The Role of Blockchain in the Digitisation of German Healthcare

Analysis and Proposal for a Decision-Making Framework

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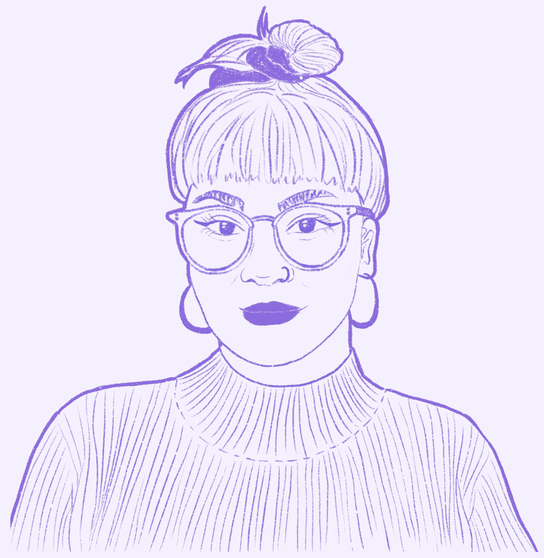

This thesis investigates the triade of blockchain technology, digitisation and the German healthcare sector.
The findings stem from extensive literature research, service design methods and analysis of non-numerical data from interviews, surveys and workshops.
It became evident that experts disagree about the relevance of blockchain for healthcare digitisation. Furthermore, healthcare workers dealing with patient data on a daily basis have made it known that there is a lack of data protection, understanding and user autonomy connected to the various systems and softwares their clinics currently use.
It was established that the complexity of the healthcare ecosystem has led to a structure of silos that makes communication, digital progress and co-creation difficult across all stakeholders.
As a result, the four paradigms of digitisation efforts, use cases, user autonomy and ethical implications emerged, on the basis of which the facilitation framework “Consult together” was developed.
The framework aims to serve as a guideline for service designers to investigate this multi-faceted topic , find appropriate methods, and connect all actors for a co-creative workshop that shall serve as a starting point for collective efforts to digitise German healthcare in an inclusive and sustainable manner.
The steps described in the framework can be carried out as described or altered to fit different approaches and target groups.
Instead of a static one-time effort, the framework is meant to incite further research and be tested in combination with different methods. Ideally, it can serve as a catalyst for breaking down silos and the development of cross-expertise communication channels.

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BACKGROUND AND GOALS

Ever since the concept of cryptocurrency gained traction, so did the conversation around its fundamental basis of encryption: the decentralised method of blockchain technology, where data is being distributed instead of transferred, and all change to said data is visible and traceable - while the data itself remains encrypted for outsiders.
Rather than a chain, this technology can be imagined as a symmetrical tree that grows a new branch whenever changes are made to the original set of data. Each branch then receives a time stamp and its own encryption.
If one zoomed out, they would see that, actually, the tree is just a branch of a bigger tree, which is also a branch of an even bigger tree - the biggest of them being part of a chain of trees that look exactly the same.

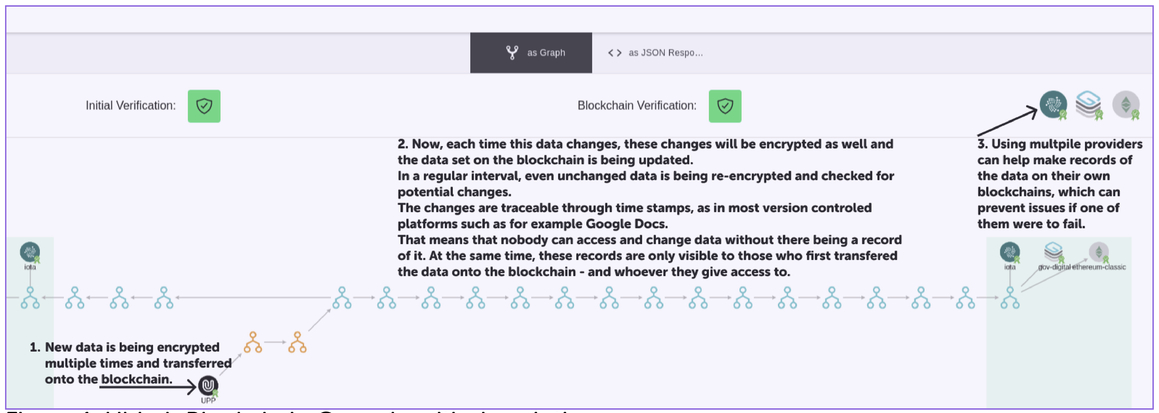


Figure 1: Ubirch Blockchain Console with descriptions

Since this is a safe and independent method of encryption, its use cases have multiplied and moved on from cryptocurrency to various other sectors.
One of them is healthcare, which has become an interesting market for blockchain companies, such as UBIRCH GmbH in Germany.
Once having started out as a cyber security company in 2014, they have recently collaborated with the German Ministry of Health to produce an application to safely check and verify vaccination and test certificates during the Covid-19 pandemic.
Following the success of said collaboration, UBIRCH have a continuous interest in expanding their service range towards the healthcare market.
This thesis is being written in collaboration between the author and UBIRCH GmbH.

Therefore, the initial goal is to explore options for them to provide solutions for healthcare stakeholders - and at the same time, to find the tools for those stakeholders to make responsible judgments on whether a blockchain solution is right for them and their practice within the German healthcare system.

METHODOLOGY

To explore the topic of this thesis and develop a prototype, the framework of the “double diamond” will be used to mark all steps and phases of the process.

The Double Diamond model consists of four consecutive phases: Discover and Define make up a research phase, while Develop and Deliver make up the Design phase.

During the Discover phase, the project topic can be explored further, research materials can be acquired and first ideas can be pondered. This phase’s purpose is to identify some fundamental needs on the user side and get a feel for the topic.

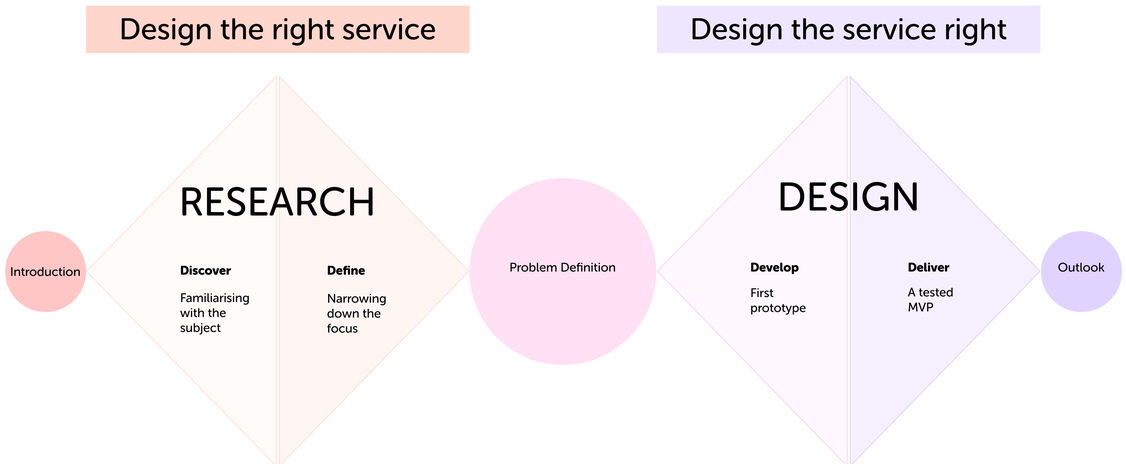


Figure 2: Double Diamond Process Model

During the Define phase, the findings from the former phase are being evaluated and interpreted as to narrow down the focus to a more specific problem area. In this phase, a preliminary problem statement can be formulated.

The Develop phase marks the beginning of a solution-oriented process in which the designer(s) ideate towards a prototype. This can require iterations.

The last phase is the Deliver phase, in which a tested prototype is finalised and launched with the respective stakeholders (Design council, 2015).

The Double Diamond model was chosen as the methodology for this project because of its clear division of tasks that still allow multiple iterations. Since I have worked with it during one other project in the Master’s program, I was already aware of its advantages and felt like my project would benefit from it.

TOOLS

DISCOVER

Literature Review:
- Market conditions
- German healthcare
- Service Design & digitisation

Questionnaire:
- Survey on data security awareness and general technological knowledge of healthcare professionals

Expert Interviews:
- Semi-structured interviews through video calls with blockchain and IT experts, both pro and contra blockchain technology

DEFINE

4 paradigms of debate:
- Defining core statements around the blockchain controversy based on the expert interviews and literature

Personas:
- Four personas of people in German healthcare affected by changed in data structures

User Stories:
- Four user stories, explored through the four personas that were derived from the questionnaire & interviews

Literature Review:
- Ethical limitations of blockchain technology in ecosystem digitisation
- Use case criteria
- Different analysis frameworks

DEVELOP

3-3-3 Brainwriting:
- Defining core statements around the blockchain controversy based on the expert interviews

Design Requirements:
- Definition of requirements for the development of a framework

Concept Development:
- Core assumptions and key conditions for developing the framework

Expert Workshop:
- Discussing user stories and ideas among four experts with diverging opinions
- Affinity Diagram based on outcome

DELIVER

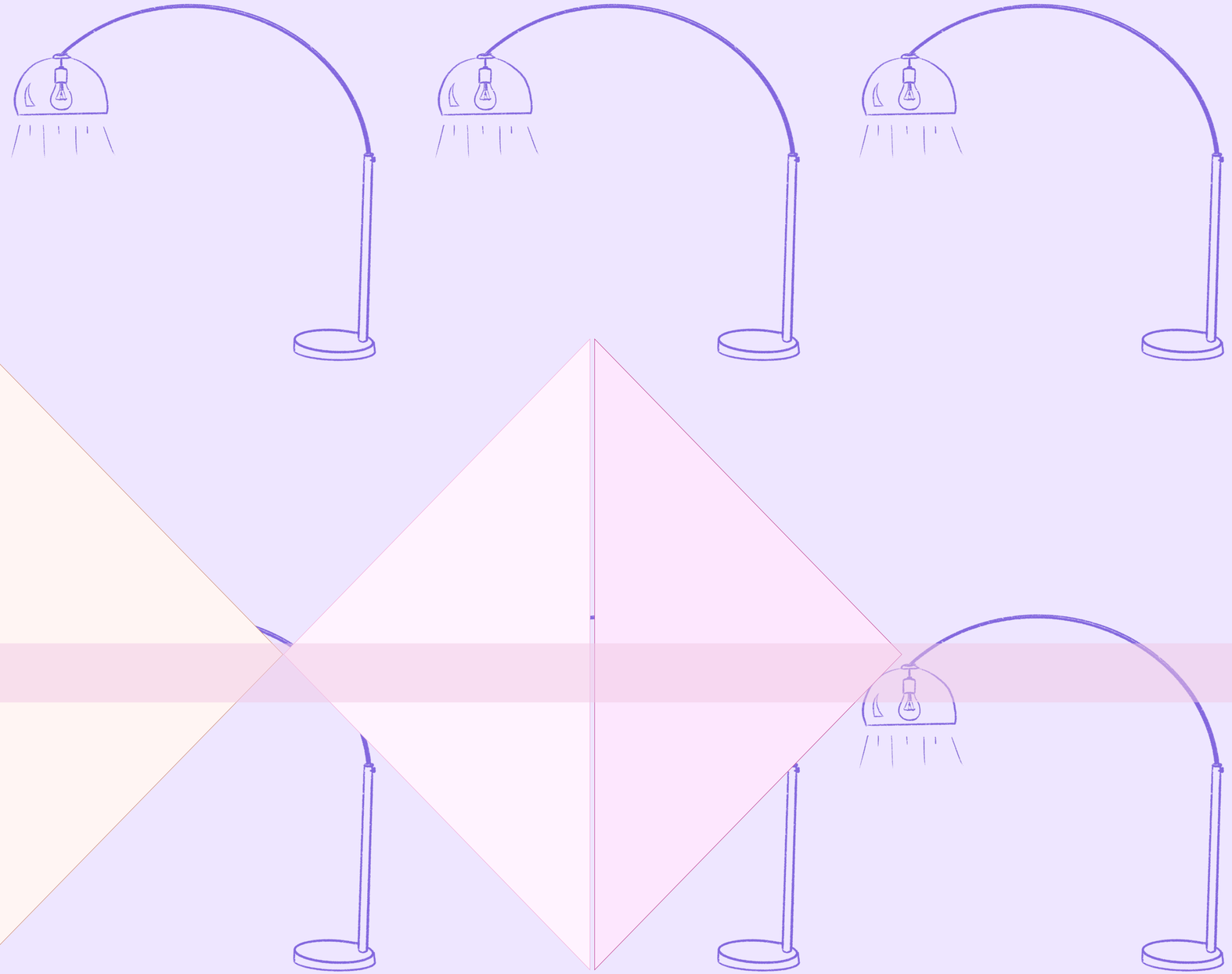
Updated Personas
- Exploring the needs, motivations, pains and skills of roles required for the framework

Actors Relevance Map:
- Mapping of stakeholders and their relevance in the conversation around digitisation and blockchain

Value Proposition Canvas
- Analysis of created, needed and shared value

Motivation Matrix:
- Picturing how stakeholders can benefit from each others' participation

Consult Together Framework:
- A guide for service designers to carry outresearch, thematic classification, workshop facilitation, paradigm-based analysis and maintenance of communication structures



DISCOVER

LITERATURE REVIEW PART 1

Big data in E-Health enables the transformation from hypothesis driven research to data-driven research by processing large volumes of heterogeneous medical data (Craciunescu et. Al, 2015, p.1). Since modern companies and, partially, the public sector in Germany have started implementing blockchain and other decentralised solutions during the last years, it is becoming clear that blockchain companies like UBIRCH are increasingly interested in developing applications for the healthcare market where they see a multitude of use cases.
Medical supply chain management, organ donation, clinical trials and drug research, and electronic health records are the main use cases currently being considered (Srivastava et Al., 2021, p. 172).
The versatility of the technology seems promising to experts, especially in the private sector, because blockchain is unique in the sense that its distributed structure does not require any stakeholder to trust another stakeholder in the process.
“Through this structure, blockchain's trustless computing environment transforms the network of information into the network of value.” (Tang et. Al, 2019, p. 43).
A network in which data is highly encrypted and the only element that gets stored in a record is a numeric value seems fitting for a highly sensitive and complex sector like the silo-structured German healthcare system.
Monetary gain by insurances and private clinics exists side-by-side with “life or death”-scenarios in which people do not have a choice but to trust healthcare professionals with their data, making digitisation efforts a highly sensitive topic.
The “Hospital Future Act”, which was approved in October of 2020, aims to achieve the following over-all goals by 2024: investments in modern emergency capacity, improvement of digital infrastructuremeasures to increase IT security, development and expansion of cross-sectoral telemedical network structures and necessary personnel measures (Zabel, 2020). 4.3 billion euros were allocated towards digitising the German healthcare system following the approval of the act.
After the German Ministry of Health has cooperated successfully with UBIRCH on the digital test and vaccination certificate service, blockchain technology is likely to be considered as a solution to tackle multiple of these afore-mentioned goals.
“Blockchain technology has evolved from the time it was introduced to the world through Bitcoin into a general-purpose technology with use cases in many industries including healthcare.” (Agbo et. Al., 2019).

