch hospitals, given the fact that they are disturbed by the usage of various systems, both inside and outside the organization. This makes it more difficult to share and process data. No previous research has been conducted into the combination of the blockchain and hospitals on data processing. Although other papers are of added value for understanding the subject area, this paper provides new knowledge. That is why the following research question has been drawn up: "What is the relationship between the use of blockchain and the impact on data processing in Dutch hospitals".

Moreover, several studies have been carried out in which the effect of technological developments on hospitals was central and have been used as a theoretical base. An example of the effect of a technological development within hospitals are the eHealth applications for example buzzers for nurses and patients to be able to communicate with each other remotely. In this research the general effect of the application of Blockchain in a Dutch hospital is discussed. Another example is the consequence of the blockchain on the aspect of privacy in the context of data processing (Zheng, Mukkamala, Vatrapu, & Ordieres- Mere, 2018). In this study, the safeguarding of privacy through the use of blockchain is discussed. As can be seen, the actual effect of blockchain on (normal) data processing in organizations like a hospital, is not mentioned within these studies and in other studies also. From that point of view, our research is more likely focussed into the effect of blockchain on data processing.

As stated earlier, a linear regression has been performed to make conclusions about the results and interpret them. A few surprising cases have been noticed. In general our results are showing a positive significant relationship of 0.34 percentage point between the patient wellbeing variables and the use of blockchain in the hospital. There was also a strong correlation of 0.378 percentage point between these two variables, which confirms the positive relation of the application of blockchain on the wellbeing of the patient. However, there is still a minority that will be dissatisfied with the use of blockchain in hospitals. This was mainly due to the older age group (41-60) who were not satisfied with the use of blockchain. Thus, the younger group of respondents (20-40) would be more likely to be satisfied. A possible cause would be that the older group does not know enough about the blockchain and therefore does not agree with the blockchain in hospitals. It seems that this data is new, when compared to the earlier mentioned articles in this study within the subject of blockchain and hospitals.

Based on the regression that has been done on the results, we can conclude that hypothesis 1 can be rejected, but hypothesis 2 can not be rejected. From the results it seems that older people have more likely a negative wellbeing toward blockchain in a hospital, but if we look at the influence of blockchain on hospitals in general without difference by age and education an interesting thing occurs. It can be speculated that that people in general their wellbeing would increase if blockchain would be implemented in their hospital. This makes it crucial to focus on age differences, since it rather adds value than that it supports the claim that people in general are positively influenced by the blockchain. Moreover, it appears that people their wellbeing with regard to data processing of today, differs by education. It can be stated that the higher people are educated, the more their wellbeing is positive toward data processing of today. This can be caused by the fact that higher educated people know more about the blockchain and trust it less.

Based on the conclusions, we can answer our research question: "What is the relationship between the use of blockchain and the impact on data processing in Dutch hospitals" as follows. As stated earlier, the relationship between the blockchain and the Jeroen Bosch Ziekenhuis are measured by using the wellbeing of a patient differed by age and education as measuring instrument. We can conclude that the relationship between the use of blockchain and the impact on data processing in Dutch hospitals is moderated by

age. If people are older, they are more likely to have a negative wellbeing with regard to that relationship and vice versa. For instance, if a hospital has on average a young customer base, they will succeed earlier with implementing blockchain in their than a hospital with on average an older customer base. Education is in this study not significant and therefore not of added value.

7. LIMITATIONS

Within the study, we did not take into account the number of hospital admissions on average or the frequency with which someone has to go to the hospital. This can have a major impact on the behaviour and/or wellbeing of the person on blockchain. By understanding and responding to this, our research could be made more unbiased. The questions of the survey were so general that people with negative experiences from hospitals could be biased.

We also should have made a better distinction in age. At the beginning we had 1 survey for everyone. The average age of the participants was in general low, resulting in the fact that we did not have a good idea about other generations. Because of this we used the survey again and applied it to a different age category. However, this could be better allocated. In the survey we had split the age from 20 to 40 and 41 to 60. The perfect situation was to divide the age between the different stages of life so the variables were better measured.

Furthermore, we did not have an overview of who exactly could access the data. All our data was on the Google Drive of our Tilburg University mail address. We did not had the data externally (stored offline). This would have been better to protect the participants' private information and our own data.

We also had an insufficient number of sample size. The right amount we needed was 75 and we had a total of 44 participants in our survey. This has a negative influence on the reliability and external validity of our survey.

Finally, we found it difficult to find contact persons in hospitals. Due to shared connections, we were able to contact the Jeroen Bosch Ziekenhuis. However, in order to be able to make more accurate statements about our research, more hospitals must be compared with each other. This ensures that the research will be more generalizable for other hospitals.

8. FUTURE RESEARCH

Future researchers who will be working on the subject we have chosen, should look more closely at hospitals themselves. Future researchers need to interview more people in different hospitals to make a benchmark between these hospitals. The benchmark ensures that hospitals are compared with each other to get a complete picture of how blockchain or future innovations can be implemented and what the general problems are regarding the usage of blockchain.

In addition, future research should also include gender in the research. This is because gender can play a role in the variables. Gender can cause a different opinion about blockchain and data processing, but also have differences with regard to the wellbeing and education level of people. By adding gender to the study, the conclusions can be drawn to a broader perspective.

Finally, future researcher(s) need to have more knowledge about dividedness of age within blockchain. Our research implies that elderly people are unsatisfied about blockchain in hospitals. Unfortunately, the reason behind is not known. A possible answer could be that they do not have enough knowledge about blockchain and thereby holding it back. The actual reasons for this must be examined more closely with for example a experimental study.

9. RESPONSE TO FEEDBACK REVIEWERS

Of all the feedback we received, we filtered for the most critical feedback that added value to our research. The first feedback we received was: ‘’ I think hospitals are using quantitative data for other purposes than hypotheses testing. Besides that I don't think observations, experiments and surveys are relevant as well. Describe what types of data hospitals use in their current processes'". Because of this feedback, we have made clear in our research what type of data hospitals are using in their current processes. In addition, we have explained in more detail which research method we used and why we used it. We did not entirely agree with the feedback on the survey method because survey gives us an accurate insight into the relationship of the moderator and the independent variable on the dependent variable.

In addition, we also received the feedback: "Healthcare sector? That's much more broad than only hospitals, take care of the definitions. Later you also talk about the European healthcare sector, later on you never use this term anymore ". As a result, we have brought more consistency to usage of our words and started to demarcate our target population. We went from the Healthcare sector to hospitals in general and from hospitals in general to Dutch hospitals. The word European healthcare has been removed from the research. It helped to make boundaries and focus more on what is feasible for our research.

Also we received the feedback: *You say your research will only focus on people of 20 to 60 years*

old. But your moderator variable is ''age'', aren't you excluding the real young and old people in this way? Besides that you need to define ''old'' and ''young''. In response to this, it can be stated that both the younger and the older group have been included in the results, with the result per tested variable per age category clearly defined. Having age as a moderator did not exclude any age categories, since we did not want to include respondents under the 20 years old or respondents above the 60 years old.

At last we received the feedback: *The research question is stated in the third paragraph, but in this RQ influence is stated twice. " What is the influence of technological developments of data processing influence on the wellbeing of customers?". I think that you should replace one of the " influences".* This feedback was useful for us because the word influence was indeed mentioned twice in our research question. We have adjusted this immediately with the word impact. The word impact is chosen because it fitted more accurate in the research since we use a correlational method.

According to the total feedback we received, we would like to thank the students for their time and effort. On the basis of this feedback, we were able to take an even closer look at our research and thus improve the quality of our research.

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