LITERATURE REVIEW PART 1

Service design professionals ongoingly analyse digitisation and its effects, stakeholders and parameters.
Where more technological perspectives can lack a holistic view, designers have been looking at blockchain and other technologies in the scope of digital democracy and citizen satisfaction.
J. A. G. M. van Dijk describes the efforts to democratise public services and data as an attempted “technological fix for basic problems of political activity and the trust of citizens in government”. He describes how public services have been making efforts to digitise as many service elements as possible on the supply-side in order to save resources and enable citizens to retrieve information and participate in society. Citizens can voice their opinions and directly request policy changes in a model called “eParticipation”. E-voting, e-government-services and e-petitions are further such efforts to digitise the participation of citizens in local governance. However, these efforts are usually one-sided and meant to re-design how already existing processes are carried out for the sake of efficiency, rather than to new processes entirely or transforming a system holistically. Van Dijk concludes that efforts to digitise public systems are currently simply “added to the traditional channels”, and that this leaves behind some parts of the population, since skills are unequally divided. (J. A. G. M. van Dijk, 2012).

Respectively, in 2020, the researchers Chan et Al. have developed a research model to help evaluate citizens’ perception of public services like e-governing and to find out how service design characteristics influence their satisfaction with them. The model, which will be touched-upon later when determining the design requirements of the project, lead the researchers to the conclusion that there is “evidence of the relevance of the identified design characteristics to different aspects of a service offering” (Chan et Al., 2020). Their results and methods suggest that the same parameters can be applied to services like digital healthcare, that share most of the elements, structures and goals of e-governance.

A practical example for the impact of service design on digitisation efforts in the realm of data democracy is a case study from 2020 in which E. Durugy et Al. have staged blockchain technology in a bike-sharing customer journey. Concluding, they describe blockchain technology as an issue that requires enormous logisitcal ad operational efforts, and one that needs to be “better explained to the public”. They also touch upon the effects on the environment and state that “it is now time to develop and implement new and innovative concepts based on the blockchain”, which their experience staging seems to have been suited for as a method (E. Durugy et Al., 2020).

PROBLEM DEFINITION

According to the findings from my literature review, ditigisation is a set goal for German healthcare and the surrounding stakeholders. During the next years, decisions will be made for or against the use of certain technologies in a multitude of healthcare areas, whilst different companies can be expected to pitch their products to stakeholders in order to become a part of the digitisation effort to grow their businesses.

Bearing in mind the complexity of the healthcare system and the growth-oriented nature of a neo-liberal market, the problem definition will be:

"How can we help professionals in the German healthcare system digitise the way they handle data whilst protecting them from unnecessary costs and trend-based sales pitches?"

Figure 3: Healthcare Trade Fair Berlin 2022

QUESTIONNAIRE

To familiarise with the technological knowledge and day-to-day use of data protection solutions, I had ten professionals from the German healthcare sector fill out a questionnaire

The requirements for choosing the respondents was that they had to:

- be currently employed in the German healthcare sector
- be involved in the maintenance and transfer of patient data regularly

The questions were meant to give me an insight over how different or similar the handling of data within different healthcare companies/institutions might be, how much those handling the data understand about data protection and whether they would be open to a decentralised approach under specific circumstances.
For each question, the respondents had to rate their level agreement with a specific statement from 1 to 5 on the Likert scale, 1 being “strongly agree” and 5 being “strongly disagree” - there was the additional option 6, “no answer”. In the following evaluation, only patients that responded to a question will be taken into account. For example, if one person ticked “no answer” and nine ticked a value from 1-5, only those nine will be considered as the total number of participants for that specific question.

While all of the participants stated they support the advancement of data encryption technology in the healthcare system, and 9/10 said the support the advancement of technologies that give patients control over their data, only 3/10 stated that they know what the term “blockchain” means. This indicates there is a knowledge gap that would need to be bridged in order to grant professionals the agency they need to implement blockchain technology without risk. This gap is not so much about the intricacies of the technology, but of its consequences and basic use cases.
Medial professionals can not be expected to become blockchain experts, which is a paradox since this makes them more vulnerable for sales pitches from for-profit companies.

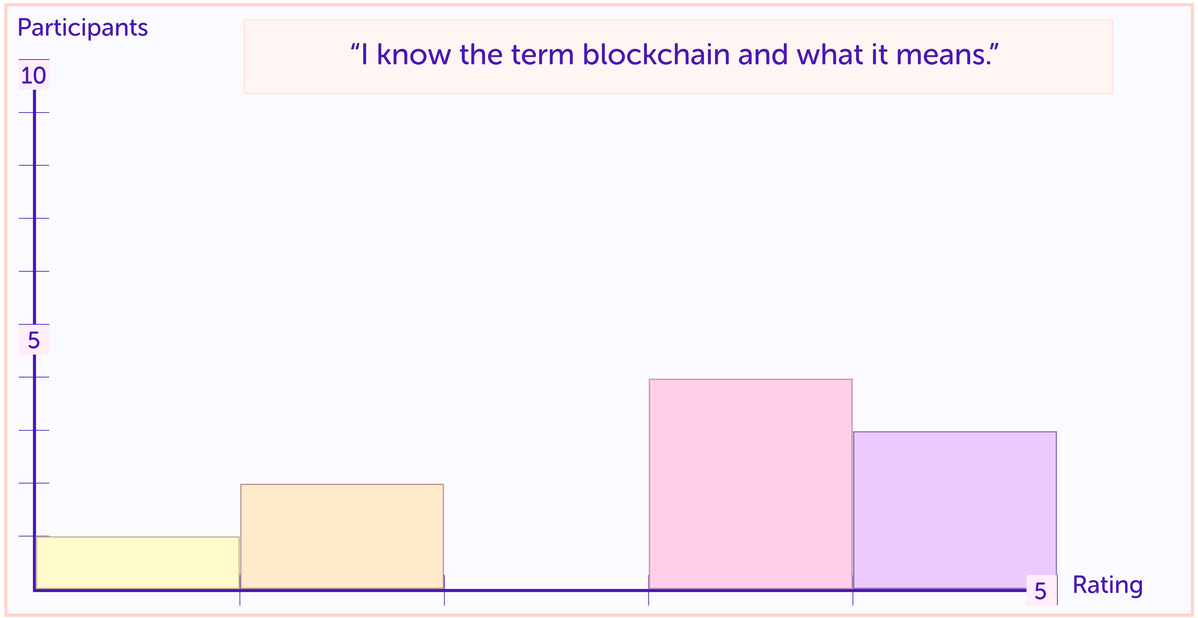


Figure 4: Exemplary questionnaire response

QUESTIONNAIRE

Besides their knowledge about blockchain and technological trends, I also wanted to find out how many of the healthcare professionals feel comfortable using the data processing software in their own practice and if they feel comfortable with it. Seven out of ten people checked that they were very familiar or familiar with their practices' systems, which still leaves three out of ten feeling like they could know more about it.

Additionally, only 5/10 stated that they agree with the way the patients' data is being used in their system which may hint towards potential abses of data or data leaks.

It is not surprising that in consequence, 9/10 state that they support efforts to enable patients to handle their own data with more agency and transparency - and 100% of them support efforts to encrypt data more safely and securely.

8/10 answer in a way that suggests that when there are questions or a lack of understanding, there is no direct contact person that can help them out. Therefore, a reasonable assumption is that data handling protocols are not only lacking digitisation, but also understanding within entire teams of medical professionals.

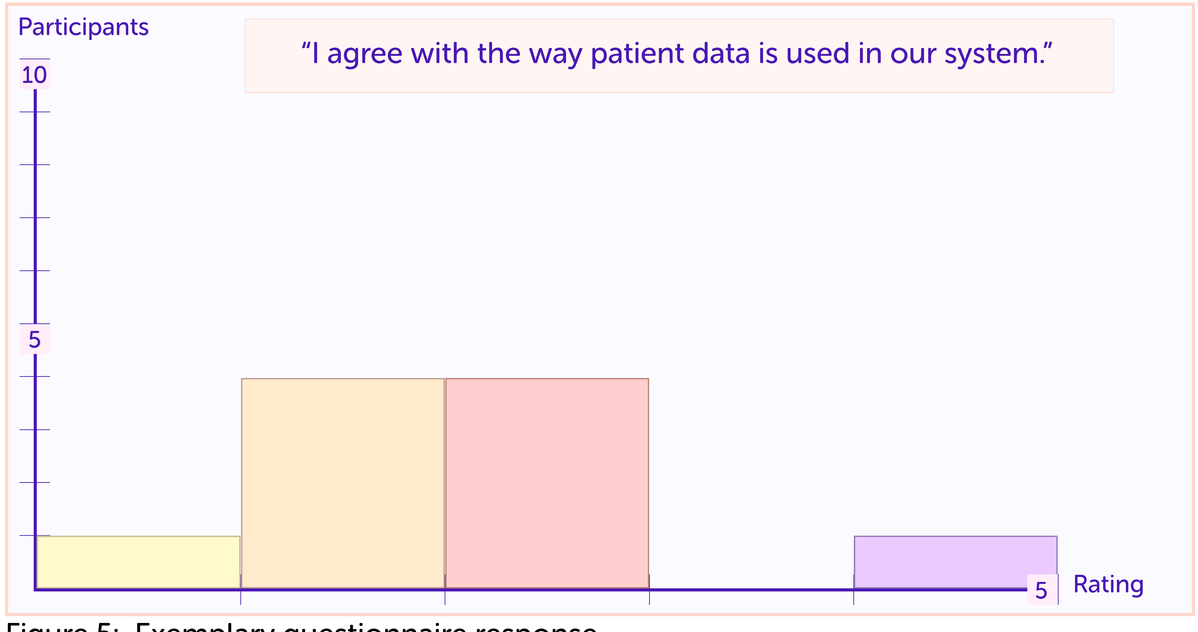


Figure 5: Exemplary questionnaire response

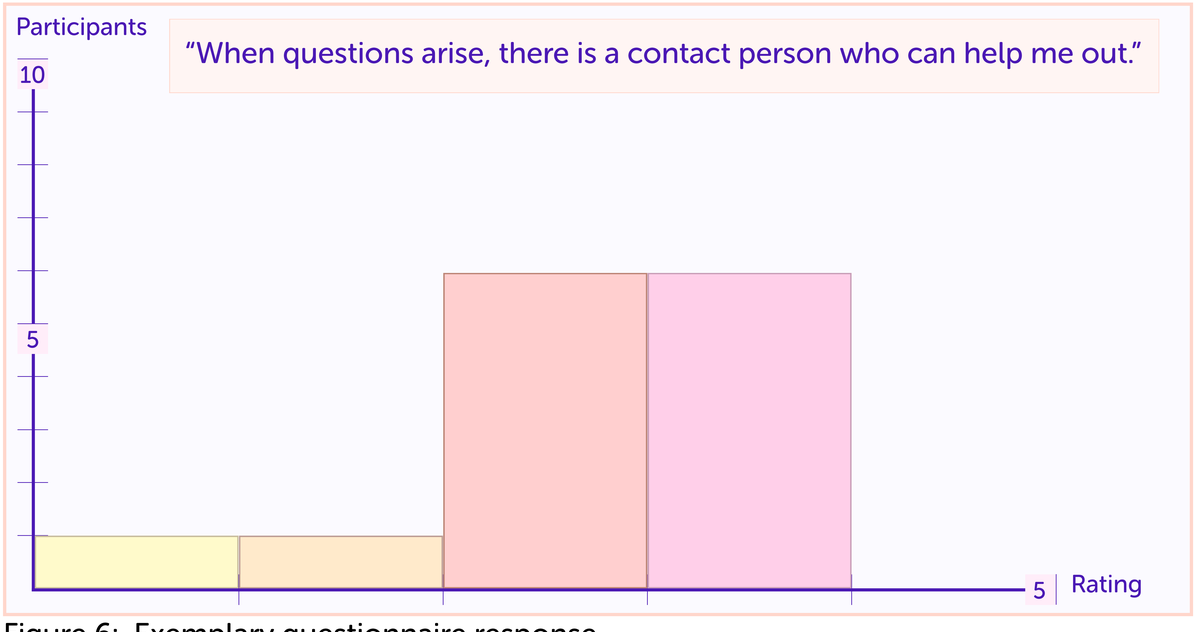


Figure 6: Exemplary questionnaire response

QUESTIONNAIRE

This is supported by only 6/10 responding that education efforts around digital systems have even taken place at their workplace. Fittingly, 4/10 did not agree with the statement “As employees, we are regularly educated on data protection”.

From the opinion of the respondents, the data protection and especially access to data does not seem sufficient: 5/8 respondents disagree, or even disagree strongly, with the statement “I agree with the level of control that patients have over their own data”.

This suggests that neither patients nor those who are responsible for direct dealings with their data know exactly what levels of data protection are in place and they do not trust it fully either. This makes sense in line with the fact that trust in the German healthcare system has been declining since 2021 (Brusemeyer, 2022).

In conclusion, efforts to help reinstate trust from both the patient and expert side seem well-directed when they go towards patient data and digitalisation.

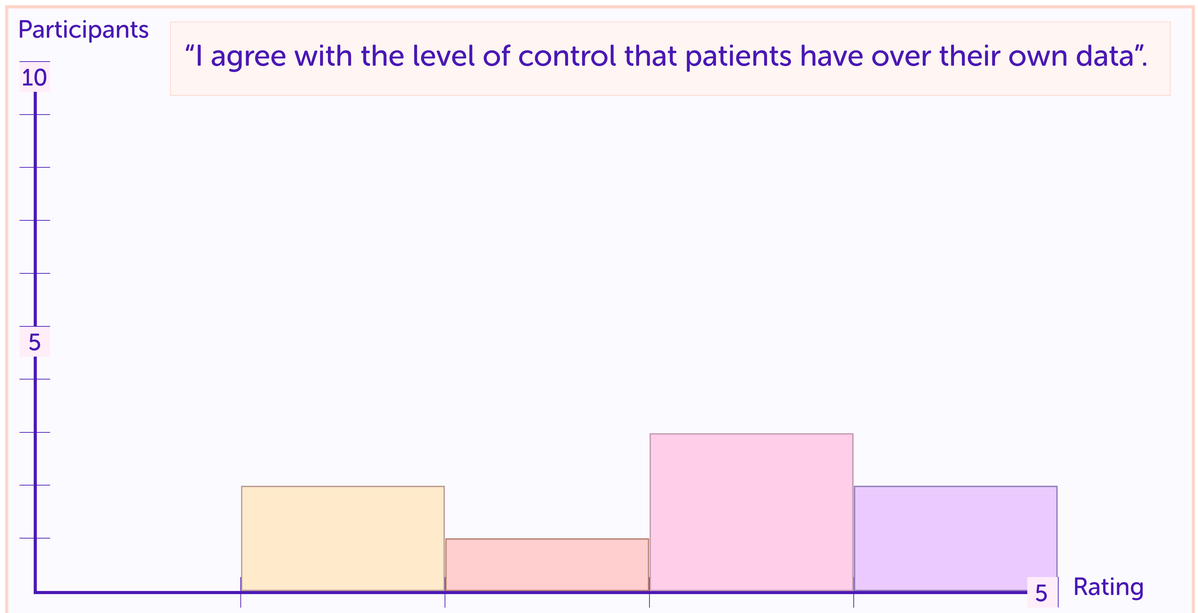


Figure 7: Exemplary questionnaire response

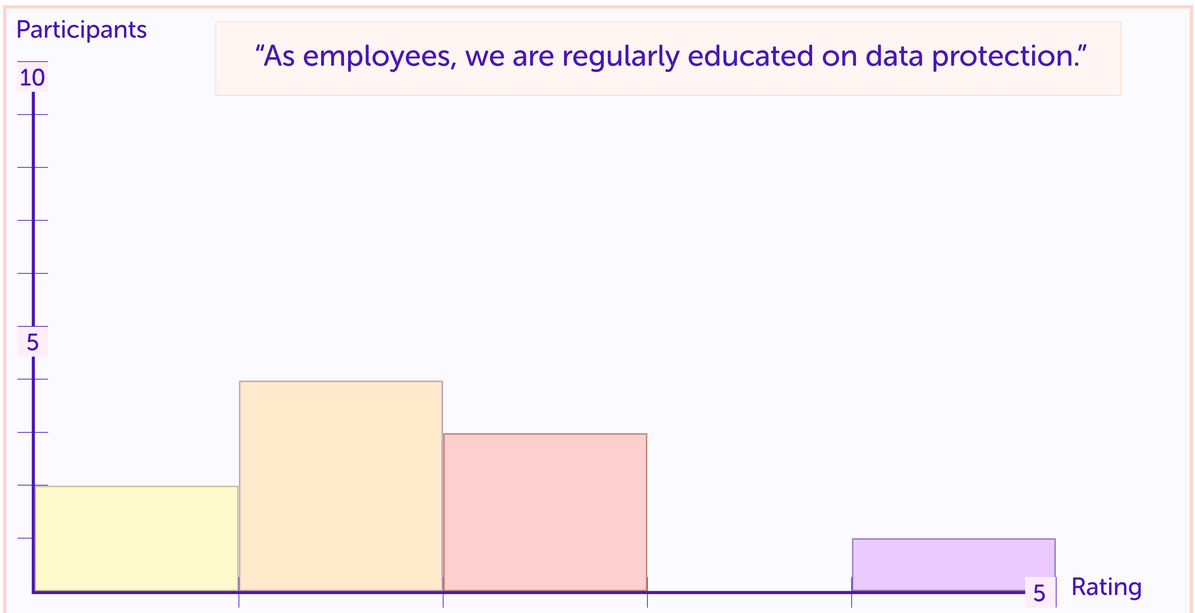


Figure 8: Exemplary questionnaire response

INTERVIEWS

Since the responses to the questionnaire point towards a lack of digitisation and knowledge, my next step was to conduct two semi-structured interviews with experts on the matter. I chose two people who have strongly diverging opinions on the subject of blockchain technology - because, despite me collaborating with a blockchain-related company, it has been important to me to keep an open mind throughout the process and reach my own conclusions.

One of them is Matthias Jugel, the CTO of UBIRCH and evidently very much in favour of blockchain technology.
The other one is Jürgen Geuter, an experienced IT Consultant who has spoken before the German Ministry of IT and Security on more than one occasion and views blockchain technology rather critically.

Outcome:
According to what has been gathered from the two experts, there are four basic conceptions their opinions diverge on:

1. “You can just as well use a database”

A MySQL database system is an open source cluster of databases that are encrypted and administrated independently in order to enable cloud-storage of large amounts of data in a safe way. Jürgen Geuter argues that most data that is being stored on a blockchain could also be stored in a database with these presets, and that those also have option to ensure that the data within is immutable. Furthermore, he argues that the data sets used in German healthcare would likely be too big to be computed on the blockchain without the use of immense amounts of money and energy.
Matthias Jugel, however, says that it is not necessary to use blockchains as an alternative to databases, but as an add-on instead. His vision would be to “prove that (...) yesterday, the state of the database was this, and now it's this and you can prove that it was like this and (...) nothing can change it” by having an immutable log that can substitute systems which would usually track changes by “print(ing) out on paper, what it has been producing all the time”, because much like a printed out and sealed paper, an entry on the blockchain can not be deleted.
In conclusion, it seems like there are ways to store data in a decentralised and immutable way that does not require a blockchain, but it remains to be seen from use case to use case which of the two makes more sense.

INTERVIEWS

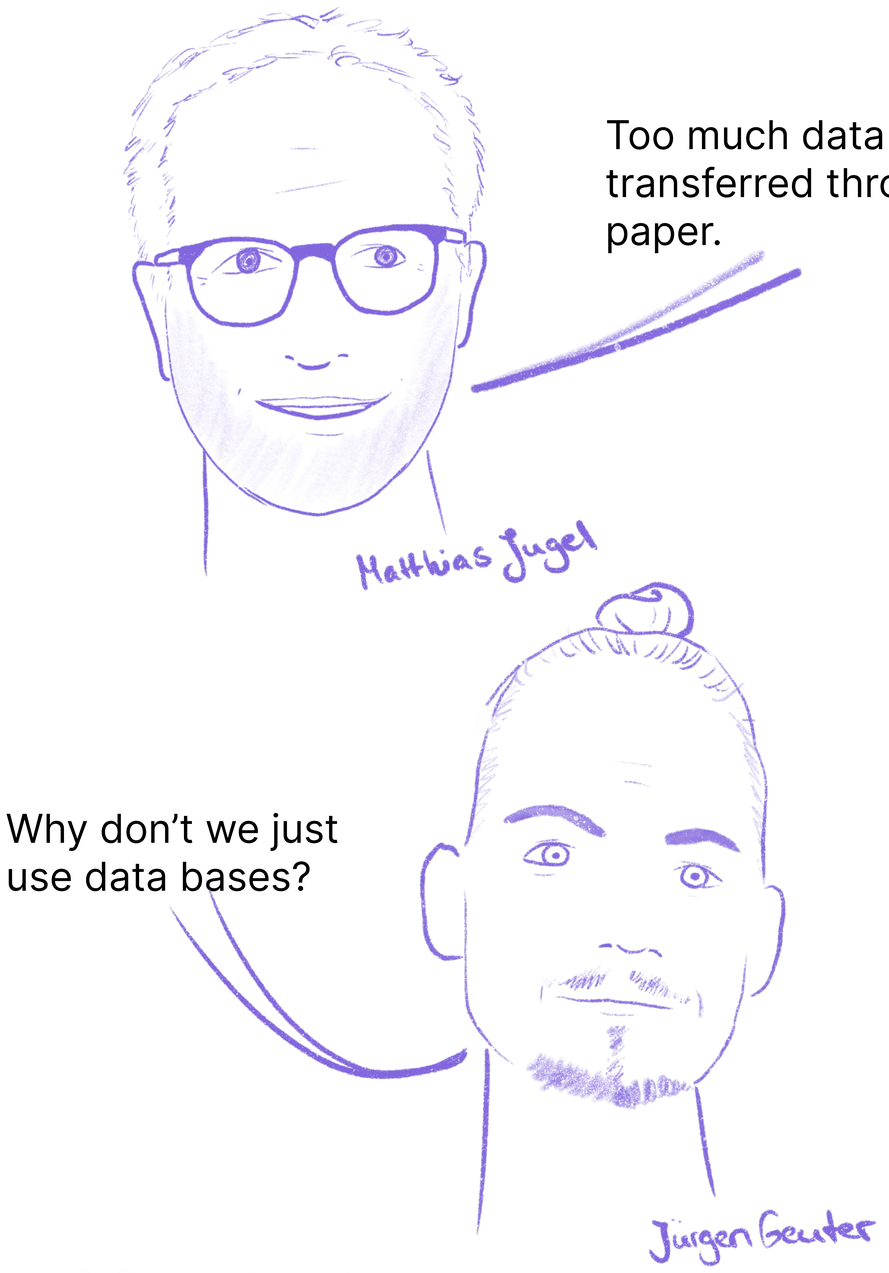


Figure 9: Sketched faces of the interview participants

2. “Blockchain only has use cases in areas where, by nature, none of the stakeholders trust each other”

This was something Jürgen Geuter said multiple times. Yet, the CovPass check app in cooperation with the German Ministry for Health was used by people all over Germany to verify their test and vaccination certificates - and it is unlikely that all of these people mistrusted all other players and vice versa.
Therefore, perhaps this assumption could be changed to “Blockchain has use cases where, by nature, not all stakeholders have the option to gain trust in one another”.

3. “It is a problem that a lot of knowledge transfer happens on paper”

The German healthcare system still very heavily relies on paper or simple files such a e-mail attachments. Prescriptions, referrals and even diagnoses are usually issued and given to the patient on paper. Matthias Jugel is of the opinion that this creates a potential trust gap, since “it’s basically not provable that this is the actual stuff that belongs to me”. His example for this was: “So basically, what you can do is you can use cryptography in terms of adding a signature to make sure it's an authentic thing.

INTERVIEWS

And use the blockchain to make sure that this is also recorded somewhere that someone has created this document. So because sometimes you also have the issue, you create a document with one medical result, and then you create another one. And the second one might somehow supersede or change things. And then it's difficult to prove which one is the right one, if you don't have any record of that this has happened." Jugel wants to solve this by providing electronic signatures for all documents, so that every signature is anchored in the blockchain with a time-stamp - therefore being easily traceable in the timeline.
Of course, Geuter is of a different opinion here, since he feels that healthcare has to rely on the "inherent trust between doctors and patients".

4. "The use of blockchain in healthcare should not really affect people, unless they plan on doing something illegal"

This is where the opinions of the two experts diverge most. Geuter has strong reservations and compares the use case for blockchain in healthcare to the one in finance:

"people would be quite negatively affected, they would have to struggle with quite the big risks, because; we also see some banks finding this quite interesting, self-sovereign identity, you manage everything yourself - and that's relevant for them because that way they entirely outsource all responsibility to you. Whenever something goes wrong, they can say "but you have agreed to this, you did this, we don't need to reverse this contract, or pay a fine, it is your problem". And now we would suddenly be at that point in healthcare, "no, your private key has signed this procedure, you were definitely informed on the process, otherwise you wouldn't have signed it".
On the other side, Jugel sees the use case not in the legitimation of specific procedures by patients who are afterwards unable to change their minds, other by doctors who can then be sued every step of the way - he instead seems to be mostly concerned with protecting both these parties from third parties that might steal or alter data, or from simple administrative mistakes.

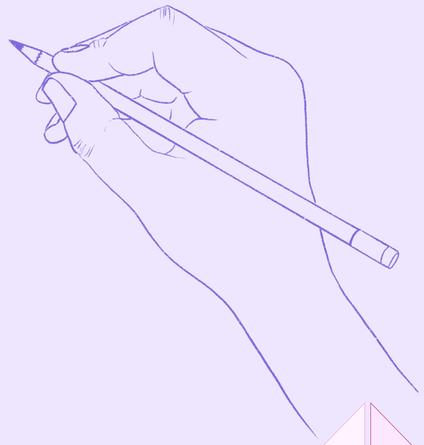
The four mentioned assumptions made by the experts I have interviewed will be the corner stones of the discussion between these two and two more experts as to be described in a later part of the thesis.

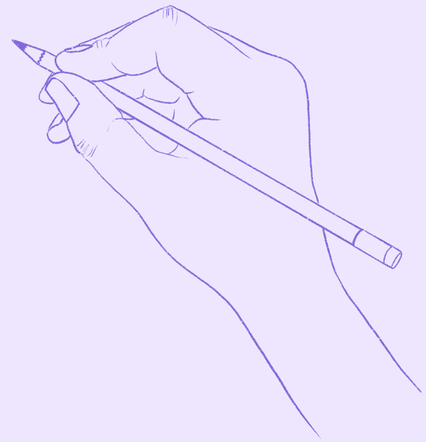
KEY FINDINGS

Through questionnaire reults and interviews it has become apparent that patients and healthcare professionals alike are not convinced by the trustworthiness of the current data protection and data transfer systems, and that they are generally open to new solutions. However, it also has become clear that they are not educated on blockchain technology, nor its alternatives, and therefore don't feel secure in judging the situation.
There is also a controversy around blockchain technology which often gets labeled as a "hype" by some experts, yet for others seem to bear many digitisation opportunities

Additionally, the desk research has made me aware of the following points:

- Blockchain in healthcare theoretically has multiple use cases, among them "management of electronic medical records, drugs and pharmaceutical supply chain management, biomedical research and education, remote patient monitoring, health data analytics" (Agbo et. Al., 2019)
- The use of blockchain could enable patients to handle their own data more autonomously and healthcare professionals to be able to rely on security measures being up to date
- The general knowledge around blockchain technology is low and some experts are sceptical whether the public would be able to understand and accept it
- Using blockchain is more cost- and energy-demanding than the use of other data processing systems
- While blockchain has evolved from its initial use case of digital financial transactions, many still only know it from the purpose of bitcoin trade
- Digitsation of the German healthcare system is necessary and has been discussed as a subject for years - yet, the complex German healthcare system seems to make it difficult to actually reach a conclusion and formulate a concrete plan on a larger scale
- The use of blockchain technology is a highly discussed subject for journalists, IT professionals and entrepreneurs who have differing views on the matter
- There are use cases, such as supply chain management, for which even those opposing blockchain agree that its implementation might be beneficial





DEFINE

PERSONAS

The personas (M. Stickdorn & J. Schneider, 2012) I built the scenarios about were derived from the answers to the questionnaire and the assumptions that I made after the expert interviews and my auto-expectation map.
Their main purpose was to create an image in the minds of the experts during the expert debate round that will be described on the Develop phase.
The personas visualised that there is an unfathomable variety of problems related to how data is handled within German healthcare:

These problems affect professionals in multiple ways and in their everyday work life, the following factors being pre-dominant:

- Many issues are interwoven because the different actors in the healthcare system rely heavily on each other's expertise
- If a problem affects one section within an organisation, it is like to directly or indirectly affect another as well
- The target group of medical professionals is large and multi-faceted with many different interests, some of which are conflicted
- A dichotomy exists between the wish to autonomously handle data and the knowledge this would currently require

Claudio, 23, Driver & Pharmaceutics student

- IT Knowledge: 6/10 (MS Office, Front End)
- Data: Prescriptions, personal info from pharmacy customers
- Pain Points: lack of trust into the politics of pharma businesses, worried about patients

Sarah, 29, Healthcare IT Consultant

- IT Knowledge: 9/10 (MSc Software Dev.)
- Data: Confidential information about specific practices and companies
- Pain Points: Confusing software, lack of digitisation, no uniform regulations

Anna, 38, Medical Assistent

- IT Knowledge: 3/10 (Basic Excel/ MS Office, Software used in practice)
- Data: Prescriptions, Referrals, Patient Files, Diagnoses
- Pain Points: Patients losing prescriptions/ referrals etc., constantly cluttered files

Akin, 42, Senior Insurance Salesman

- IT Knowledge: 5/10 (Excel/ MS Office, PowerPoint)
- Data: Insurance files, Diagnoses, Patient data
- Pain Points: Complaints from patients who didn't fill out their forms right, laws against genetic diagnosis data in insurance files

Figure 10: Profiles of the personas

USER STORIES

Using the four summarising statements from the expert interviews, I created four user stories matching the personas. The user stories stem from the method description of the Interaction Design Foundation (Domingo, 2021) and were adjusted with the expert workshop in mind that they will be used for. The goal was to explore scenarios that seem likeliest from the questionnaire outcomes and interviews.
The four use cases were as follows:

1. “Sarah has been working as an IT consultant in the healthcare sector for 2 years and is currently experiencing the renewed discussion about blockchain in data protection. With every customer, she is faced with the question of how best to solve their problems without overtaxing the customer or selling them something unnecessary. She is looking for a kind of blueprint with which the majority of the practice's internal systems can be easily structured while data protection is improved and the customer can quickly get used to the new software.”

2. “Anna has been working in a psychiatric practice for 8 years and continues to lead the team of four medical assistants. She would like to spend less time keeping paperwork in order and waiting for referral slips or reports from other practices to be handed in later. She would like an uncomplicated system in which she can manage all patient data online, but is aware that this data is highly confidential and therefore feels unsure about new systems.”

3. “Claudio is studying pharmacy in the 4th semester and earns money as a driver for drug delivery services. In his part-time job, he often worries about the supply chain for the medicines he sells, since he is learning a lot about competition in the pharmaceutical industry and generics during his studies. He often wonders whether the regulatory authorities are really impartial. He knows that as a pharmacist he will soon have to help patients choose the right medication. But how is he supposed to know exactly whether a package contains the drug that is labeled on it?”

4. “Akin has been working for a large German insurance company for 12 years. He fundamentally appreciates contact with patients and enjoys his responsibility. In recent years, however, he feels he is getting more and more workload while patient satisfaction with insurance benefits seems to be declining. This often leads to them directing their displeasure at him or his colleagues, although they themselves usually provided inaccurate information when concluding the contract or did not read the contracts carefully enough. They don't seem to trust the insurance anymore but perceive it as a burdensome cost factor.”

INITIAL PROBLEM AREA & HOW MIGHT WE QUESTIONS

After creating the user stories, it felt necessary to attempt an initial definition of problem areas which can create a foundation for another literature review with more tangible stakeholders in mind.

- There is a big knowledge gap around the definition of blockchain technology
- There is a big knowledge gap around which use cases/ consequences the use of a technology like blockchain has
- Opinions on the aforementioned use cases diverge strongly between different IT experts
- There are trust gaps within the German public healthcare system
- There are many different software systems that healthcare professionals use to handle helathcare data
- Healthcare professionals feel insufficiently knowledgeable in regards to those systems
- Healthcare professionals support the idea of patients having more agency regarding their own data
- Healthcare professionals feel like patient data should be more protected
- Blockchain companies are trying to move into the healthcare market
- The German healthcare system is one of the most complex in the world and decisions are made slowly in comparison to other markets

The resulting '"how might we" questions (Odell Keller, 2019) are:

1. How might we make healthcare professionals and patients feel more safe about the way data is being saved and transfered
2. How might we bridge the knowledge gap on a subject as complex as blockchain technology?
3. How can experts compromise enough to use blockchain in a beneficial way
4. How might we as designers facilitate workshops in an efficient way that includes both sceptical and pro-blockchain experts
5. How might we as designers use the wide array of opinions on the matter of blockchain technology to sufficiently advise healthcare professionals in order to give them the tools to make an educated decision on the systems they want to use.

INTITIAL PROBLEM STATEMENT

An initial problem statement in summary of the first research outcomes, to allow further investigation with a more concrete intention:

How can the responsible healthcare digitisation stakeholders make educated decisions on the benefits and disadvantages of a blockchain application for specific use cases?

LITERATURE REVIEW PART 2

A second iteration of a literature review was conducted after summarising the initial findings and creating increased tangibility through an initial problem statement to serve as a map through the complexitiy of the subject. My goal was to learn more on the analysis of ethical advantages and disadvantages of blockchain technology, to find sources that back the main claims made by the two experts, and to discover service design efforts on the topic.
Jürgen Geuter is by far not the only expert who has concerns about the thics of blockchain; many believe that implementing such a technology would eventually only benefit a small minority of people that hold a majority of privilege in society.

In the International Journal of Cognitive Computing in Engineering, Srivastava et Al. describe and analyse the main ethical concerns with blockchain technology, which also support some of Jürgen Geuter's statements. They cross-analyse each of the main medical use case areas through the lense of eight ethical parameters; accountability, fairness, privacy, accuracy, data access, data ownership, governance and the "right to be forgotten" (the right for individuals to request that search engines "delete their inadequate, irrelevant or no longer relevant personal data" from databases). The graphic below shows that they have found ethical dilemmas with each of the use case groups (Srivastava et Al., 2021).

Parameters	Electronic Health Records	Medical Supply Chain Management	Clinical Trials and Drug Research	Organ donation
Accountability	No Ethical Dilemma	No Ethical Dilemma	No Ethical Dilemma	No Ethical Dilemma
Fairness	***Ethical Dilemma***	No Ethical Dilemma	No Ethical Dilemma	***Ethical Dilemma***
Privacy	***Ethical Dilemma***	No Ethical Dilemma	No Ethical Dilemma	No Ethical Dilemma
Accuracy	***Ethical Dilemma***	***Ethical Dilemma***	***Ethical Dilemma***	No Ethical Dilemma
Right to be Forgotten	***Ethical Dilemma***	***Ethical Dilemma***	***Ethical Dilemma***	No Ethical Dilemma
Data Access	***Ethical Dilemma***	No Ethical Dilemma	***Ethical Dilemma***	No Ethical Dilemma
Data Ownership	No Ethical Dilemma	No Ethical Dilemma	No Ethical Dilemma	No Ethical Dilemma
Governance	No Ethical Dilemma	No Ethical Dilemma	No Ethical Dilemma	***Ethical Dilemma***

Figure 11: Table of eigth parameters illustrating ethical blockchain dilemmas

LITERATURE REVIEW PART 2

While it is certainly cause for concern to find that there is no medical blockchain application to date without embedded ethical dilemmas, dismissing them before attempting to find solutions would be insufficient when the more traditional data structures currently used in German healthcare have also been known to create a variety of correlating issues (Rauter et Al., 2021).
Next to ethics, other important factors play a role in the validity of a technology - one of them is whether the technology provides patients with autonomy and sovereignty over their own data. Here lie the chances of blockchain as opposed to traditional healthcare data systems: the current system is flawed in the sense that, as Matthias Jugel says, "knowledge transfer happens on paper", which makes it easy for a third party to steal a prescription note or look at a patient's file. Pharmacies do not require customers with prescription notes to hand over any proof of identity when they pick up medication, so once a person gets their hand on someone else's prescription notes, they can simply pick it up at any german pharmacy themselves. If patients had their own data stored within an immutable digital system, it would not only protect said data from theft, but also ensure that "control is distributed to patients and health service providers" (Srivastava et Al., 2021).

When branching out into the more technical aspects of blockchain use cases, experts like Jürgen Geuther often bring up database systems in combination with various tools as a preferable alternative to blockchains. Naturally, this highly technological analysis would require extensive knowledge of IT systems, yet it seems like research supports Matthias Jugel's claim that it is possible to combine blockchain and databases instead of comparing one to the other, as done by Nathan et Al. in 2019 where they directly compared blockchains and databases and found that a combination of the two would potentially solve some of the otherwise existing issues. In the graphic below, they list the unique properties of both technologies and the enhancements both of them could gain when "leveraging and enhancing the features of relational databases to build a permissioned blockchain platform, rather than building one from scratch" (Nathan et Al., 2019, p. 1540).

Blockchain Properties	Relational Database Features	Enhancement Needed
Smart contract	PL/SQL procedure	Deterministic execution
Authenticity, non-repudiability	User management with groups and roles	Crypto-based transaction authentication
Access control	Role & content-based ACL policies	None
Immutable transaction logs	Transaction logs	Digitally signed transactions
Consistent replicated ledger between untrusted nodes	Master-slave & master-master replication with trust on transaction ordering and update logs	Decentralized trust and transaction ordering determined by consensus
Serializable isolation level	Strict 2-phase locking, optimistic concurrency control, serializable snapshot isolation	Order must respect block ordering obtained through consensus
Async transaction & notification	LISTEN & NOTIFY commands	None
Provenance queries	Maintains all versions of a row	Enable query on historical records

LITERATURE REVIEW PART 2

As a consequence to these findings, there are already four different stakeholder groups to be considered: next to patients and healthcare professionals, it seems additionally necessary to distinguish between experts with different views on blockchain technology, mainly the ones that support the growth of the blockchain industry and those who oppose it. In order to discover which use cases have a raison d'être without bias, both groups should be engaged in dialogue.
Finding the right methods to facilitate change with this many stakeholders requires a further definition of the level on which the design effort shall be taking place.

In the paper “Service Design and Organisational Change (Junginger & Sangiorgi, 2011), Junginger and Sangiorgi point out three different levels towards which the impact of design projects can be directed:

- Service Interaction Design, which they regard as “remaining on the periphery” of the organisation - the traditional process of user-centered design which typically “suggests new/improved artefacts, without really questioning norms or values behind it”, therefore mostly superficially transforming an organisation through products and interfaces

- Service design interventions, which affects multiple elements of the organisation and has consequences for the whole service concept. These interventions require cooperation from the organisation which needs to make a conscious effort to contribute to the facilitation of change

- Organisational transformation, which can be met with some resistance from the organisation since it requires larger changes and the questioning of core values and mechanisms. The organisation faces an ongoing, long-term commitment they have to be on board with, and they may be required to re-structure multiple sections of their organisation.

Since so many stakeholders are involved and the German healthcare system has been described as highly complex during the research process, the perspective of organisational transformation seems to come closest to the structural level that has to be considered in the process.

KEY FINDINGS

From the four main statements and the literature review, four categories have emerged which need to be considered the main cornerstones of debate surrounding blockchain as a part of digitisation efforts in healthcare. These paradigms are the elements that must be investigated in order to come to an educated decision surrounding the application of blockchain technology in a specific healthcare service. The paradigms will later on be used in combination with further findings and to cluster statements from workshops in the style of an affinity diagram. Below, they are displayed together with the guiding research findings that serve to define each paradigm further.

Digitisation Efforts

- The silo structure of German healthcare makes data exchange and implementation of new technology difficult, which results in Germany finishing in the lower third of european countries regarding digital health
- Organisational transformation needs to be the goal of any design approach that aims to facilitate sustainable change

- 4.3 billion euros have been allocated to digitise German healthcare until 2024(Herzog, 2021).
- “Concerns regarding data security, regulation and reimbursement, and data infrastructure remain major obstacles to doctors developing trust in digital alternatives to current practice” (Ladewig, 2019 in Albert, 2020, p.2828)

Ethical Implications

- Experts are continuously debating the different aspects of ethical impacts around blockchain
- Since highly vulnerable stakeholders are affected by digitisation in healthcare, ethical considerations need to be part of any ongoing transformative effort

- In the scope of cybersecurity, blockchain can enhance the security of data and systems, providing robust solutions when threats are constant, environments are complicated, and traditional measurements are expensive. (Tang et. Al, 2019)
- “As a discourse or text blockchain recounts a broad matrix of socioeconomic and political issues in a constant state of flux. Moreover it is revealing something very important about the evolution of the subject caught in the force-feld of neoliberal economic reason both at the macro level of contemporary free-market capitalism, and more intimately” (Herian, 2018, p. 170)

Use Cases

- There are arguments for and against specific use cases of blockchain technology in healthcare, dividing IT experts on the matter
- Both, use cases with and without blockchain would require educating the public to enable safe handling

- “At the highest level, executable smart contracts are offered to empower autonomous applications in areas like Fintech, digital property, cybersecurity, and autonomous contracts. Through this structure, blockchain's trustless computing environment transforms the network of information into the network of value.”(Tang et. Al, 2019, p. 44)
- Medical supply chain management, organ donation, clinical trials and drug research, electronic health records are the main uses cases (Srivastava et Al., 2021)

User Autonomy

- Data ownership is one of the few areas where experts see no dilemma in regards to the implementation of blockchain technology
- Patients as the users of healthcare technology have been increasingly advocating for a shift in access to research data and networks

- “Blockchains have transformed Electronic Health Records by providing patients control over their medical data through access to an immutable log of their records. All records of a patient go on a single blockchain and give the patients easy access to their complete medical history. Control is distributed to patients and health service providers via decentralization enabled by consensus algorithms.” (Srivastava et. Al, 2021)

DEVELOP

EXPERT DEBATE ROUND

The four personas and user created earlier were now used on a Miro board for an expert workshop. Four experts were invited: Jürgen Geuter and Matthias Jugel from the previous expert interviews, plus Waldemar Grünwald and Teal Bauer. Waldemar Grünwald is a PhD of electrical engineering & a senior embedded systems engineer at UBIRCH, while Teal Bauer is a strategic innovation consultant and previous digital design director. I chose these four people in order to have two pro-blockchain voices versus two sceptical ones. The goal was to create a discussion about concrete use cases and find out how experts of such diverging opinions will engage with each other when presented with a multi-faceted problem.
For each user story and persona, the experts had 10 minutes of time (or until they were all finished) to analyse the user's problems and come up with a solution or proposal to solve as many problems as possible that were described in the story. They were asked to specifically think about blockchain technology and whether it would make sense in the specific scenario. Afterwards, they had 15 minutes per scenario to discuss what they came up with and, if possible, agree on a compromise.

In total, the round took 1.5 hours and during each round, the experts were ready before the time was up, resulting in me ending up giving them reduced amounts of time to read the tasks in order to save time for the discussions. The transcript of the discussions was afterwards divided into an affinity diagram.

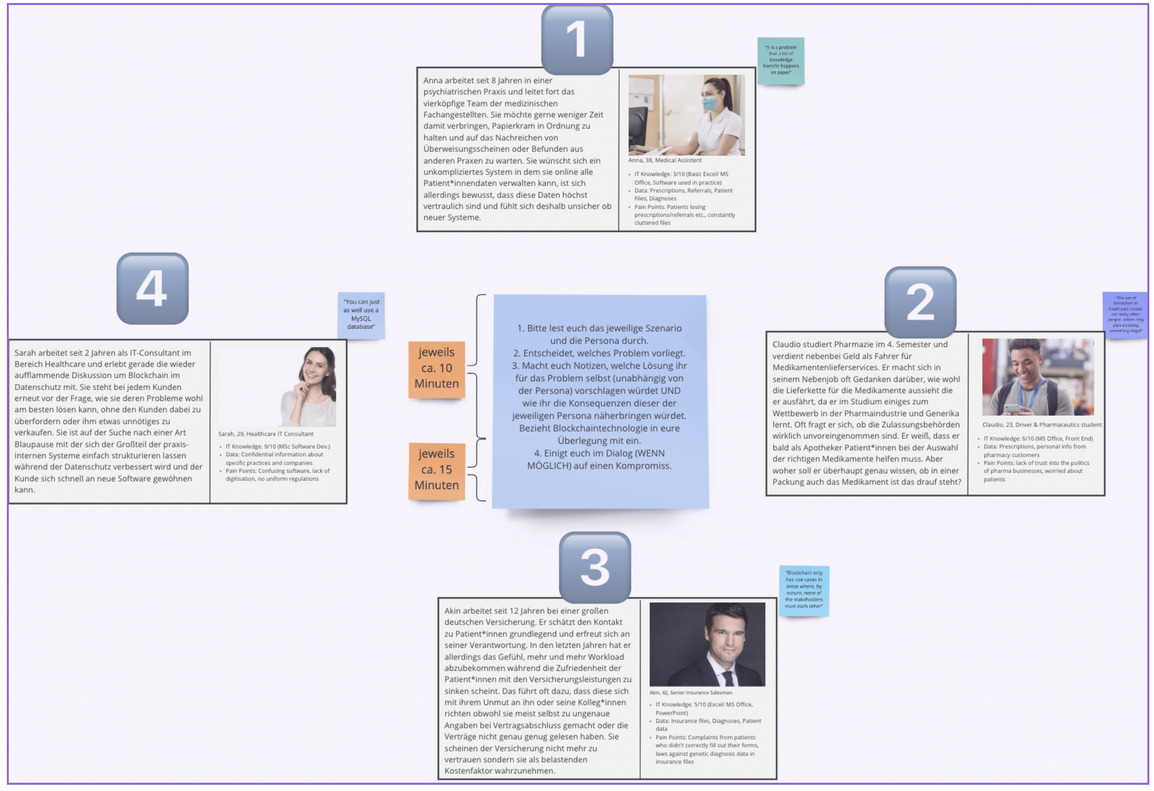


Figure 12: Screenshot from the Miro board used during the expert debate round

EXPERT DEBATE ROUND AFFINITY DIAGRAM

The statements made during the debate round were clustered in an affinity diagram (UserTesting, 2020) built on the four paradigms that were determined earlier. The most significant statements that summarise the core take-aways are displayed in the affinity clusters below which are the same categories as the four paradigms that were determined earlier.

User Autonomy

"Doctors have no time for patients anyway and patients also offer no real transparency about what they are doing. So **if someone tries to get their patient files from the doctor's office somehow, the doctor says, why? You don't need that. We don't have to give you this.** In the best case, they get a whole bunch of handwritten or somehow printed out things that can barely be deciphered."

"To be fair, it is also important to **protect healthcare professionals from having to do two different highly qualified jobs**, because they already have one. They don't want to manage data banks in addition to their other tasks. Which is why I think education is necessary - **they need an easy-to-navigate system that lets them easily retrieve what data they are looking for, and they need the right communication tools to make patients understand why they need a specific thing** from the patient and what it will be used for, so that the patient in turn can make an informed decision to share the specific data and give the healthcare professional access to whatever they need."

"I don't go to different specialists for no reason - probably all people with chronic diseases who simply aren't being taken seriously by the medical system know what I'm taking about. Sometimes you just have to see multiple specialists before you get someone who actually wants to listen to you. So then the question would not be 'is this document a duplicate or was something overwritten', but actually **what should I as a patient pass on or share**?"

"I would even be okay with a centralised system as long as the data is encrypted in transit and **can only be shared with a key that is kept by the patient**."

"As long as patients can then **delegate access accordingly or share the data**, i consider the other secondary problems solved."

Use Cases

"Rule of thumb, **can I solve this with a database? Can I solve it with PKI**? And if all of that is no, then maybe **blockchain** is an approach and otherwise I would just say yes, then let's make **signed records**."

"I also think the implementation of some systems go in the right direction. It is overly complicated, as Germany likes to do things, but at the moment if all medical professionals somehow had a **smart card with a certificate, while there is also a small chain of certificates in the hands of the health authorities, and at the end of the day there are different organisational goverment-led units that cannot be touched**, where it is very important that the ultimate data sovereignty lies with the patient, the requirements would actually be met for me."

"For example, I'm at the doctor's, get a report or something like that and have to prove my health status with it somewhere else. So for example **health certificates** in the food industry or something similar."

"We need to get **as close to the source as possible when we're using proof of authenticity**, best case is if we already sign the sensor that measures a certain development."

"Drug detection is a good example, I go to one doctor who says I've taken drugs and then I go to another and they tell me I haven't. Now, which one is right, so to speak? If I went there during a short period of time, how do I know that these certificates validly exist, so to speak, that they exist, so that I also can't let anything fall by the wayside. For such situations it would make sense to have **some kind of registry**."

Digitisation Efforts

"Actually, the German system suffers a bit from the fact that things like **laboratory findings or similar are often not authenticated information**, sometimes there is only a stamp on it somewhere which often has to be enough for you to recognise it as official - in a certain way we have also realised this during the pandemic in the certificate system, that it is not enough to run around with the yellow vaccination registry book and then just put some doctor's signature in there everytime you get vaccinated."

"All of **the systems they use in healthcare are awful**. I haven't seen a single exception on that specific market yet."

"**A magical blueprint that will solve all problems will be difficult**. Especially in a world that still holds such extreme heterogeneity, where everyone has their own systems and it's all programmed incompatibly. Old Fire Base or Access systems that have been in use for ages."

What does blockchain even mean? **Do I really need a global blockchain that uses complex mechanisms and does some other nonsense, maybe even simultaneously dealing with finances**? We're currently experiencing what that means as certain systems are crashing. Or would, for example, a consensus-oriented distributed ledger that is used with a sufficient number of participants to function without any problems be enough?

I have also observed this several times now in the last five or six years, that **healthcare managers are on this hype train where everyone talks about blockchain, but when that hype train actually arrives at the station, the station is called "basic digitisation"**. Yet, to get there they had to find something that made them go 'ah yes, I read that in Manager Magazin. Blockchain, let's do that, great.' Then a huge system is put in place, maybe 1/20 of which really makes sense, and at the end after two years of pilot project, where many consultants have earned a lot if money, in the end they say yes, pilot project is successful, we are now doing Jason with signature here and we are putting that on the central server, done.

Ethical implications

"I also see that this is more of an **economic, social and political problem**, that's what it's all about, it's not really about tech all the way."

"But then there are more such topics for me, like what are the consequences for security failures, so that the **software manufacturers are really made responsible** for building secure software for users."

"Sometimes in medicine, **shame can also be an issue**. I think you have to talk about that very, very much with an openness, transparency and that the **explicit creation of trust**, which in today's medical business often fails because people are not encouraged to talk about things."

"Some of the problems are actually somewhere within the **communication between the doctors and the patients** and not so much at the technical level."

"The question is, how can we **substitute the social component of trust** with a technology?"

"It's **not enough to verify vaccination certificates** as long as there are doctors who will give them to unvaccinated people for money. And these doctors existed during the pandemic, and people who wanted to **fake their certificats** found those doctors."

Figure 12: Affinity diagram

EXPERT DEBATE ROUND FEEDBACK

After the Expert Debate Round, three of the four experts took the time to fill out a feedback survey about the process. The survey was focussed on finding out how they felt after debating with people of vastly different options:

- During the expert debate round, the experts usually needed less time on their tasks than I had given them
- Even the pro-blockchain experts often suggested solutions unrelated or only indirectly related to blockchain technology
- The experts agreed on more points than they themselves had anticipated when I talked to them before the round
- It was sometimes necessary to regulate the distribution of talking time
- In the end, people felt like they had gotten there points across and overwhelmingly were content with their use case discussions

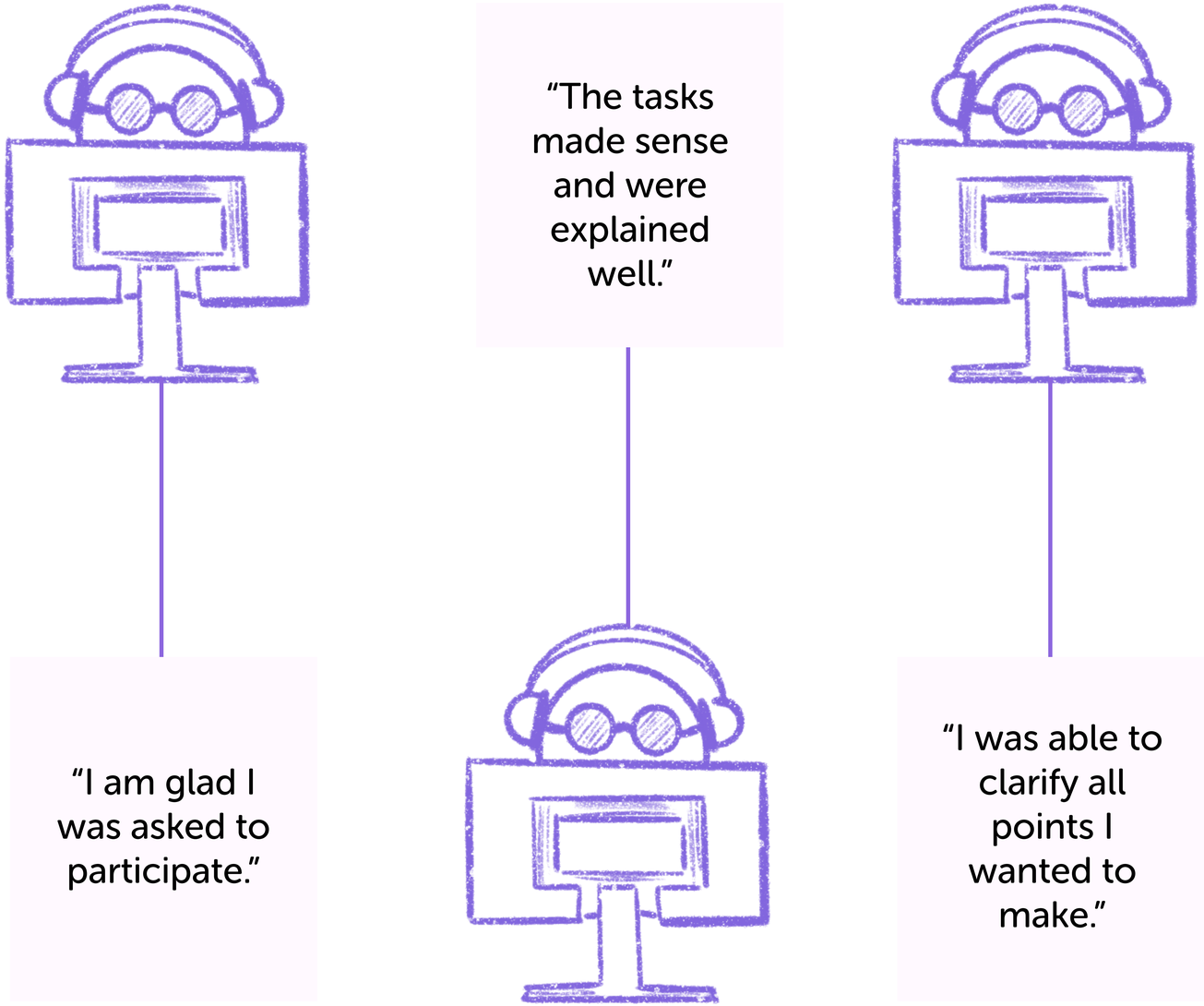


Figure 13: Exemplary survey responses

DESIGN REQUIREMENTS

It has become evident that the goal of this project should not be to make a final decision on the necessity of blockchain in healthcare. Instead, the outcome shall be to create a basis for the involved stakeholders to find common grounds, share their expertise and eventually help one another make an educated decision on which technology suits the specific use cases, so that digitisation will be carried out in a sustainable way. The design requirements have been informed by the outcomes of the priorly conducted research, mainly:

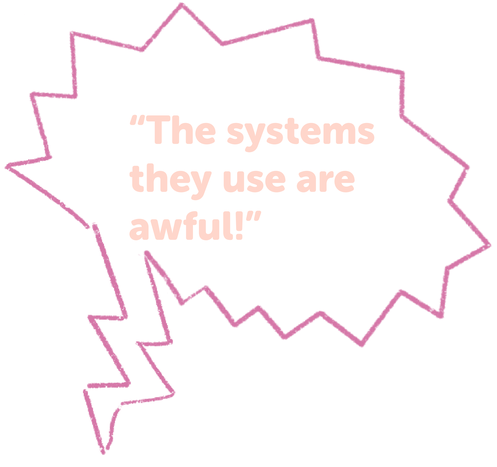
- The eight parameters of ethical challenges as defined by Srivastava et Al.
- The ten design characteristics of complimentarity by Chan et Al.
- The three levels of potential impact by Junginger & Sangiorgi
- The four paradigms as derived from the expert debate around use cases

The design shall fulfill the following requirements:

1. Advancing the **digitisation efforts** in German healthcare
2. Improving the level of **patient autonomy** in regards to the patient's data ownership & access
3. **Organisational transformation** within the healthcare ecosystem as the underlying shared goal
4. Enabling careful **analysis of adequate use cases** to create the foundation for educated decision making
5. Clearly defining stakeholder accountability in terms of **ethical consequences** of specific technologies
6. Facilitating **cooperation** between all stakeholders

FINAL PROBLEM STATEMENT

"How can the need for novel technologies like blockchain for the digitisation of German healthcare be analysed adequately by the relevant stakeholders with a focus on the current growth of blockchain companies?"



3-3-3 BRAINWRITING

In the 5-3-6 brainwriting technique, “a small design team (...) each takes the initial 5-15 minutes of the exercise to develop a small number of concepts intended to solve a design problem. These ideas are captured through a combination of sketches and words. Optimally, large sheets of paper and different coloured markers are provided for each participant. After this initial 5-15 minutes, participants pass their paper to the adjacent team member. An additional 5- 10 minutes are now provided for the members to add to/comment on the ideas of their colleague, or create an entirely new idea as inspired by the sketches passed to them. This rotational process continues until each member has taken the opportunity to add to the concepts from all other members. No verbal communication is allowed during this entire process until all team members obtain their original concept sheet.”(Jensen et Al., 2012).
I adapted and simplified this technique to suit the team size of three people and the requirements of the problem statement. The participants of the ideation round were all working as IT experts in different healthcare areas: one in the IT department of an insurance provider, one at Telematik (the communication infrastructure for German clinics) and one as a software developer for clinic software. Additionally, two of them suffer from chronic illnesses and therefore regularly need to navigate the German healthcare apparatus from a patient perspective themselves.

The rules I set for the round were the following:

Question: "What tools and paradigms should frame a process where physicians and other healthcare stakeholders cooperatively digitise their systems?"

1. The brainwriting takes place on a Miro board.

2. Each participant enters three ideas per round in the top line of the sheet in front of them. A round lasts three minutes or ends earlier if all participants have already entered three ideas.

3. After the end of the round, all participants rotate clockwise to the next sheet. Now a new round begins: Each of the participants adds three ideas to the worksheet in front of them, this time in the second line - the post-its they write on always have the same color. The ideas already noted by the others can and should be taken up as inspiration or developed further. Completely new ideas are also allowed.

4. Step 3 is repeated until all participants have completed each frame. Finally, an evaluation takes place, in which they present their ideas and a discussion arises.

3-3-3 BRAINWRITING: OUTCOME

The relevant IT skills have to be taught to patients, especially when involved in decision making

Infrastructure needs to be evaluated holistically and with the goal to make it compatible enough to make processes efficient, yet diverese enough to ensure data protection

It has to be clear who can guide whom along the way, also after implementation. Where lie the capacities to help one another out?

Insurances need to realise and clearly define their political role in the partially-socialised healthcare system.

There has to be a conversation about salaries. If we want digitisation, we have to pay healthcare professionals like nurses in an adequate manner and provide good working conditions.

We have to come up with a flexible way to maintain the digitised systems through IT professionals in healthcare, but also in some case through external IT professionals so that things don’t take as long as they do now.

CONCEPT DEVELOPMENT: CORE ASSUMPTIONS

Before developing the “Consult together” framework, extensive literature research was carried out alongside different interviews, a questionnaire and two different workshops.
The outcomes from all research were evaluated through different service design methods and clustered at appropriate times in the process to allow the step-by-step creation of principles on which a framework can be developed in a safe and beneficial way.

“Consult together” is a co-creation framework that aims to expand the term of “expert” by making the expertise of all stakeholders within their own roles tangible for the others. It shall be a starting point for digitisation stakeholders to align with each other and engage in “cross-pollination of expertise and viewpoints”(Interaction Design Foundation, 2018). The goal is to dissolve silos into more accessible pools of shared knowledge.

The target groups for the framework are the responsibles from all tangible steps of a digitised system. Since the conversation revolves around the goal of finding or ruling out use cases for blockchain applications during a global blockchain “hype”, there have to be three IT experts present of which one needs to working in healthcare IT, one should be a database professional from outside the blockchain realm, while the other one should be a blockchain expert.

The other three paticipants should be a doctor, a healthcare worker (such as nurse) and a patient. This ensures that everyone directly dealing with patient data or providing patient data in the current system is present in the workshop and beyond.
The preparation, methods used in the workshop and evaluation of the workshop outcome shall be based on the four parameters. Examples for questions to be reflected upon:

Ethical Implications: What are the ethical consequences of digitising the relevant area in German healthcare? What ethical standards for digitisation efforts do stakeholders agree upon as non-negotiable? What ethical evaluations are being made by stakeholders in respect to their field/community? How will agreed upon ethical standards create change in relevant areas/communities?

Use Cases: What are the use cases for the discussed change in the relevant area of German healthcare? What actions will stakeholders be carrying out in the future to explore and optimise these use cases? What processes will be put in place to ensure continuous re-evaluation of the use cases?

Digitisation Efforts: What is the estimated timeline for the efforts to come into place? How will the efforts affect the elements in the ecosystem of German healthcare? In which ways will the silo-structure in the healthcare system be transformed and how do we ensure sustainability of this transformation? Which groups in society may need help navigating new technologies and how will help be provided?

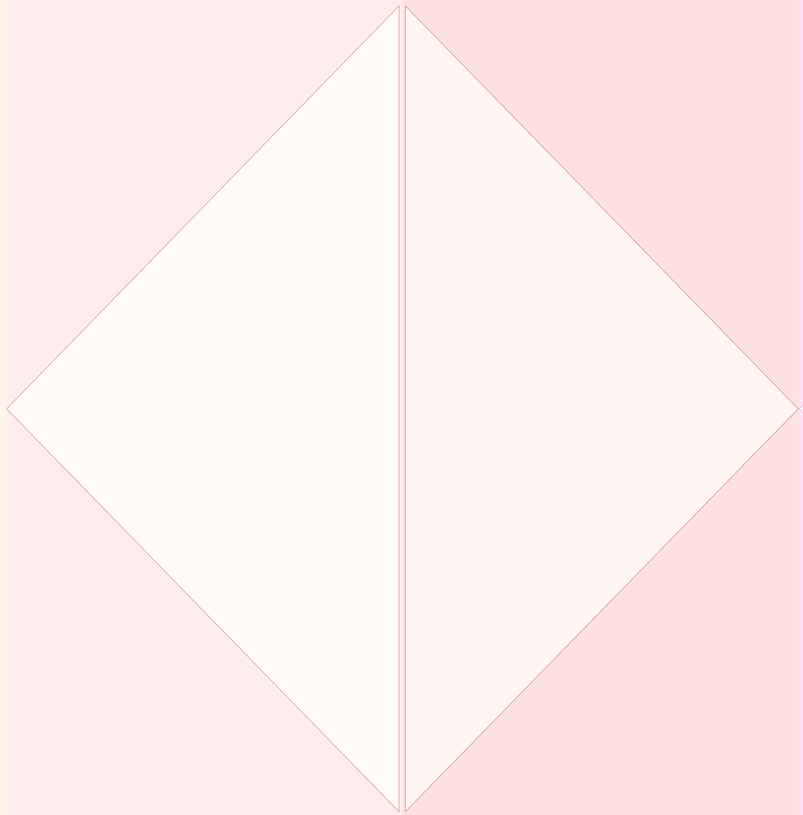
User Autonomy: What aspects of autonomy do users want and expect from digitisation efforts? How will autonomy and data ownership transform their experiences within the healthcare system and beyond? What responsibilities will be transferred from other stakeholders to the users? How will users be supported when adjusting to this change?

KEY FINDINGS

It is evident that a system as complex and inter-dependent as the many stakeholders in German healthcare requires its own framework for an educational and co-creative exchange among all stakeholders, led by a designer who themselves has to "develop news skills, sensitivity and attitudes" in the process (Sangiorgi, D., 2010). The goal should be to teach each other about one's needs and goals and co-create structures for a digitised healthcare system. The concept is based on the assumption that inside-out approaches in service design are not sufficient and that users need to be empowered as equal experts in the "interplay between micro-level user activities, the meso-level actor configuration, and macro-level institutions" (Trischler & Westman Trischler, 2021, p. 2).

Junginger and Sangiorgi describe an orienting framework for service design and organisational change in order to explore services in a way they call "reflection-in-action" (Junginger & Sangiorgi, 2011). Within the framework, they describe the afore-mentioned three levels of impact of design projects. Given the results of the design process, organisational transformation seems to be insufficient when trying to involve all levels that need to be considered to facilitate change in the healthcare system.

Considering such an interwoven system beyond dyadic interactions, the term of a service ecosystem is more fitting to describe its structural complexity. Organisational transformation would be needed for a multitude of organisations in order to carry out a digitisation of the system in an impactful way. Furthermore, stakeholders need tools to frame those values in the context of their expertise. Only when this is achieved, a common set of values and goals can be defined and questions can arise on the basis of which the stakeholders can engage in a discussion. Ideally, the right facilitation of such a discussion will then lead to an exploration of ideas and tangible use cases as described in ecosystem design (Vargo. S.L., 2016 p.48-49).



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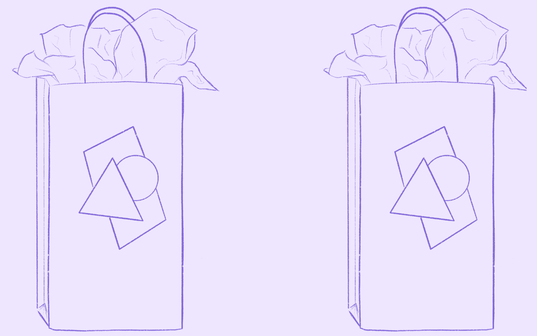


UPDATED PERSONAS

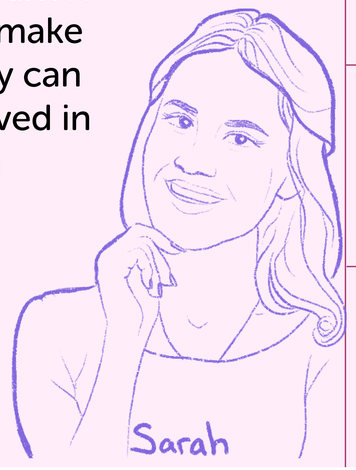
To better display the responsibilities and needs of the stakeholders that are relevant for the framework, three of the personas used for the expert debate round are being adjusted and three new ones are being created to explore the motivations, needs, pain points and skills that would make it likely for a stakeholder to participate in a workshop.

Profile:
- Anna, 38, Medical Assistant.
- Outgoing and communicative
- Impatient when things don't work immediately

Pains: Cluttered data systems, complicated processes, having to remind patients of what she needs from them a lot	Skills: • Tech-savviness: 5/10 • Empathy for everyone • Great organisating skills
Needs: A structured work environment, the ability to quickly retrieve information, time for ad-hoc tasks	Motivators: Seeing patients feel better, getting to know people, quality time with her colleagues

"I don't want to have to learn how to use a different system every year - I want to help patients get better"

"We need to teach patients the relevant IT skills to make sure they can be involved in decision making"



Profile:
- Sarah, 28, Healthcare IT Specialist.
- Solution-oriented work ethic
- Wants to revolutionise the way data is handled in healthcare

Pains: High workload, lack of transparency in the healthcare system, feels like she can't create a sustainable change on her own	Skills: • Tech-savviness: 9/10 • Marketing & Sales Tactics • Cross-team communication
Needs: Working communication channels, reliable colleagues, stakeholders need to be more willing to digitise	Motivators: A better future for healthcare, climbing the ladder in the company

UPDATED PERSONAS

Profile:
- Akin, 42, Senior Database Consultant
- Confident in his work
- Worried about the future of data security

Pains: Unrealistic demands from the UX designers in his company, bitcoin and other hypes he finds dangerous	Skills: • Tech-savviness: 10/10 • Five different languages • 20 years of experience in his field
Needs: Reliable systems, clients that listen to what he says, methods to explain things better	Motivators: Seeing that things get easier for non-tech-savvy people to use, providing for his daughters

"If people would just listen better, they wouldn't think everything is so complicated."

"My days are so hectic, I barely get to have a conversation with a patient anymore."

Profile:
- Elijah, 47, Surgeon
- Loves the responsibility his job brings
- Doesn't love all the paperwork and overtime around it

Pains: High stress during busy days, the constant threat of being sued in the back of his mind if anything went wrong	Skills: • Tech-savviness: 3/10 • Time Management • Team work
Needs: Efficient communication with patients and nurses, easy access to patient files even from other clinics/doctor's offices	Motivators: Patients getting better, receiving praise for doing a good job, being liked by those he supervises

UPDATED PERSONAS

Profile:
- Diana, 36, Graphic Designer & Patient
- Knee problems after an accident, ADHD and asthma
- Wishes she could still pursue track running

Pains: Coordinating all doctors appointments & medication next to her full-time job, feeling like she is not being taken seriously	Skills: • Tech-savviness: 7/10 • Goal-oriented • “Never give up”-Attitude
Needs: A reliable step-by-step plan for how to get better, empathy from doctors, correct information around her conditions	Motivators: Seeing how her strength is slowly building back up, Being creative

“Navigating different doctors when chronically ill feels like an extra job - and more often then not they won’t even really listen to my history.”

“You never know when the next big thing is around the corner, but I’m ready.”

Profile:
- Sam, 33, Software Engineer
- Excited about new technologies
- Feels pressure from his boss to come up with revolutionary ideas

Pains: Nay-sayers who don’t like anything if it’s new, spontaneous changes in his tasks with unrealistic deadlines	Skills: • Tech-savviness: 9/10 • Scrum Master • Open-minded
Needs: Reliable systems, clients that listen to what he says, methods to explain things better	Motivators: Being part of innovation, the chance to one day have his own name on a patent

SERVICE DESIGNER PERSONA

In order to exemplify the different steps in the Consult Together framework in the most descriptive way, a seventh persona was created. The service designer persona, though being in the role of the facilitator and outside of the group of stakeholders, is needed to perform the steps in the framework that cause the participants to carry out their steps in return and explore where adjustments may be needed.

Since the framework has an extensive co-creative element at its core, the illustration of the service designer's role shall make the required spirit of collaboration between them and the participants tangible.

<table>
<tr><td colspan="2">Profile:
Emma, 30, Service Designer
Carrying out the framework as the responsible facilitator
Hoping to achieve great results</td><td>"Even if I just get one group of stakeholders to do things differently - the ripple effect for other stakeholders and designers could be great!"</td></tr>
<tr><td>Pains: Lack of digitisation in big ecosystems like healthcare</td><td>Skills:
Tech-savviness: 7/10
Goal-oriented
"Never give up"-Attitude</td><td rowspan="2">  </td></tr>
<tr><td>Needs: Cooperative participants for service design methods, data, the right tools, feedback</td><td>Motivators: Laying the foundation for change that affects society in positive ways</td></tr>
</table>

Figure 14: Updated personas

ACTORS RELEVANCE MAP

To ensure the involvement of all relevant participants, an Actor's Map was created according to the actors described in an overview of the German healthcare system (Schneider, J. & Stickdorn, M., 2012), including each actor group's relevance to blockchain discourse in terms of frequently they were mentioned during interviews, debates and workshops. The purpose of the map is to show who is included in the complex ecosystem and differentiate between relevant and not relevant actors that should be included in the facilitation of the framework.

Through executing a search count each time I found a specific relevant word in the interview & workshop transcripts, I was able to determine all relevant terms to be searched and the number of times they were talked about (for exact list, see attached). The level of outward-pertrusion towards the edges of the map indicates the relevance of the actor group to the discourse.

In consequence of the relevance displayed on the map, the target groups of civil society actors and academic actors will not be included in the framework at this point.

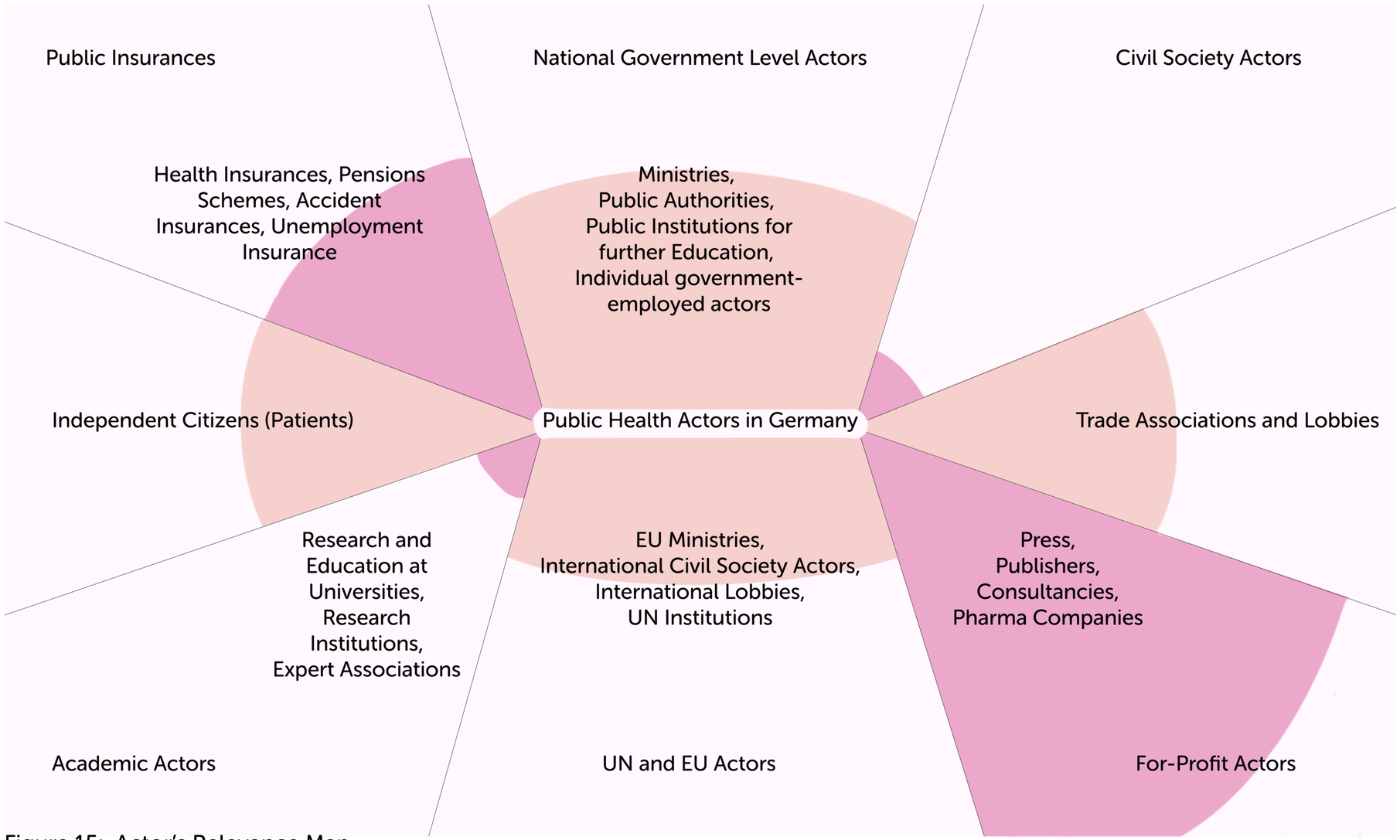


Figure 15: Actor's Relevance Map

VALUE PROPOSITION CANVAS

The value proposition canvas can be used to make sure a specific product provides value to the appropriate stakeholders in a market. It is a way to picture the pains and gains of customers, their roles, and the value the service creates for them by either relieving pains or creating gains (Strategyzer, 2017). Even though this canvas is primarily a marketing tool, it seems appropriate to display the responsibilities of the participants of my framework and what the framework offers them in order to relieve their pains or create gains, thus validating the framework as a tool.

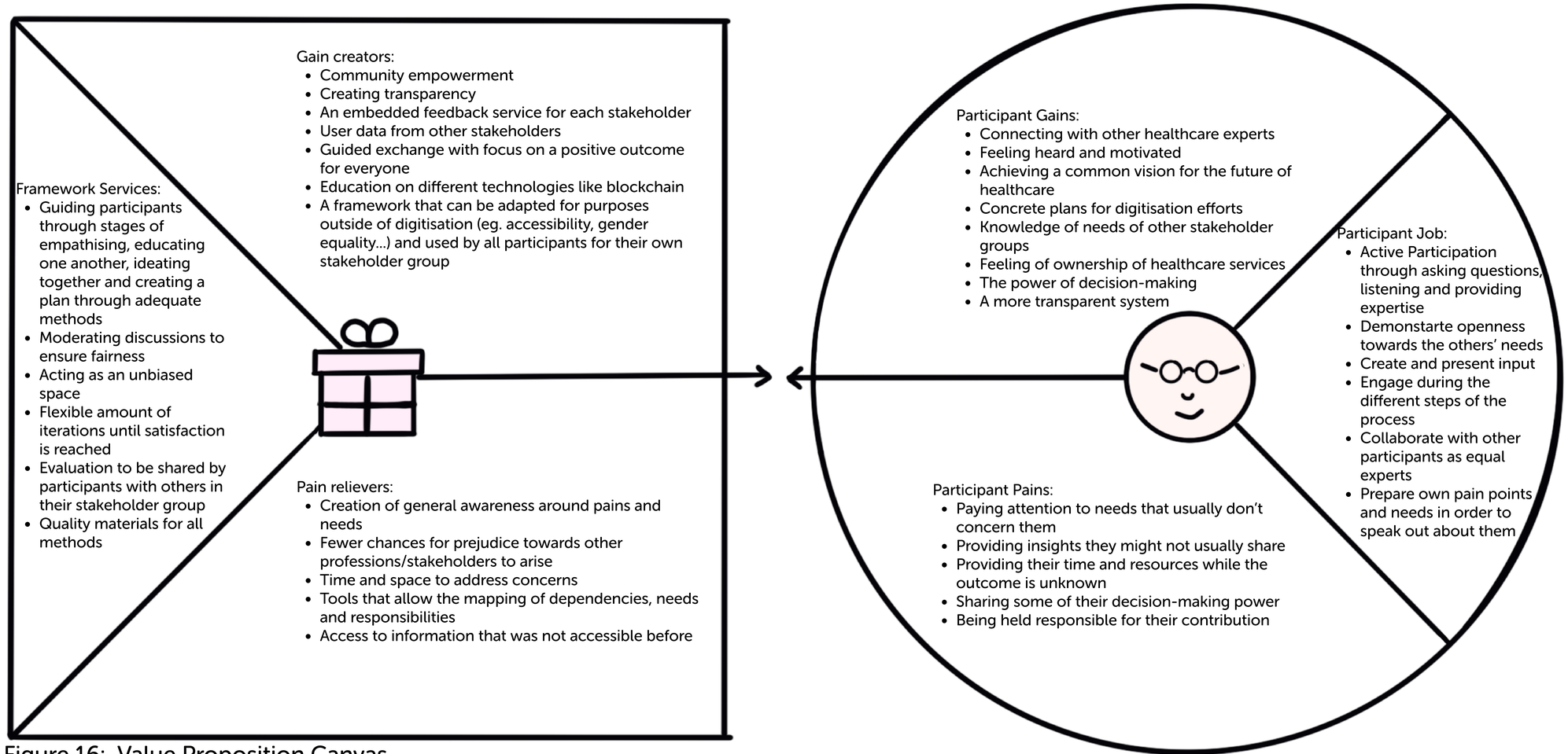


Figure 16: Value Proposition Canvas

PARTICIPANT MOTIVATION MATRIX

In order to find find benefits of the interaction between participants beyond the outcome of the workshop, a motivation matrix (Morelli, N & Tollestrup, C., 2006, p. 3) was created to explore what value each participant could create for another participate through interaction on an inter-personal scale.
This was important because, while the change to be created on the ecosystem level would benefit each of the participants, too, it seems relevant to display how a simple dialogue could prove valuable as well.
The matrix emphasises the co-creational belief that each participant has something to offer the others, because even a question or an anecdote can serve as inspiration for further engagement and ideas.
Quotes were added to exemplify the simplicity of the actions considered in the smallest possible increments.

Gives to	Doctor	Healthcare worker	Patient	Healthcare IT Expert	Blockchain Expert	Database Expert
Doctor		• Acknowledgement • Support • Tools "I acknowledge your need for better work conditions"	• Reassurance • Answers • Explanations "We want to take time for patients but our tasks often prevent that."	• Requirements • Practical Insights • Ideas "If I could get treatments greenlit with less effort, I could treat more people in less time"	• Requirements • Practical Insights • Ideas "The equipment we have at the clinic right now keeps failing whenever there are large sets of data to be processed"	• Requirements • Practical Insights • Ideas "I don't want to search for what my patients need in many different folders, is there a way to connect them and have a better search function?"
Healthcare worker	• Knowledge • Tools • Feedback "Patients want to know we work together as a team"		• Acknowledgement • Insights "When a patient is kind and cooperates, my whole day becomes better"	• Questions • Requirements • Practical Insights • Ideas "Why do I have to still manually clock in or sign when I had a break?"	• Requirements • Practical Insights "I want to have to use computers as little as possible during my work time."	• Requirements • Practical Insights • Ideas "Could we just sync up all the patient files with our vital sign monitors automatically?"
Patient	• Acknowledgement • Feedback/ Suggestions "Finding a doctor who listens feels like a rare privilege"	• Acknowledgement • Insights "Hospitals can be scary. If the staff ask my pronouns, I feel safer."		• Insights • Requirements "Isn't there a way to get my prescriptions online?"	• Insights • Requirements "It would be great if I had a more tangible example to understand blockchain."	• Insights • Requirements "As a patient, security of my data is more important to me than efficiency""
Healthcare IT Expert	• Acknowledgement • Tools • A communication channel to healthcare providers "There is this platform where doctors can hand in feedback to insurances"	• Acknowledgement • Tools • A communication channel to healthcare providers "This filing software has been causing trouble all over, I recommend this one instead"	• Tools "We have developed a new app that lets you get your medication delivered monthly"		• Acknowledgement • Tools • A communication channel to healthcare providers "Smart contracts are only an option if they won't cause legal problems for the insurance"	• A different perspective • Communication channel to healthcare providers "There is a project we could collaborate on together"
Blockchain Expert	• Education • Ideas "Here, I can show you how blockchain works with lego pieces"	• Education • Ideas "We have developed a tool you could test"	• Education • Ideas "Blockchain doesn't necessarily have anything to do with bitcoin"	• A different perspective "Smart encryption would allow efficient communication channels between providers"		• A different perspective What if we used a database but added time-stamps on a blockchain?"
Database Expert	• Knowledge • Tools • IT help "With a few simple changes, you'd spend half the time on filing"	• Knowledge • Tools • IT help "If you show me how you track data day-to-day I will tell you how to do it more efficiently"	• Knowledge • Tools • IT help "Here's why you should change your password every month"	• A different perspective "You could save costs if you used other servers"	• A different perspective "You could save costs if you used our servers"	

Figure 17: Motivation Matrix

CONSULT TOGETHER FRAMEWORK

Example for one designer action per step	Emma sends questionnaire to Anna about the daily routines of healthcare workers involving patient data	She watches a TedTalk on the difference between blockchains and databases	Emma makes an actors map on Figma	She reads a report on the impact co-creative design had on a healthcare project in Mumbai	One of the six paradigms she defines for her analysis is "time management" because she wants to see how much time for patient contact digitisation could free up	Emma sends an e-mail to her former boss Akin and asks him if he would be available for the workshop	Emma decides that she wants to use cameras to record the different methods on video	The first method she carries out after the introduction is "the 5 whys" in which participants can get answers to their questions and make their pain points known	She watches a video recording scene where Elijah tells Akin that he often loses valuable time because the printer in his office is not working and a patient is waiting for a diagnostic file	Emma creates a WhatsApp group with all participants	On a shared Miro Board she created earlier, Emma posts a picture of a collage she made from the post-its and papers used during the workshop	Emma posts a link to a Doodle poll in the WhatsApp group to find the time for another workshop
Service Design Steps for Facilitation	Prepare evidence of needed digitisation effort	Understand the subject of debate Empathise with each group	Connect evidence to paint a bigger picture	Understand the possible outcome	Define specific goals	Gather the stakeholders to be involved in the round	Plan the decision-making workshop	Facilitate the workshop	Evaluate the workshop	Follow up	Maintain connections	Iterate
Objectives	Empathise with the subject Having a way to navigate the topic	Gaining the ability to moderate a workshop	Determining potential participants for the workshop	Gauging the potential of the workshop outcome	Knowing how to measure the outcome of the workshop	Having a set group of willing participants	Having a toolkit that allows you to collect material pertaining to all four paradigms of ethical consideration, use cases, digitisation efforts and user autonomy	Holding the space for the participants to engage effectively	Learn from potential mistakes Ensure participants understand their instructions thoroughly	Making sure participants follow through and change is created	Dissolving silos	Dissolving silos
Actions by the Designer	Familiarise yourself with pain points within the service (eg. through a service safari or auto-ethnography) Carry out desk research needed to fathom the structure of the service Conduct interviews with stakeholders & determine their willingness to participate	Familiarise with the needed technical know-how to understand the reasons for and effects of core problems Determine what level of understanding different stakeholders have about the blockchain application in question Rate the tech-savviness of stakeholders that are willing to participate (or let them rate it themselves)	Map the stakeholders and their interdependence to one-another Determine each stakeholders relevance for the topic Iterate in collaboration with stakeholders to ensure accuracy of the map	Picture each relevant stakeholder's main pain points and objectives Determine the expertise each stakeholder can offer Determine the tools already in place the stakeholders can use to convey their expertise	Set the tangible goals that can be achieved for each stakeholder Iterate if needed (eg. if a stakeholder insists an achievable goal is missing)	Find six participants from the relevant groups according to this criteria and set the time and place for the workshop: • Roles: 1 Healthcare IT Consultant, 1 Blockchain expert, 1 database expert, 1 Nurse/healthcare assistant, 1 doctor, 1 patient • Availability & willingness to participate	Find methods to carry out four workshop phases plus tools to provide an introduction and collect feedback & recordings: 1. **Education** phase - enabling participants to educate one another on their field of expertise, their role as a stakeholder & their goals, needs and pain points 2. **Collaboration** phase - enabling participants to create use case examples in groups of two that serve at least one other participants goals/relieve at least one other participants pains 3. **Iteration** phase - helping participants present their use cases and adjust them through the input of the stakeholder the use case touches until they deem it accurate 4. **Determination** phase - provide the participants with the tools they need to make a final decision on the next necessary steps to reach each others goals. Help them define the standards through which they want to measure the effects of those next steps.	Carry out the workshop by moderating each phase, setting the appropriate time constraints and providing solutions for potential roadblocks Record the participants' efforts and collect all tangible materials Collect feedback	Evaluate the feedback and outcomes of the workshop Refine the proposals for next steps to make them more tangible if needed	Assign responsibilities to each stakeholder regarding their field and capabilities in order to reach the proposed goals through the determined steps Communicate the standards with which success in the achievement of a goal will be measured	Summarise succesful change and communicate it to all participants Enable participants to stay in touch and regularly exchange information	After an appropriate amount of time, organise another iteration of the workshop the check in and solve problems that may have emerged
Actions by the stakeholders	Be available, provide information, provide existing resources	Provide further resources if applicable, share knowledge, share tools that demonstrate the technology where applicable	Give feedback on the accuracy of the mapping efforts	Demonstrate the common tools used to explain your area of expertise to the designer	Provide feedback whether an iteration is necessary	Share availabilities and willingness to participate		Attend the workshop Provide feedback at the end		Carry out your specific tasks Provide feedback on how satisfied you are with the goals that were reached	Share your success with your company/ colleagues/peers Celebrate your achievements Maintain your connections	Participate in another workshop
Example for participant action demonstrated by relevant personas	Anna answers a questionnaire about the technology in her clinic and stating that she is available for further inquiries or interviews	Sam sends Emma a small sensor from his company than she can plug in to her PC to discover how blockchain works.	Elijah knows a lot about the healthcare ecosystem and can help Emma find all the healthcare actors	Sarah shows Emma the software she would like one of her clients to implement for vital stat tracking	Diana sees that one of Emmas goal is to make recurring descriptions easier to come by and is happy that what she said during a former interview has been heard	Akin shares his availabilities in a Doodle poll		Akin writes in the comment box on the feedback form that she enjoyed being able to lose some prejudice on blockchain technology		Sam connects Akin and Sarah with his team to work on a patient-administered database for mental health resources	Anna tells her colleague about the app she helped Akin develop in which patients can re-new their recurring prescriptions without having to visit the doctor each time	Sarah responds to the Doodle poll
Estimated amount of value created by Designer and Participants	Gains value ↑ Provides value ↓											

Figure 18: Consult Together Framework

INTENDED USE

The intention of the Consult Together Framework is for service designers to support democratising the digitisation efforts in German healthcare through research, thematic classification, workshop facilitation, paradigm-based analysis and maintenance of communication structures.

Even though the framework leaves certain freedoms to the designer who uses it, I would like to offer some suggestions on the intended use of the framework:

- **Stakeholder investigation:** Beyond the mere definition of relevant stakeholders, an underlying goal of the framework is the investigation of the structures they exist in. Questions you might want to consider could be: What circumstances decide how much decision-making power a person has within their group of stakeholders? And respectively, what factors this group of stakeholders to gain or lose power within the network of actors in the ecosystem? Answering these questions will allow you from the beginning to make a more conscious decision on the characteristics of those you want to involve in the further process, and thus serve as a tool to create a more diverse group of participants.
- **Adaptation:** Re-structuring the framework to suit a specific outcome or even a different ecosystem is intended as long as the phases are still carried out within a design framework. They could be divided further or iterate over in order to grant opportunities for more thorough research. However, that there should always be a level of initial research, a relevant set of participating stakeholders, an adequately prepared workshop with clear, holistic goals, a tangible action plan as an outcome and guidance from the designer through all steps of the process and after.
- **Ethical Guidelines:** Even if the research and the goals of the participants suggest no ethical or political dilemmas, it is important that all steps are carried out with a certain level of guidelines on the designer's side, such as the democratisation of decision-making processes or more data autonomy for patients. The approach this framework is based around the paradigms of co-creation and participatory design and should be facilitated as such.
- **Continuity:** The framework serves as a catalyst for cooperation across silos within a static and complex system with strong hierarchies. In order to sustain these cooperation efforts, stakeholders need to be supported in their attempts to break down barriers. The steps in this framework are a starting point to create a conscious collective desire for change, yet they are not meant to execute it. This is where stakeholders will need to be supported on a more regular basis, with methods that can facilitate bottom-up communication efforts between eg. groups of former workshop participants and representatives from their superordinate structures.

LIMITATIONS

The design process and methods used to carry out this project have been affected by certain limitations, which will be outlined in the following.
First of all, the conclusions from the research process largely relied on the various IT experts as the main stakeholder group considered. However, understanding the technological possibilities could have been considered a mere vantage point for further inquiries, instead of a focus point of the Discover phase. This certainly affected the timeline of the framework development later on: especially creating the persona of a patient has been based mostly on statements that were made by healthcare and IT experts about patients, yet not by a patient themselves from that sole point of view. Given that patient data security is one of the main goals to be achieved through digitisation, and thus through the use of the framework, interviews and co-creation methods involving patients as their own target group would likely have brought insights on potential solutions earlier on in the process and made the patient persona & motivations more tangible.
Additionally, the lack of involvement of decision-makers on a legislative level limits the ability to predict the level of change that facilitations of the framework could actually cause.
While there is reason to predict a beneficial outcome of ongoing cooperation as opposed to silos, it was not possible to determine the scope in which political actors or high-level decision makers (eg. within insurance companies) would have to be mobilised in a separate effort.

Furthermore, designing a framework rather than a direct improvement of a specific healthcare service made the process less tangible and, at times, created difficulties when defining responsibilities and exemplifying tasks. If the framework could have been tested, specific methods and steps for the workshop could have been determined to make it less abstract and create more value, especially since most design methods seem more suited for action than framework design.
Another limitation was the collaborative setting with UBIRCH - whilst grateful for the freedom I was given by them to explore the purpose of my project, diverting my focus from blockchain technologies seemed off-limits, and producing an outcome the company could use for profit was in the back of my mind during the entire process.
Moreover, I would have prefered to involve a set of people from more diverse communities in my research to get different perspectives, since class, racial and gender bias are highly relevant topics when discussion experiences in healthcare. While genders were balanced in regards to the questionnaire respondents, six out of seven participants in the interviews, debate and 3-3-3 workshop were white cis-gendered men.
Lastly, not having been able to test the framework has limited my ability to prove its relevance for the involved stakeholders. With these limitations in mind, a final evaluation of the project would certainly benefit from a further exploration of the key points yet to be investigated.

FURTHER RESEARCH

Considering the project limitations, a need for further research is implied.
First and foremost, the workshop as the core of the framework should be carried out to check whether there is a need for adjustments or further research into target groups.
It would be especially beneficial to have another service designer carry out all taks described in the framework and reflect on them. Both, the second service designer and a group of participants that have taken part in a workshop could then act as co-creation partners for my efforts to iterate over the different framework steps. This way, the role of service designer would become more tangible and be separated from my own role, thus eliminating the dichotomy of being the creator of a framework and its facilitator at the same time.
It would hereby be implied that there is an emphasised need for monitoring of the connections and activities that emerge after the workshop, when designers are not directly in volved in the process any longer. Since “in service design, designers are defined by what they can enable, not what they ‘make’” (Morelli, 2009, p.7), it is the continuation of a newly triggered process that bestows value upon the designer’s work, rather than a snapshot of one specific milestone.

When carrying out the suggested steps, I would aim to acquire a more diverse group of experts, research the patients’ needs more beforehand and get more insights into the legal limitations for change in German healthcare.
Additionally, a range of co-creation methods could be hand-picked for the workshop to enable designers to choose from them rather than having to investigate suitable methods themselves.
Outside of the framework, the insights gained during the research process could be communicated directly to decision-maker such as the German General Medical Council to establish a second communication channel through which the most urgent demands for change from patients could be communicated. This concept could be carried out for communication channels with other large decision-making entities as well, to ensure that ideas emerging from the framework that currently are limited by said decision-makers serve as bottom-up examples for what changes in policies and structures might achieve. This way it could be possible to, over time, restore effective communication between all levels within the complex healthcare apparatus and flatten hierarchies in a sustainable manner.

REFLECTION

Concluding two years of studies, this thesis was an opportunity for me to apply the skillset acquired through the different courses. As someone who entered the program with no experience in the field of professional design, it was difficult to grasp the requirements of the profession in the early stages of my studies. However, through group projects in which methods were exemplified, I have learned to treat the different theories and methods as a toolset for intention, as opposed to set-in-stone rulebooks.
Even though this thesis, due to its nature, relies heavily on literature, I have attempted to stretch my former understanding of the design toolkit even further and bend methods in a way that suit my needs during the respective stage in the process. While this felt like a risk for a large part, I believe that it is possible to trace each step I have taken back to a deliberate intention that was in turn backed by research and connected to a former point in the process.
Unfortunately, working on this project has also made me aware of the biased understanding many stakeholders seem to have of a designer's work - this became most evident when I had to explain that "service design" is not a less valuable sub-category of UX design during my negotiation with the company. On the other hand, many of my colleagues have been curious and open to learning more about the ins and outs of service design.

Despite feeling welcome as a part of the company, I also felt out of place being the only designer. This was a challenge I would not have faced if I had instead collaborated with a design agency or a bigger company. However, these limitations also pushed me to reach out to fellow students more often for exchange and to be disciplined into following my own structure for the project. They gave me a set range of options and thus took away the risk of overthinking the topic of my project.
Having this red thread allowed me to focus on the execution instead from the start.
Carrying out the different research methods with participants taught me a lot about facilitating with experts and communication across different channels to convince two opposed parties to engage with one another.
While designing for ecosystem transformation leaves space for the application of the sociological theories (which as a former social worker, I usually apply to all my projects), I have limited myself by relying mostly on design theory. This was a conscious decision and a necessary step for me to understand my role as a designer with my own expertise and identity, yet it has also taught me that I will use my unique mix of experiences again in the future.
After all, the more holistic the approach to a project, the more innovative its outcome.

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ATTACHMENTS

Attachments can be found here: https://drive.google.com/drive/folders/1567-X_gvPavRIxf9j-eQFMN826DArVOR?usp=sharing

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